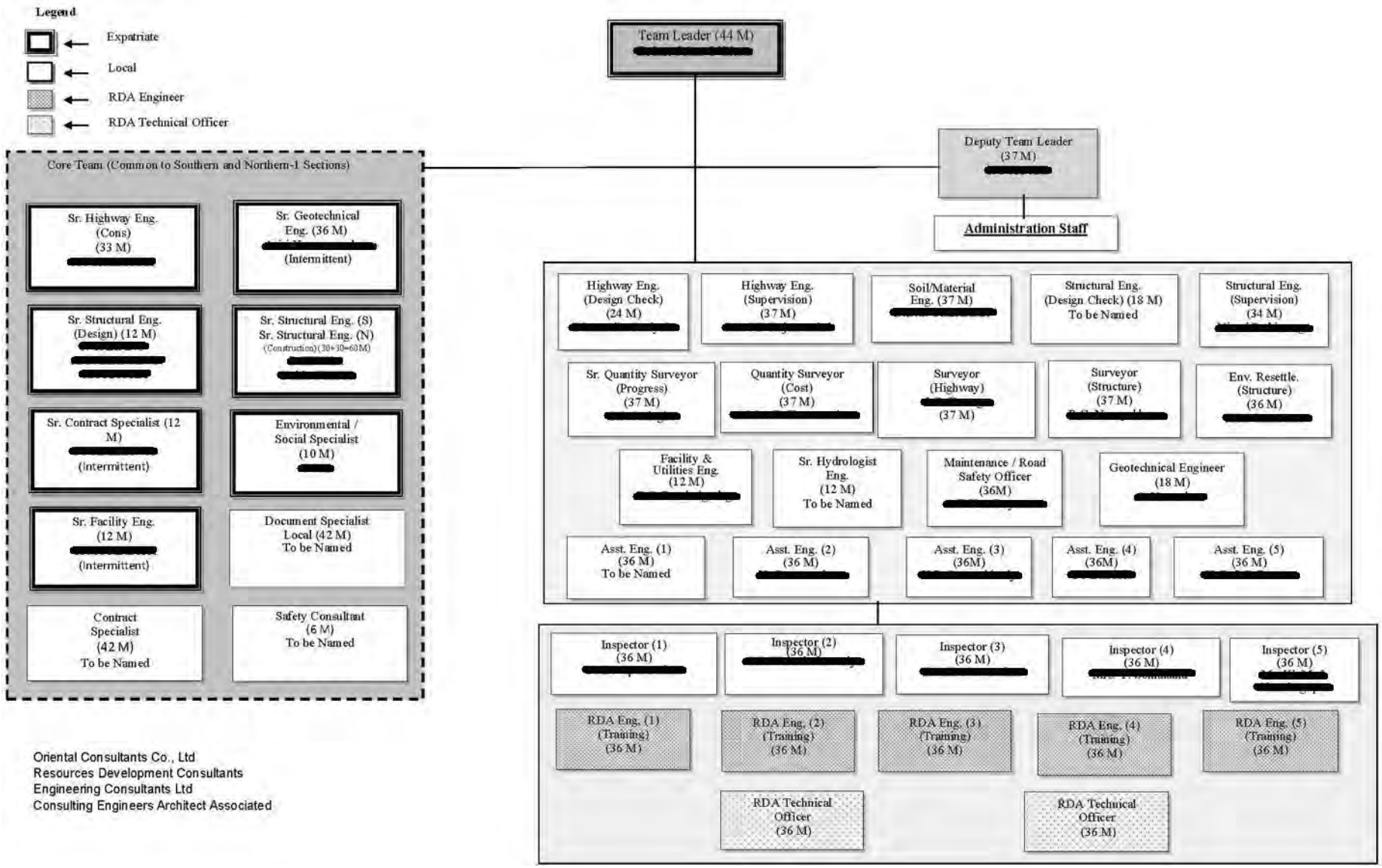
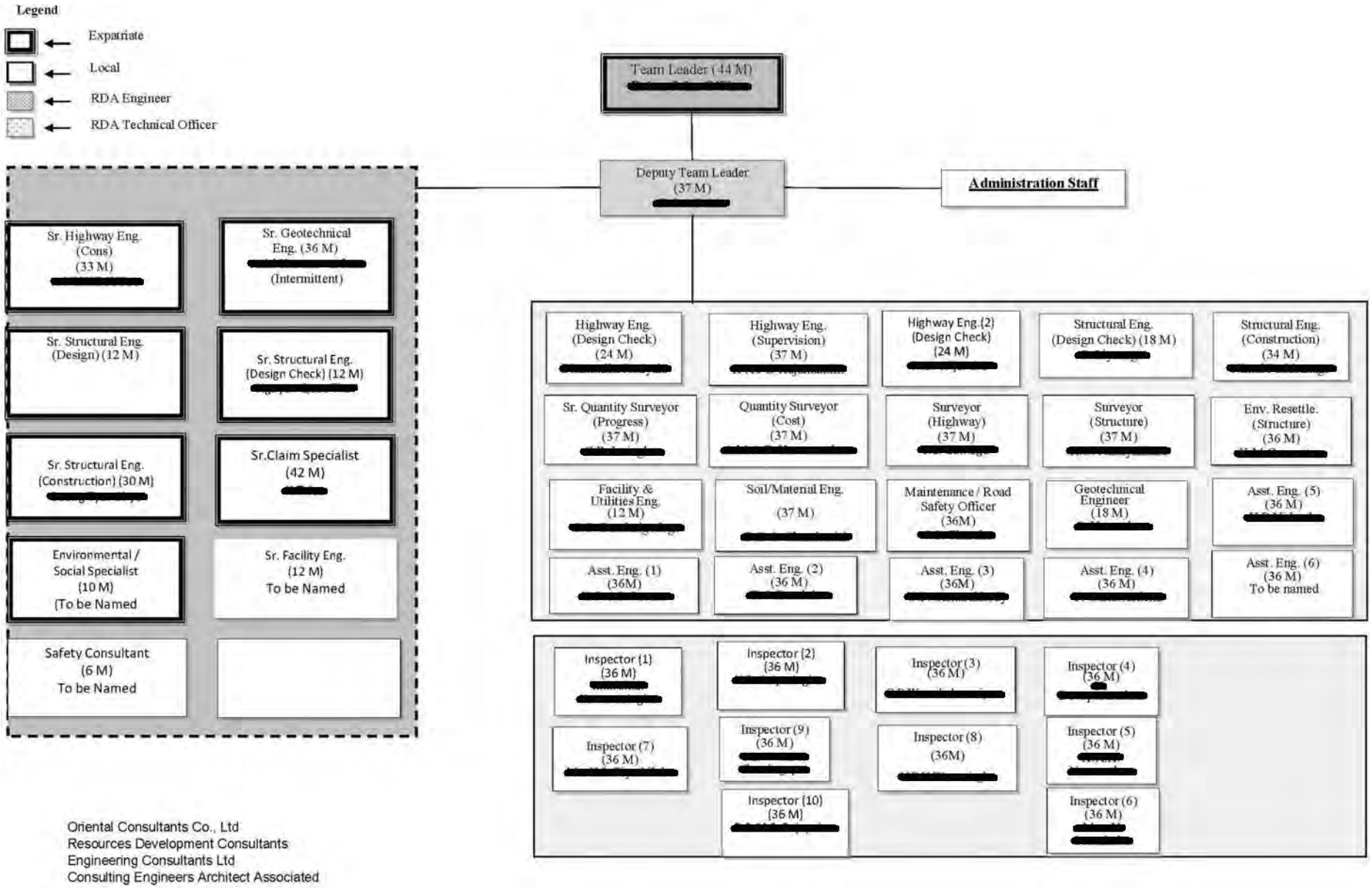
Appendix-3 OCH Organization Charts

# Consultant's Organization (Original)



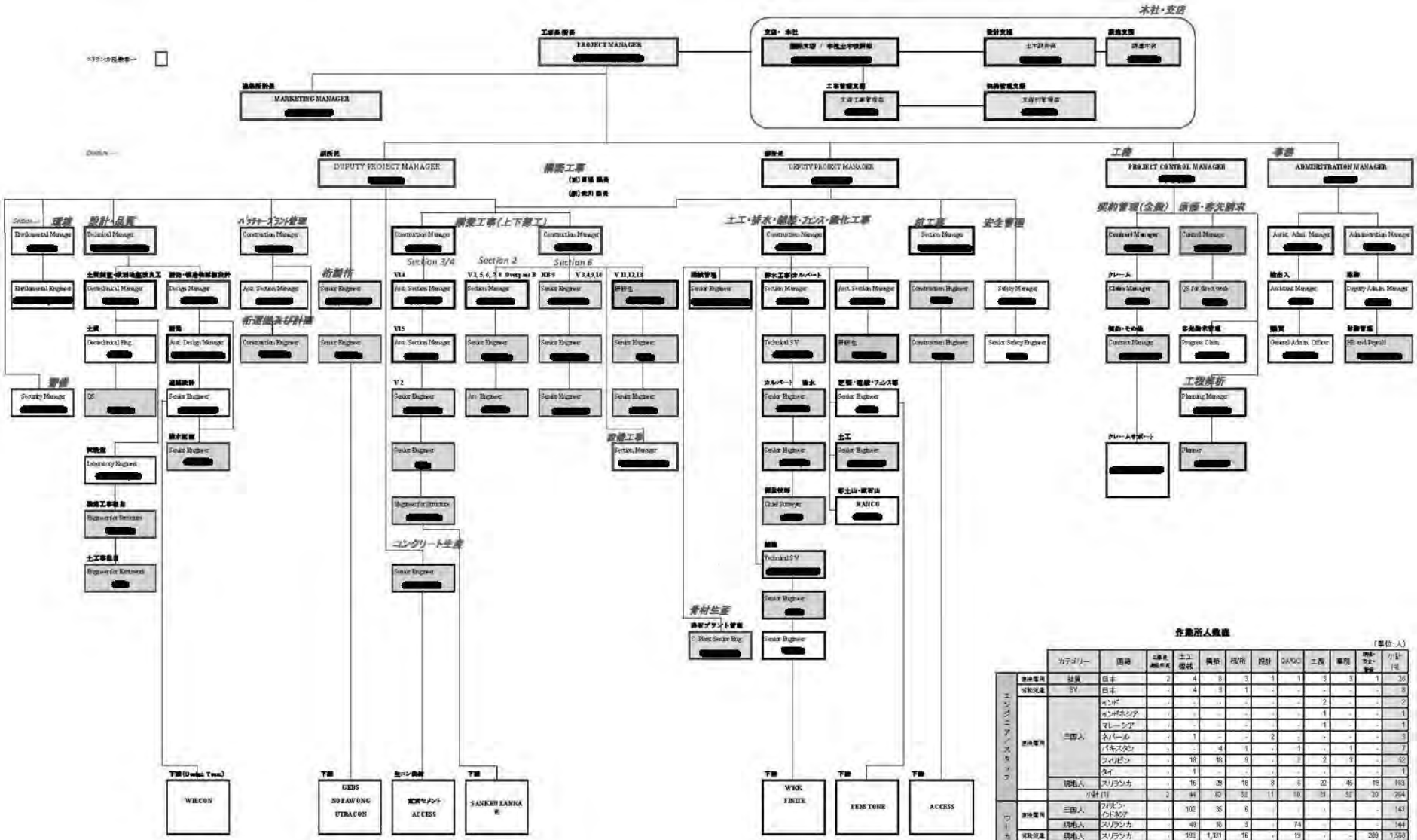

Oriental Consultants Co., Ltd
Resources Development Consultants
Engineering Consultants Ltd
Consulting Engineers Architect Associated

# Consultant's Organization (Latest)




Oriental Consultants Co., Ltd
Resources Development Consultants
Engineering Consultants Ltd
Consulting Engineers Architect Associated

# Contractor’s Organization (Original)



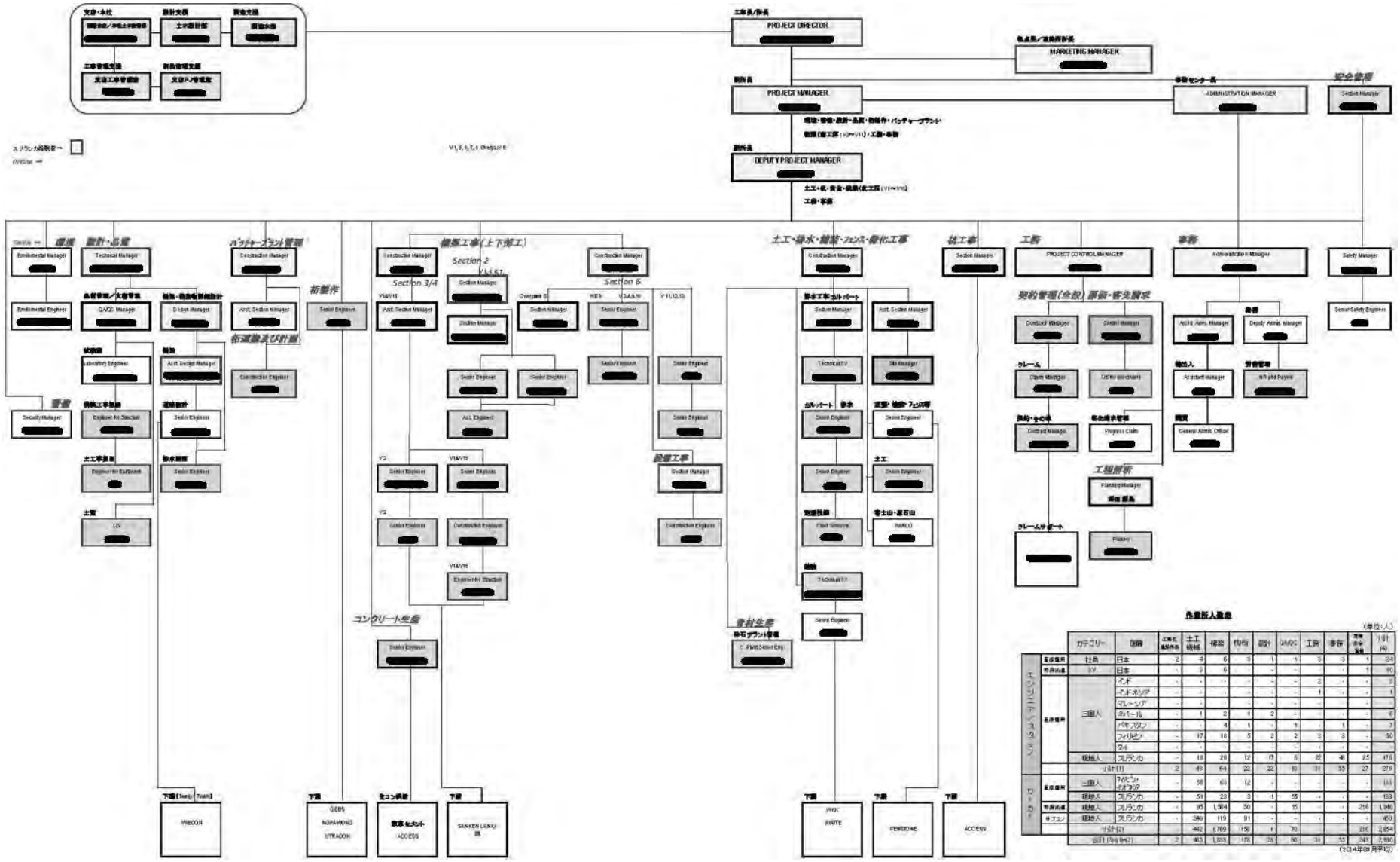

作業所人数表

（単位：人）

| カテゴリー | 国籍 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| エンジニアスタッフ | 社員 | 日本 | 2 | 4 | 8 | 3 | 1 | 1 | 3 | 3 | 1 | 26 |
| | SV | 日本 | - | 4 | 3 | 1 | - | - | - | - | - | 8 |
| | 三国人 | インド | - | - | - | - | - | - | 2 | - | - | 2 |
| | | インドネシア | - | - | - | - | - | - | 1 | - | - | 1 |
| | | マレーシア | - | - | - | - | - | - | 1 | - | - | 1 |
| | | ネパール | - | 1 | - | - | - | 2 | - | - | - | 3 |
| | | パキスタン | - | - | 4 | 1 | - | 1 | - | 1 | - | 7 |
| | | フィリピン | - | 18 | 18 | 9 | - | 2 | 2 | 3 | - | 52 |
| | | タイ | - | 1 | - | - | - | - | - | - | - | 1 |
| | 現地人 | スリランカ | - | 16 | 28 | 18 | 8 | 6 | 22 | 45 | 19 | 163 |
| | 小計 (1) | | 2 | 44 | 62 | 32 | 11 | 10 | 31 | 52 | 20 | 264 |
| ワーカー | 三国人 | フィリピン・インドネシア | - | 102 | 35 | 6 | - | - | - | - | - | 143 |
| | 現地人 | スリランカ | - | 48 | 16 | 3 | - | 74 | - | - | - | 144 |
| 現地採用 | 現地人 | スリランカ | - | 193 | 1,101 | 16 | - | 19 | - | - | 209 | 1,538 |
| サブコン | 現地人 | スリランカ | - | 246 | 204 | 312 | - | - | - | - | - | 762 |
| | 小計 (2) | | - | 589 | 1,356 | 337 | - | 93 | - | - | 209 | 2,676 |
| | 総計 (1)+(2) | | 2 | 633 | 1,418 | 369 | 11 | 103 | 31 | 52 | 229 | 2,940 |

（2014年01月平均）

# Contractor’s Organization (Latest)



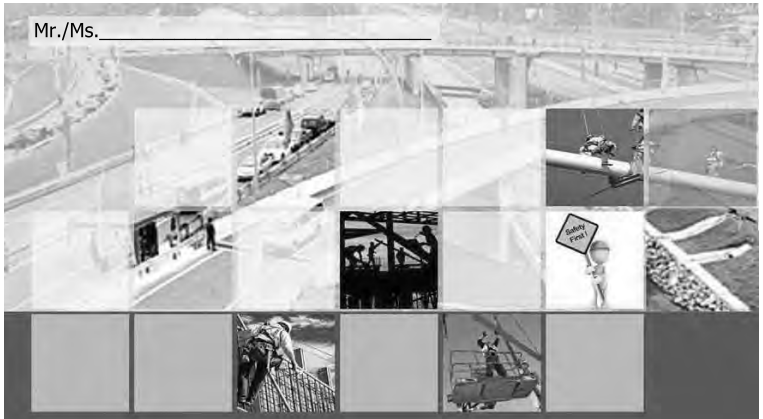
Appendix-4 List of Accident Records

**ACCIDENT & INCIDENT RECORD AND RELATED DOCUMENTS**

| No. | Date | Location | Description | Date / Letter No | Method Statemant | Monthly Progress Report | | Remark |
|---|---|---|---|---|---|---|---|---|
| | | | | | | on that Month | 2 month before | |
| 1 | 1-Feb-13 | Ch.16+150 North side of HB-9 | Boom moved further the backward uncontrollably and boom main frame broken from the main bottom joint. | 06th February 2013, TC-SAF-GEN-020-2464 | TC-COB-MS-036-1327 | Report No.14 (Feb-2013) | Report No.12 (Dec-2012) | |
| 2 | 18-Feb-13 | V4 P2 Ch. 15+945 | 25t mobile Crane toppled during lifting work for piring preparation. | 20th Feb 2013 TC-SAF-GEN-021-2565 | TC-COB-MS-026-1100 | Report No.14 (Feb-2013) | Report No.12 (Dec-2012) | |
| 3 | 11-Oct-13 | OB9 | Public bus fell down at OB9 | 11th Dec 2013 TC-SAF-GEN-060-5555 | TC-COB-MS-034-1312 | Report No.22 (OCT-2013) | Report No.20 (Aug-2013) | |
| 4 | 4-Dec-13 | V-7 (P4) | Whilst correcting the verticality of pier rebar (32mm) of inside the pier reinforcement cylindrical cage Ø 1.7m, 2 workers were injured who were inside the cage due to tilting the whole cage with the workers because of inadequate support | 10th December 2013, TC-SAF-GEN-057-5522 | TC-COB-MS-042-1617 | Report No.24 (Dec-2013) | Report No.22 (OCT-2013) | |
| 5 | 14-Mar-14 | OB-12 Temporary Girder Stock Yard | Whilst Working near the stored Girder, Girder has toppled. 03 workers dead and 02 workers got minor injured. | 18th March 2014 TC-SAF-GEN-082-6576 | TC-COB-MS-065-3071 TC-COB-MS-073-3292 | Report No.27 (Mar-2014) | Report No.25 (Jan-2014) | |
| 6 | 2-Jun-14 | Mandaranayake Mawatha Diversion | A car belongs to a third party person, had come along the Bandaranayake Mawatha public diversion at Ch.01+300, while passing the first pipe culvert, suddenly the car fallen down with the asphalt layer in to the culvert due to washing out of all the soil underneath the asphalt layer, around the steel pipes which had been laid for the culvert and the Car rested on the steel pipes. | 05th June 2014 TC-SAF-GEN-110-7250 | TC-COR-GEN-036-3970 TC-CON-GEN-665-7259 | Report No.30 (Jun-2014) | Report No.28 (Apr-2014) | |
| 7 | 20-Jul-14 | OB-10 South side Ramp | Whilst transporting a pre-cast girder from girder stock yard at South side of OB- 10 to V15, came along the girder transporting Ramp Road from the direction of south towards north the trailer was slipped and toppled the girder with rear trailer on to the left side and the front cabin section slipped and dragged with the rotating part of the trailer. | 21st July 2014 TC-SAF-GEN-121-7679 | TC-COB-MS-088-6706 | Report No.31 (Jul-2014) | Report No.29 (May-2014) | |
| 8 | 3-Aug-14 | Viaduct 1,Pier 2 at A1Bypass | Whilst carrying out preparation work for bearing plinth on pier head at viaduct 1 pier 2 at A1 Bypass worker named Ajith Prasad Kumara fell off from the pier head in to the water filled pier base depth about 01m. A fellow worker named Shammuganathan who was working with him, has seen the fallen worker was waving his hand sitting on the bank of the pier base excavation. Immediately he has come down, helped him to come out from the water and taken to Ragama Hospital for treatment and the doctors confirmed after examined him and his test reports including X-Rays of scull, chest and abdomen that, his life is out of danger and on our own wish we admitted him to Nawaloka Hospital, Colombo for CT Scan Examination for further confirmation of his condition and doctors confirmed no any internal injuries caused to his head, neck, chest or abdomen after the CT SCAN Examination. | 04th Aug 2014 TC-SAF-GEN-122-7797 | TC-COB-MS-042-1617 | Report No.32 (Aug-2014) | Report No.30 (Jun-2014) | |
| 9 | 6-Aug-14 | V-4 P3-P4 | Whilst adjusting the RC panels on the erected girder at V4 P3-P4 LHS. One worker fell down from the space through removed RC panels, in to the muddy ground. Immediately the fallen worker was taken to the Biyagama Hospital and from there he was transferred to the Colombo Accident word for further medical examination and treatment. After taken X-RAY he has been examined by the doctors and confirms that his left wrist bone and backbone were cracked. CT SCAN examination was done for further confirmation of his condition and doctors confirmed that no any internal injuries caused. | 7th Aug 2014 TC-SAF-GEN-123-7825 | TC-COB-MS-019-873 | Report No.32 (Aug-2014) | Report No.30 (Jun-2014) | |

Appendix-5 Seminar Materials

Mr./Ms._____



# Safety Review Study of On-Going ODA Loan Loan in Sri Lanka

A Seminar for everyone involved in construction work

## November 11th 2014

Waters Edge Hotel, 316 Ethul Kotte Road, Battaramulla

RDA would like to invite you to the Safety Review Study of On-Going ODA Project in Sri Lanka supported by JICA. This Seminar will provide valuable information to assist you in managing Safety of ODA Construction Projects in Sri Lanka.

**PROGRAMME:**

| | | |
|---|---|---|
| 1:30 - 2:00 | : | **Registration** |
| 2:00 - 2:10 | : | **Opening Address**<br>*Mrs. T. S. H. Abewickrema (P.D., RDA)* |
| 2:10 - 2:30 | : | **Mission of the Study**<br>*Mr. Haruo Sakashita (Landtec Japan Inc.)* |
| 2:30 - 3:15 | : | **Explanation and Discussions on "The Guidance for the Management of Safety for Construction Work in Japanese ODA Project"**<br>*Mr. Toshiaki Shishido (Landtec Japan Inc.)* |
| 3:15 - 3:30 | : | **Coffe Break** |
| 3:30 - 4:50 | : | **Interim Report of Safety Study on OCH II Project**<br>*Mr. Toshiaki Shishido (Landtec Japan Inc.)* |
| 4:50 - 5:00 | : | **Closing Remarks**<br>*Mr. Haruo Sakashita (Landtec Japan Inc.)* |

Road Development Autority
*Sri Lanka*

Japan International Cooperation Agency JICA

**Safety Review Study of On-Going ODA Loan in Sri Lanka**

Date: November 11, 2014

Venue: Waters Edge, 316 Ethul Kotte, Road Battaramulla

| | Name | Company | Position | Time | Signature |
|---|---|---|---|---|---|
| 1 | M&S Pinto | RDA | STO | 13.20 | |
| 2 | Justin Shyu | OC | SrBCE | 13:25 | |
| 3 | M.M. Sirajudeen | RDA | DD | 13.23 | |
| 4 | N.A. Pabhiranayk | OC | BCE | 13.27 | |
| 5 | J. Chathura Tharaka | OC | Safety Eng. | 13.28 | |
| 6 | S.B. Dahanayake | SPMU | Chief Engin | 13.28 | |
| 7 | B.O'Shea | OC | TL. | 1/30 | |
| 8 | R P Chandrasoma | RDA | PE | 13.30 | |
| 9 | K. Ravindralingam | RDA | DPD | 13.30 | |
| 10 | T. S. H. Abewickrema | RDA | PD | 13.30 | |
| 11 | Yoshinori OKAHARA | TAISEI | Manager | 1345 | 岡原 |
| 12 | P. J. P. H. Pathberiya | RDA | PE | 13.50 | |
| 13 | D.G.S.K Amerasena | RDA | PE | 13.55 | |
| 14 | Yosuke Sato | JICA | Rep | 14:03 | |

**Safety Review Study of On-Going ODA Loan in Sri Lanka**
Date: November 11, 2014
Venue: Waters Edge, 316 Ethul Kotte, Road Battaramulla

| | Name | Company | Position | Time | Signature |
|---|---|---|---|---|---|
| 1 | A. Nishimura | Oriental Consultants | SHE | 13:30 | |
| | ~~S.B.D. Bandaranayake~~ | | | | |
| 2 | R. B. Piyadasa | Oriental | SE | 13.30 | |
| 3 | Katsuya Kusanagi | Oriental | SE | 13:30 | |
| 1 | Ryo TAKEKAWA | TAISEI | DPM | 13:45 | |
| 5 | M.C.W Dissanayake | RDA | PE | 13/50 | |
| (?) 6 | Tashihiko AOKI | Taisei | PD | 13:55 | |
| 7 | Yasushi Taira | JICA | rr | 14:00 | |
| (?) 8 | G.J.C. Gunathilake | MOHPS | Add Sec | 1420 | |

**Safety Review Study of On-Going ODA Loan in Sri Lanka**
Date: November 11, 2014
Venue: Waters Edge, 316 Ethul Kotte, Road Battaramulla

| | Name | Company | Position | Time | Signature |
|---|---|---|---|---|---|
| | K.K.R. Gunawardena | OC | Site Engineer | 13:30 | |
| 7 | R.A.T.D. Rajamanthri | OC | H.of Hwy Cons. Eng. | 13.30 | |
| 7 | R. S. A. Peiris | OC | DTE | 1330 | |
| 4 | K. Sakoda | OC | Support BE | 13:30 | |
| 5 | P.H. Gunasinghe | RDA. | C-Eng. | 13.40 | |
| 6 | A. Tanabe | Taisei | PM | 13:50 | |
| (?) 7 | Akito ANDO | Taisei | CM | 13:50 | |
| 8 | S. D. N. Silva | RDA | DPD | 13.50 | |
| 9 | Namal Ralapanawe | JICA | | | |
| (!) 10 | Kiyoshi AMADA | JICA | | | |
| 11 | M Abeysinghe | RDA. | S/D | 1350 | |

# Guidance for The Management of Safety for Construction Works in Japanese ODA Projects

November 2014

Japan International Cooperation Agency (JICA)
Landtec Japan Inc. (LTJ)

## Introduction

**Japan's Official Development Assistance Charter was formulated to assure:**

- *"Ensuring human safety" by focusing on individuals when implementing safety management on ODA construction works.*
  - -Establish a safe and health-conscious working environment.
    - -minimize the negative impact on the environment.
    - -improve efficiency and productivity.
    - -enhance the standards of social culture in the recipient country .
    - -and greatly encourage their socio-economic advancement.
  - -The stakeholders should cooperate closely with each other
    - - to conduct multifaceted safety management
    - - ensuring safety of construction sites
    - - safety of the people of the recipient country
- **Respecting the World Human Rights Declaration**
  - -respect of basic human right
  - -safety of all people, including third parties, involved in the work
- **ODA construction projects require general management,**
  - -compliance with the time for completion,
  - -quality assurance,
  - -improvement of productivity
- **Promoting "a culture of safety"**

## Chapter 1: General Rules

### 1.1 Purpose

The Guidance contains the basic policies for safety management, and technical guidance on specific methods for safe execution of works in order to prevent occupational accidents and public accidents on ODA construction projects for public and other facilities.

By fully understanding the Guidance and complying with the regulation therein, Project Stakeholders will be in a position to respect the basic human rights of all parties involved in ODA construction projects. This will help prevent the occurrence of occupational and public accidents by creating a culture of safety, and help realize social development in the recipient country. This is the purpose of the Guidance.

### 1.2 Scope of Application

The Guidance applies to works for public and other facilities to be constructed with ODA support (including both grants and loans) (hereinafter "ODA Projects").

### 1.3 Plans for Safety Management

Two plans for the safety management for construction work sites shall be prepared and implemented by the Contractor, namely the "Safety Plan" and "Method Statements on Safety."

### 1.4 Roles and Responsibilities of Project Stakeholders

The roles and responsibilities of Project Stakeholders (i.e. Employer, Engineer, Contractor, Subcontractor, Workers) specified.

## Chapter 1: General Rules (Plans for Safety Management

| | Safety Plan | Method Statements on Safety |
|---|---|---|
| When | At the pre-construction stage | At the construction stage |
| Prepared by | Contractor | Contractor |
| Role | Basic Plan (basic policies on the general safety management and operation for the entire works at site) | Detailed Plan (specifics for the safe execution of works and safety measures for each type of work) |
| Items to be incorporated | (1) Basic Policies for Safety Management<br>(2) Internal Organizational Structure for Safety Management<br>(3) Promotion of the PDCA Cycle<br>(4) Monitoring<br>(5) Safety Education and Training<br>(6) Voluntary Safety Management Activities<br>(7) Sharing Information<br>(8) Response to Emergencies and Unforeseen Circumstances | (1) Construction plant and machinery<br>(2) Equipment and tools<br>(3) Materials<br>(4) Necessary qualifications and licenses<br>(5) The order of command for the works<br>(6) Work items<br>(7) Procedure for the execution of the works<br>(8) Foreseeable risks<br>(9) Precautionary measures |
| Timing of Submission | ● at the time specified in the tender/the contract documents<br>● no later than seven (7) days prior to the commencement of the relevant works | ● prior to commencement of the relevant works according to the execution plans<br>● Date specified in the contract documents |
| Reviewed by | Employer, Engineer | Employer, Engineer |

# Chapter 2: Basic Policies for Safety Management

## 2.1 Basic Principles of Safety Management

Basic principle 1: Safety is a top priority
Basic principle 2: Elimination of causes
Basic principle 3: Thorough precautions
Basic principle 4: Thorough compliance with relevant laws and regulations
Basic principle 5: Thorough prevention of public accidents
Basic principle 6: Thorough implementation of PDCA cycle for safety management
Basic principle 7: Thorough sharing of information
Basic principle 8: Thorough participation of all Project Stakeholders

## 2.2 Compliance with Relevant Laws and Regulations

Survey and Confirmation of the relevant laws and regulations;
Confirmation of the compliance levels

## 2.3 PDCA for Safety Management

- "Plan" being the process of establishing the Safety Plan and its Method Statements on Safety,
- "Do" being the specific implementation of the plan thus established,
- "Check" being the observation and confirmation of the safety management process, and
- "Act" being the implementation of improvements to the implemented plans based on the past performance to ensure the continuous development of field site safety standards.

# Chapter 3: Contents of the "Safety Plan"

## 3.1 Composition of the Safety Plan.

(1) Basic Policies for Safety Management
(2) Internal Organizational Structure for Safety Management
(3) Promotion of the PDCA Cycle
(4) Monitoring
(5) Safety Education and Training
(6) Voluntary Safety Management Activities
(7) Sharing Information
(8) Response to Emergencies and Unforeseen Circumstances

## 3.2 Basic Policies for Safety Management

The Contractor shall determine the basic policies for safety management applicable during construction (hereinafter the "Basic Policies") based on the scope of work, the environment where the works are performed, relevant laws and regulations of the recipient country, contract documents and other applicable or documents or data incorporated into the contract.

# Chapter 3: Contents of the "Safety Plan"

## 3.3 Internal Organizational Structure for Safety Management

The Contractor shall determine an internal organizational structure to manage safety and prevent accidents at construction sites in accordance with the Basic Policies and the following requirements to:

(1) Establish an internal organizational structure for safety management.
(2) Appoint appropriate personnel, including a supervisor responsible for safety management and safety officers, within the internal organizational structure and clarify their respective roles, responsibilities and authority.
(3) In accordance with any requirements under the contract documents, consider establishing an organization appropriate to manage safety, such as a safety committee, which may be composed of appropriate Project Stakeholders including the Employer, Consultant, and subcontractors.

## 3.4 Promotion of the PDCA Cycle

The Contractor shall set out the basic principles for promotion of the PDCA Cycle at construction sites in accordance with Clause 2.3 "PDCA for Safety Management".

## 3.5 Monitoring

The Contractor shall set out the basic principles for monitoring safety management while considering the following requirements:

(1) Monitoring by the Contractor
(2) Monitoring of accidents or injuries
(3) Monitoring near misses

# Chapter 3: Contents of the "Safety Plan"

## 3.6 Safety Education and Training

The Contractor shall set out the basic principles for education and training on safety to maintain
safety during the construction works and take into account the following requirements:

(1) Compliance with laws & regulations of the recipient country on education and training on safety.
(2) Education to all Project Stakeholders (and to all new entrants to the site) on:.
(3) Education on the Method Statements on Safety for the assigned work.
(4) Education when changes are made to work
(5) Education and training for special workers
(6) Education and training for emergency response personnel
(7) Education for visitors
(8) Training for emergencies and unforeseen circumstances
(9) Activities to promote safety awareness
(10) Language used for education and training
(11) Confirmation and recording education and training

## 3.7 Voluntary Safety Management Activities

(1) Morning meetings on safety
(2) Foreseeing hazardous activities
(3) Tool box meetings
(4) Safety rota systems
(5) Regular, monthly and periodic inspections
(6) Sorting, decluttering and cleaning
(7) Safety conventions
(8) Safety patrol
(9) Near-miss reporting system
(10) Other activities

# Chapter 3: Contents of the “Safety Plan”

## 3.8 Sharing Information

The Contractor shall set out the basic principles for sharing information necessary to ensure effective safety management while taking into account the following requirements:

(1) Description of education for new entrants
(2) Other information necessary to maintain safety

## 3.9 Response to Emergencies and unforeseen Circumstances

### 3.9.1 Response to emergencies

The Contractor shall determine the policies for responding to emergencies considered to be caused by accidents whilst taking into account the following requirements:

(1) The priority of saving human lives
(2) The establishment of an emergency communication network
(3) Procedures for responding to emergencies
(4) Responding to first-aid treatment
(5) Reporting on accidents and injuries

### 3.9.2 Responding to unforeseen circumstances

The Contractor shall determine the policy for responding to any unforeseen circumstances considered to be caused by natural disasters such as rainstorms or earthquakes while taking into account the following requirements:

(1) Emergency evacuation procedures
(2) The establishment of an emergency communication network system
(3) Procedures for responding to unforeseen circumstances
(4) Collection of weather information

# Chapter 4: Contents of the “Method Statement on Safety”

## 4.1 Composition of the “Method Statements on Safety”

### 4.1.1 Items for inclusion in a “Method Statements on Safety”

The Contractor shall formulate a Method Statements on Safety for each type of work based on the design or documents implementing the design in order to accurately and efficiently undertake work, maintain a safe working environment and prevent any unsafe action by workers. The Contractor shall incorporate the following items in any Method Statements on Safety:

(1) Construction plant and machinery
(2) Equipment and tools
(3) Materials
(4) Necessary qualifications and licenses
(5) The order of command for the works
(6) Work items
(7) Procedure for the execution of the works
(8) Foreseeable risks
(9) Precautionary measures

# Chapter 4: Contents of the “Method Statement on Safety”

### 4.1.2 Method Statements on Safety – Template

A template for a Method Statements on Safety is shown below for guidance. A form different to that below is acceptable as long as it fully satisfies the requirements as set out in Clause 4.1.1 "Items for inclusion in a Method Statements on Safety“.

Method Statements on Safety [*Enter the type of work or Project name*]

| | |
|---|---|
| (1) Construction plant and machinery | [*Enter the specifications and quantity of construction machines to be used in the work.*] |
| (2) Equipment and tools | [*Enter the equipment and tools to be used in the work.*] |
| (3) Construction materials | [*Enter the specifications and quantities of major materials to be used in the work.*] |
| (4) Necessary qualifications and licences | [*Enter the qualifications or licenses necessary for the work.*] |
| (5) Order of command (including names of supervisors) | [*Enter the name of supervisors for each section of work.*] |

| (6) Work items | (7) Procedure for the execution of the works | (8) Foreseeable risks | (9) Precautionary measures |
|---|---|---|---|
| [*Enter the work items classified into the unit work according to the order in the works schedule.*] | [*Enter the procedure for the execution of the major work operations for each type of work item.*] | [*Enter the foreseeable risks for each work item.*] | [*Enter the countermeasures to prevent the foreseeable risks and the necessary protective gear.*] |

# Chapter 4: Contents of the “Method Statement on Safety”

## 4.2 Applicable Standards for the "Technical Guidance for Safe Execution of Works"

### 4.2.1 Technical Guidance for Safe Execution of Works

**Technical Guidance for Safe Execution (by the Type of Work) - Chapter 5**

5.1 Excavation Work
5.2 Pile Foundation Work
5.3 Formwork and Form Shoring System Work
5.4 Reinforcing Bar Work
5.5 Concrete Work
5.6 Work over Water
5.7 Demolition Work
5.8 Work where there is danger of oxygen deficiency
5.9 Slinging Work

**Technical Guidance for Safe Execution (by the Type of Accident) - Chapter 6**

6.1 Measures for Prevention of Fall Accidents
6.2 Measures for Prevention of Accidents Involving Flying or Falling Objects
6.3 Measures for Prevention of Accidents Involving Collapse of Structures
6.4 Measures for Prevention of Accidents Involving Construction Machinery
6.5 Measures for Prevention of Explosion Accidents
6.6 Measures for Fire Prevention
6.7 Measures for Prevention of Public Accidents
6.8 Measures for Prevention of Traffic Accidents
6.9 Protective Gear

# Chapter 4: Contents of the "Method Statement on Safety"

## 4.2.2 Applicable Standards for the Method Statements on Safety

When any risk specified in Clause 4.1.1(8) "Foreseeable risks" is foreseen, that risk shall be identified with reference to the checklist shown in Clause 4.2.3. The counter measures for those foreseeable risks must comply with the provisions of the corresponding items shown in Chapter 6 "Technical Guidance for Safe Execution (by the Type of Accident)".

*1) Does the work involve a risk that workers will fall from high places?*
➔ **Clause 6.1 "Measures for Prevention of Fall Accidents".**

*2) Does the work involve a risk that flying or falling objects will hit workers?*
➔ **Clause 6.2 "Measures for Prevention of Accidents involving Flying or Falling Objects".**

*3) Does the work involve a risk that workers will be crushed by the collapse or fall of sediment or structures?*
➔ **Clause 6.3 "Measures for Prevention of Accidents involving Collapse of Structures".**

*4) Does the work involve a risk that workers will be caught or entangled by machines or structures?*
➔ **Clause 6.4 "Measures for Prevention of Accidents involving Construction Machinery".**

*5) Does the work involve a risk of explosion?*
➔ **Clause 6.5 "Measures for Prevention of Explosion Accidents".**

*6) Does the work involve a risk of fire?*
➔ **Clause 6.6 "Measures for Fire Prevention".**

*7) Does the work involve a risk that the general public or any other third party will suffer adverse effects?*
➔ **Clause 6.7.1 "General rules for prevention of third-party accidents".**

*8) Does the work involve a risk that underground facilities, aerial lines, or surrounding facilities will be damaged?*
➔ **Clause 6.7.2 "General rules on preventing accidents relating to underground utilities or facilities" and**
➔ **Clause 6.7.3 "General rules on preventing accidents relating to aerial utilities including aerial lines".**

*9) Does the work involve the risk of traffic accidents?*
➔ **Clause 6.8 "Measures for Prevention of Traffic Accidents".**

# Chapter 4: Contents of the "Method Statement on Safety"

## 4.2.4 Applicable Standards for the Technical Guidance for Safe Execution (by the Type of Work)

When the Contractor executes works which are specified in the Technical Guidance for Safe Execution (By the Type of Work), he shall prepare a Method Statements on Safety and conduct the works in accordance with the provisions for each corresponding type of work as specified in the said Technical Guidance. Kinds of work specified by the Technical Guidance for Safe Execution:

- (1) Excavation Work
- (2) Pile Foundation Work
- (3) Formwork and Form Shoring System Work
- (4) Reinforcing Bar Work
- (5) Concrete Work
- (6) Work over water
- (7) Demolition Work
- (8) Work where there is danger of oxygen deficiency
- (9) Slinging Work

+

**Chapter 6**
Technical Guidance for Safe Execution (by the Type of Accident)

# Chapter 5: Technical Guidance for Safe Execution (by the Type of Work)

**5.1 Excavation Work**
- 5.1.1 Key points for the preparation stage
- 5.1.2 Key points for excavation works
- 5.1.3 Key points for cofferdam and timbering

**5.2 Pile Foundation Work**
- 5.2.1 Key points for the preparation stage
- 5.2.2 Key points for the precast pile foundation work
- 5.2.3 Key points for the cast-in-place pile foundation work

**5.3 Formwork and Form Shoring System Work**
- 5.3.1 Key points for the preparation stage
- 5.3.2 Key points for the formwork
- 5.3.3 Key points for the form shoring system work

**5.4 Reinforcing Bar Work**
- 5.4.1 Key points for the preparation stage
- 5.4.2 Key points for the reinforcing bar work

**5.5 Concrete Work**
- 5.5.1 Key points for the preparation stage
- 5.5.2 Key points for the concrete work

**5.6 Work over Water**
- 5.6.1 Key points for the preparation stage
- 5.6.2 When working over water

**5.7 Demolition Work**
- 5.7.1 Key points for the preparation stages
- 5.7.2 At the time of demolition work

**5.8 Work where there is danger of oxygen deficiency**
- 5.8.1 Key points for the preparation stage
- 5.8.2 Key points for working in places where there is a risk of oxygen deficiency

**5.9 Slinging Work**
- 5.9.1 Key points for slinging work

# Chapter 5: Technical Guidance for Safe Execution (by the Type of Accident)

**6.1 Measures for Prevention of Fall Accidents**
- 6.1.1 General rules
- 6.1.2 Scaffolding

**6.2 Measures for Prevention of Accidents Involving Flying or Falling Objects**
- 6.2.1 General rules
- 6.2.2 Measures for the installation of safety nets
- 6.2.3 Protection against flying or falling objects at work areas with heights or openings
- 6.2.4 Measures for work conducted at different heights
- 6.2.5 Measures for rotating machines

**6.3 Measures for Prevention of Accidents Involving Collapse of Structures**
- 6.3.1 General rules
- 6.3.2 Measures to prevent the collapse of natural ground
- 6.3.3 Measures to prevent collapse of cargos
- 6.3.4 Measures to prevent the collapse of temporary structures (timbering, forms, form shoring system, scaffolding, etc.)
- 6.3.5 Measures to prevent collapse of structures

**6.4 Measures for Prevention of Accidents Involving Construction Machinery**
- 6.4.1 General rules
- 6.4.2 Measures for mobile crane work

**6.5 Measures for Prevention of Explosion Accidents**
- 6.5.1 General rules
- 6.5.2 Measures for storage of explosives
- 6.5.3 Measures for transport of explosives
- 6.5.4 Measures for handling of explosives

# Chapter 5: Technical Guidance for Safe Execution (by the Type of Accident)




1. **Is English version of the Guidance available?**
   *- YES*
2. **When will the application of the Guidance commence ?**
   *Grant projects:*
   *- already started.*
   *Yen Loan Projects:*
   *- will judge/decide at the project formation stage.*
   *- will judge/decide on a project-by-project basis.*
   *- will not be retroactively applied to the on-gong projects.*
3. **In case the Guidance is used as a part of tender documents, what is the priority of each document?**
   *- It is not envisaged to use the Guidance as a part of tender documents, but to assume the borrower to prepare the tender documents taking account of the local laws and regulations as well as respecting the spirit of the guidance.*

4. **If the guidance is not directly used as a part of the tender and/or contract documents, how/where the safety control-related information is incorporated in the documents; SCC, Specification, Employer's requirements or Safety Plan?**
   **- It is assumed the safety control requirements are incorporated in the specification. The significance of the safety plan will remain unchanged.**
5. **How to state the safety guidance requirements in the minutes of discussions signed by JICA and the borrower at the loan preparation stage? Template for the TOR for DD/CS consultant regarding the safety guidance? / Standard method as to how to deal with the guidance in tender/contract documents? / How to reconcile with local safety & health laws/regulations and/or criminal laws in the borrower's country? / Any influence on the contractor's all risk insurance and/or the DD/CS consultant's professional indemnity insurance?**
   **- JICA will build consensus with the borrower on the following points:**
   - **To include safety requirements with reference to the borrower's local laws/standards and the safety control guidance, and, as necessary, international safety standards such as international organizations' safety guidelines.**
   - **To confirm, at the consultant's review stage, the above requirements are met in the tender documents.**

6. **Are there any differences between STEP and ordinary Yen loan projects in terms of the Guidance?**
   - **There are no particular differences.**
7. **Any influence to payments to the contractor regarding the Guidance?**
   - **Whether or not conforming with the guidance may not affect payments to the contractor.**
8. **Will incorporation of the guidance requirements into BOQ be obliged?**
   - **It is assumed that the expenditures related to the guidance will not be included in BOQ, but be included in indirect expenses in the construction cost.**
9. **Are there any differences between STEP and ordinary Yen loan projects in terms of the guidance?**
   - **There are no particular differences between two loan schemes.**
   - **Dissemination of the guidance will be conducted through safety control seminars by JICA or loan negotiation with the borrower on new projects. In principle, the safety control guidance will be applied to all Yen loan projects.**

# GUIDANCE FOR THE MANAGEMENT OF SAFETY FOR CONSTRUCTION WORKS IN JAPANESE ODA PROJECTS

**November 2014**

**Japan International Cooperation Agency (JICA)**

**Landtec Japan Inc.**

## THAT'S A GOOD IDEA FOR SAFETY! (AND FOR SAFETY AWARENESS, TOO)

Ski Belt (100cm in length)

Workers are wearing Ski Belt while working on the slope

### A simple life belt using Ski Belt (urethane foam)

#### Merit & Effect

1. Ski Belt is well received by the workers because it is simple to use.
2. It does not hinder their work movement.
3. It gives workers a sense of security in case of falling into the water.
4. Workers feel more comfortable with Ski Belt in comparison with the ordinary life jacket because Ski Belt is quite effective in keeping their body temperature normal.
   (the rate of heat stroke has greatly reduced since we started using Ski belt.)

## THAT'S A GOOD IDEA FOR SAFETY! (AND FOR SAFETY AWARENESS, TOO)

The Device to Hook the Safety Belt

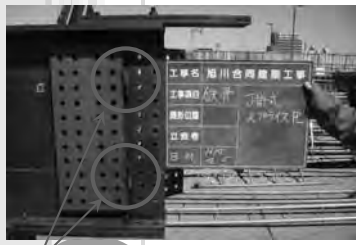
The Device in Use

### A Special Device To Hook The Safety Belt In Shoring Work

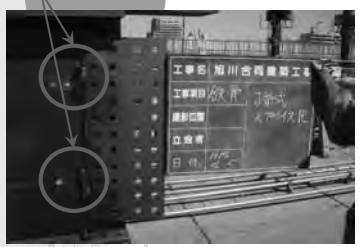
#### Merit & Effect

1. The device is quite simple and easy to make.
2. It is handy to carry (light weight) and very easy to set up(horizontally/vertically) , and unfasten using a ratchet which is a standard tool for every worker.
3. By using the device, prevention of fall accidents during installation of the main ropes or the handrails was considerably improved.

## THAT'S A GOOD IDEA FOR SAFETY! (AND FOR SAFETY AWARENESS, TOO)



Hinges



### Hinged Splice Plates

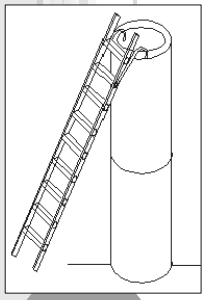
#### Work Procedure

1. Weld a hinge to the beam and the splice plate at the shop.
2. Lift and set the beam to the planned
3. Rotate the hinge 180 degree around, then insert and fasten the bolts.

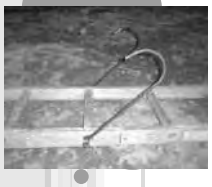
#### Merit & Effect

1. The splice plate is firmly attached to the beam at the shop.
2. The steelworkers can concentrate on inserting bolts and fastening them.
3. Hazardous works such as handling heavy objects on high scaffolding can be eliminated.

## THAT'S A GOOD IDEA FOR SAFETY!
## (AND FOR SAFETY AWARENESS, TOO)



How to use



Metal Fitting for Fixing a Movable Ladder

### A Metal Fitting for Fixing a Movable Ladder

#### Merit & Effect

1. A set of metal fittings is installed on an aluminum ladder using the hole through each rung (see the photograph).
2. The metal fitting is always kept attached to the ladder, and easy to relocate and adjust in accordance with the height of the wall.
3. Climbing up and down the ladder without the help of another worker became much safer.
4. unsafe actions such as climbing up and down unstable and dangerous ladders have been totally eliminated.

## THAT'S A GOOD IDEA FOR SAFETY!
## (AND FOR SAFETY AWARENESS, TOO)

Work on ground

Lifting and installation work

### Prefabrication of Floor Deck Plates

#### Merit & Effect

1. Works for installing small beams and floor deck plates can be performed on the ground.
2. Safety handrails and safety net are installed on the ground, too.
3. Due to the proper working posture for welding, the quality of the work is improved.
4. Because the deck plates are installed on the ground, openings are minimized, thus safety is improved.

## THAT'S A GOOD IDEA FOR SAFETY!
## (AND FOR SAFETY AWARENESS, TOO)

Workers are meditating (for 30 seconds) on the danger of the work for the day.

A designated worker is presenting his KY card.

### One-man KY Activity at The Morning Meeting

#### Activity Procedure

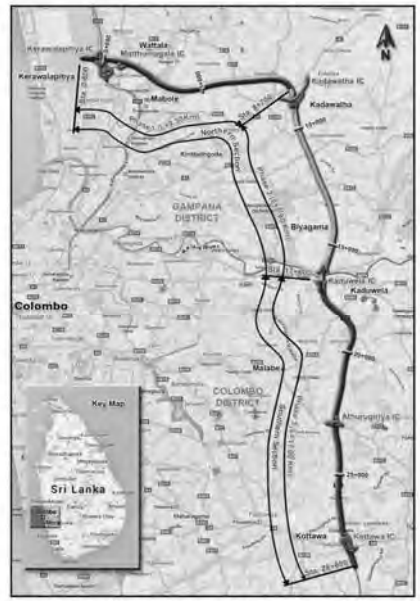
1. Before starting, all workers meditate to predict potential dangers in the work, and to think about proper countermeasures.
2. Each one writes them on a KY card. A few designated persons of the day put the cards on a bulletin board and present them to all workers.

#### Merit & Effect

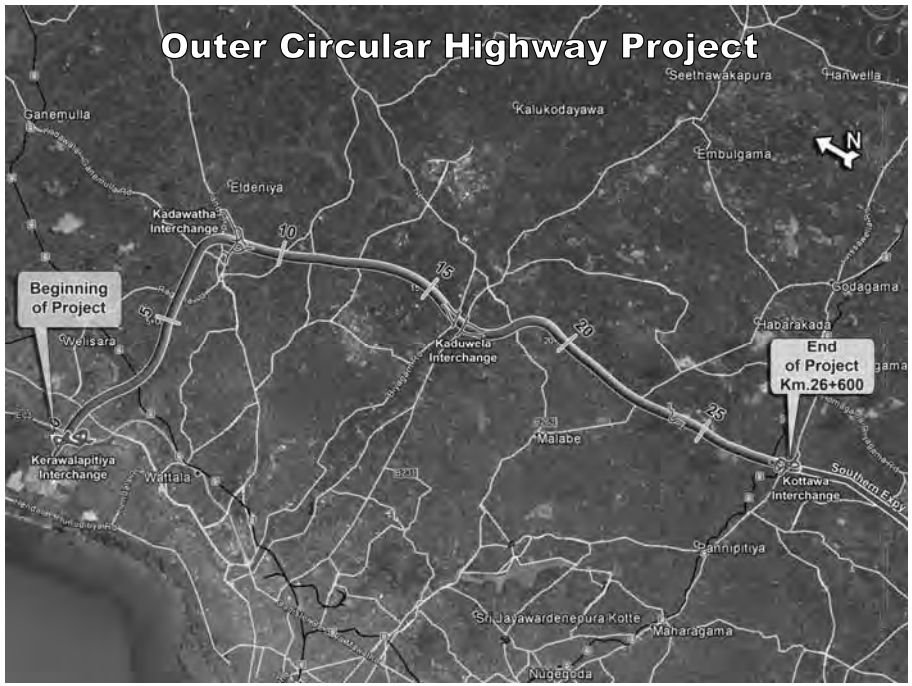
1. One-man KY activity makes it possible to self-examine his work without disturbing his work time.
2. One-man KY activity can promote awareness of safety in individuals by promising and vowing his determination in safety to all.

# Outer Circular Highway
# Northern Section 1 Project

# Root Cause Analysis of the Accidents



Location Map of Outer Circular Highway Project (Phase 2)




## Chronological List of Accidents for Study

| Date | Accident Description | Casualty |
|---|---|---|
| 2013/02/01 | A Crane boom broke from the main bottom joint and damaged a house and a vehicle in the vicinity. | Nil |
| 2013/02/18 | 25t mobile crane toppled during lifting work due to inadequate ground support condition. | Nil |
| 2013/10/11 | A public bus fell down at OB9. | 2 Injured |
| 2013/12/04 | The pier reinforcement cylindrical cage tilted and worker in side were injured. | 2 Injured |
| 2014/03/14 | While working near the stored girder, the girder toppled. | 3 Died<br>2 Injured |
| 2014/06/02 | A car belonging to a third party fell from the top of the pipe culvert. | 1 Injured |
| 2014/07/20 | While transporting a PC girder, the trailer slipped and girder was toppled. | 1 Injured |
| 2014/08/03 | A worker fainted and fell from the top of a pier while working with adhesive chemicals. | Nil |
| 2014/08/06 | While adjusting RC panel on the erected girder, a worker fell through the opening between the girders. | 1 injured |

# Root Cause Analysis of the Accident

# 1. Toppling of PC Girder(2014/03/14)

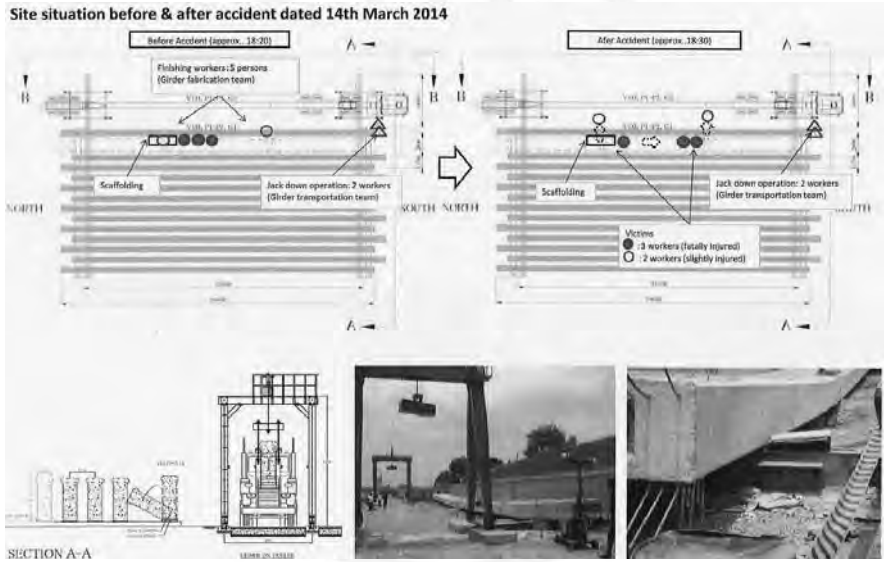
## 【The Accident】

A root cause analysis for the grave accident in which three workers were fatally injured, occurred on 14th March 2014 at the site of the Outer Circular Highway to the City of Colombo Project is stated in detail hereinafter.

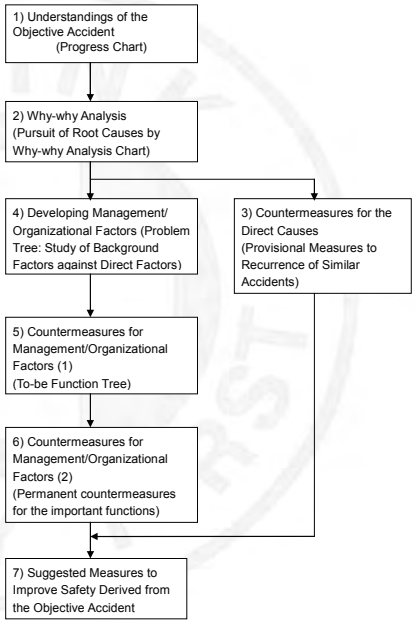
## 【Outline of the Accident】

At temporary girder stock yard, after shifting of PC girder (L=35m, H=2m, W=70t) from the trolley to temporary supporting H-400 by using hydraulic jack, wood levelling filler gave away which caused to topple the PC girder. 3 workers of girder finishing work team were died and 2 worker were sustained minor injuries.

## The Accident Caused by the Toppled PC Girder

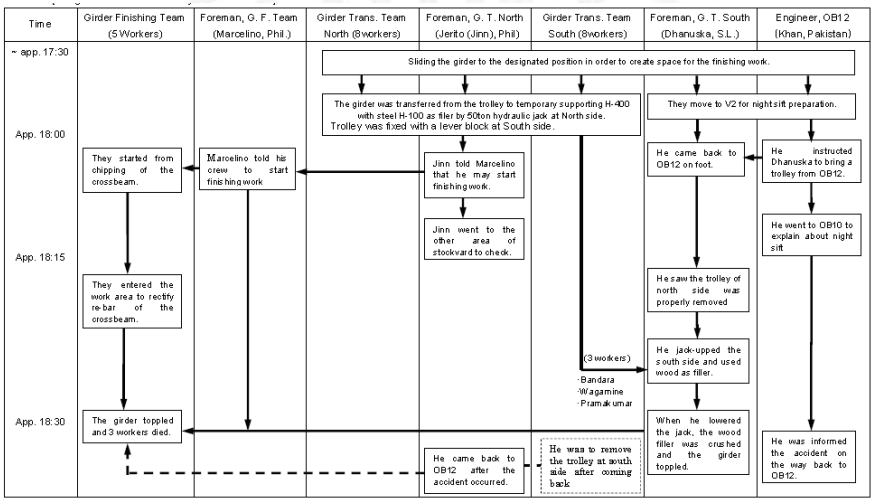



## Root Cause Analysis and Countermeasure Study Flow



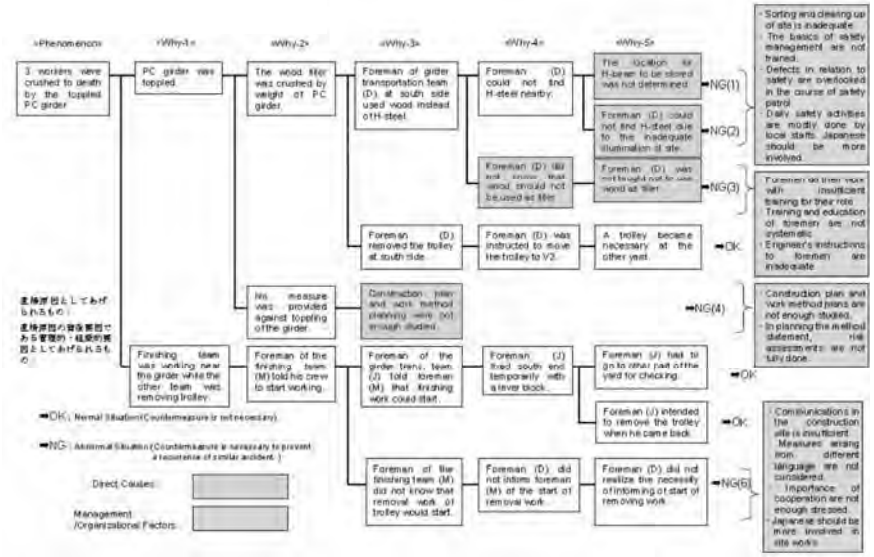
# Understandings of the Accident (2014/03/14)

【Time Sequence Chart of the Accident】




# Understandings of the Accident(2014/03/14)

Pursuit of Root Causes by the Why-why Analysis Chart




# Countermeasures against Direct Cause(2014/03/14)

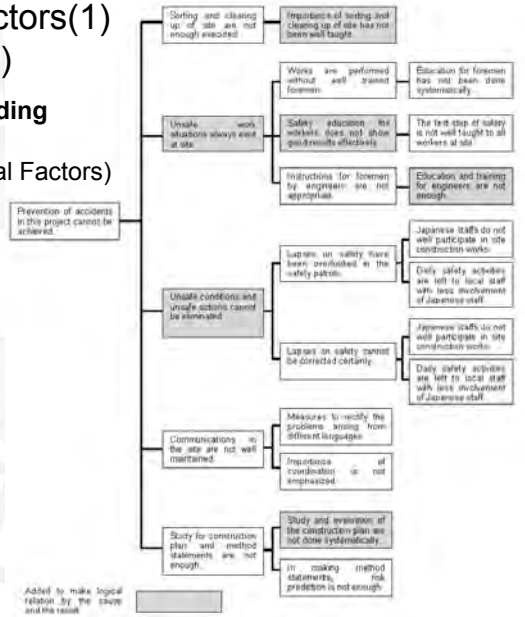
(Provisional countermeasures to prevent recurrences of similar accidents)

| Direct Causes derived from Why-why Analysis (shown in yellow in the chart) | Countermeasure 1 | Countermeasure 2 | Countermeasure 3 |
|---|---|---|---|
| 1. Foreman (D: who is directly responsible for the accident) did not know that wood should not be used as filler. | Prepare a series of practical method of statement showing every predictable risk and prohibited action. | Explain to and make the foremen fully understand about the work, how to perform and what they never be allowed to do. | |
| 2. The location for H-beams to be stored was not determined. | Keep everything in order in the site and clarify the locations where materials, equipment and tools to be stored. | At the start and the end of the day, foreman shall check the numbers and location of objectives with his crew and record them every day. | |
| 3. Foreman (D) could not find H-steel due to the inadequate illumination at site. | Investigate and act quickly to create safe work environment by providing proper illuminations. | As for achieving safe work environment, recheck the site wholly by various point of view as well as improperness of illumination. | |
| 4. Construction plan and work method planning were not enough studied. | Not only toppling of girder but each work that would contain dangerous factors shall be studied with special care and the result shall be reflected in the construction plan and method statement as well. | At the planning stage of the work, risk assessment shall be practiced, and countermeasures if necessary, shall be included in the plan. | Reliable measures preventing toppling of girder shall be planned as quickly as possible and be applied at site. |
| 5. Foreman (D) did not realize the necessity of informing of start of removing work to the finishing team. | Make it a most strict rule that finishing work and others while works which involve dangerous factors such as transporting girder is in progress shall not be done simultaneously. | Foremen must confirm that the site is clear except workers involved in the work directly. | |

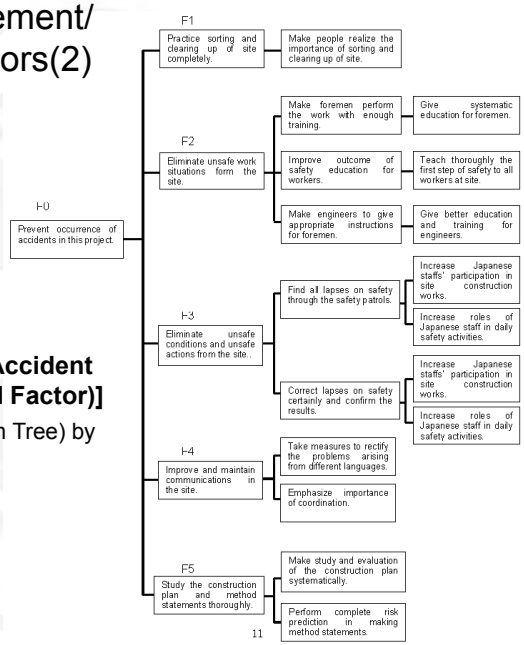
# Developing Management/ Organizational Factors(1) (2014/03/14)

**[A Problem Tree Leading to the Accident]**

(Management/Organizational Factors)



## Developing Management/ Organizational Factors(2) (2014/03/14)




**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

Convert the problems (in Problem Tree) by reversing to functions.

## Developing Management/ Organizational Factors(2) (2014/03/14)

F0

Prevent occurrence of accidents in this project

- F1: Establish a culture of sorting and clearing up of site.
- F2: Eliminate unsafe work situations form the site.
- F3: Eliminate unsafe conditions and unsafe actions from the site.
- F4: Improve and maintain communications at the site.
- F5: Study the construction plan and method statements thoroughly.

**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

**(<u>Basic Function & Second Level Functions</u>)**

# Root Cause Analysis of the Accident

# 2. Falling from Pier by Passing Out (2014/08/03)

## The Accident : Falling from Pier by Passing Out

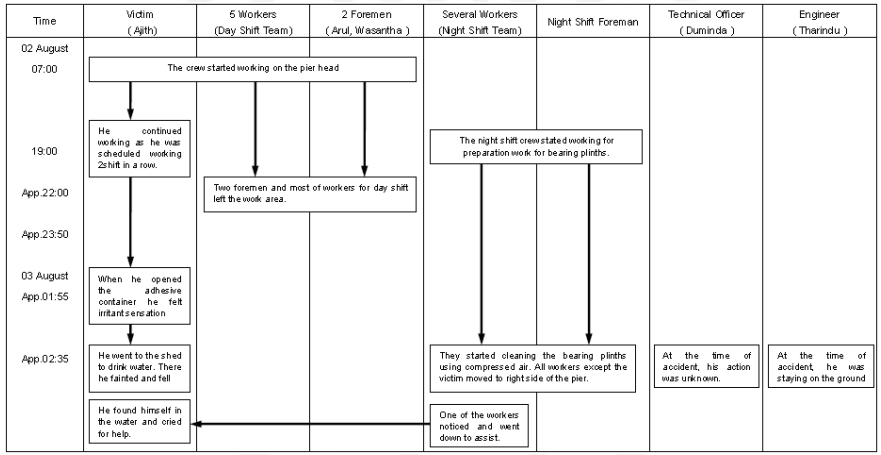
Viaduct 1 Pier No.2 at A1 Bypass

Top of the Pier

Shed by Tarpaulin

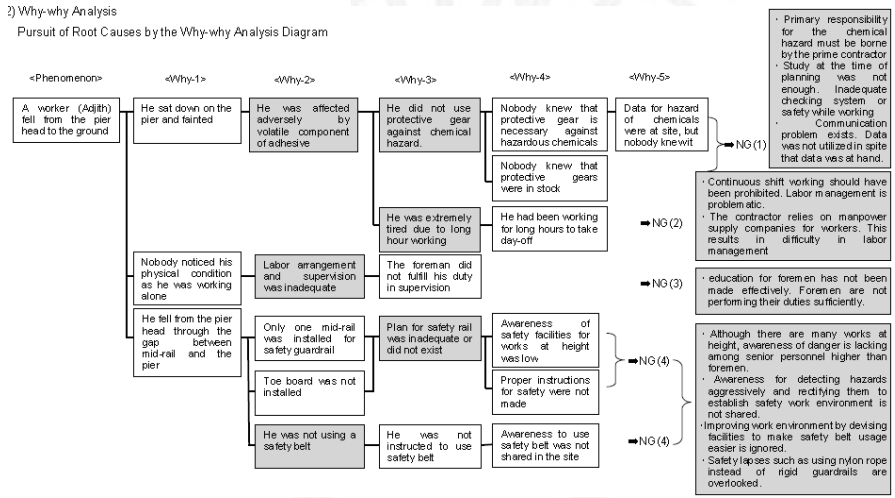
# Understandings of the Accident (2014/08/03)

【 Time Sequence Chart of the Accident】




# Understandings of the Accident (2014/08/03)

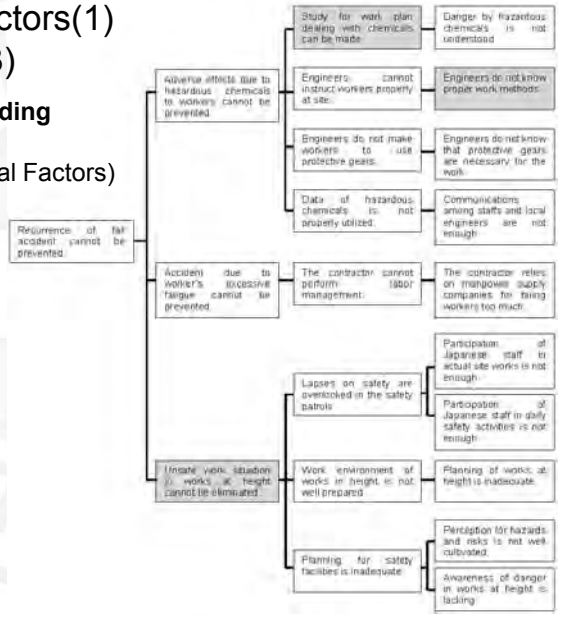
## Pursuit of Root Causes by the Why-why Analysis Chart




# Developing Management/ Organizational Factors(1) (2014/08/03)

**[A Problem Tree Leading to the Accident]**

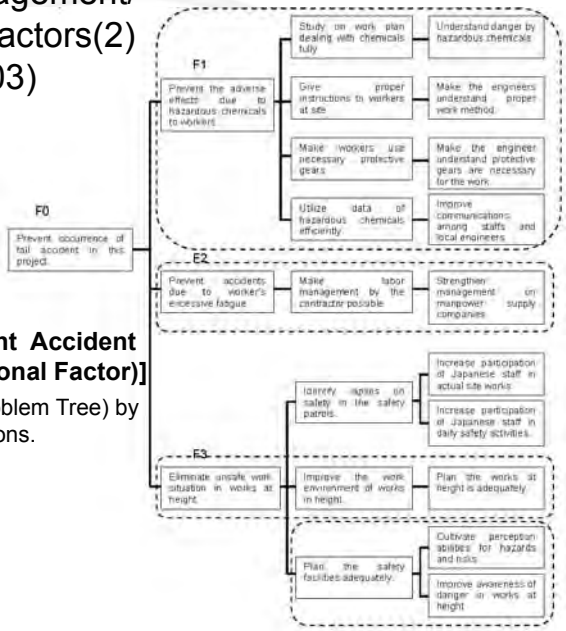
(Management/Organizational Factors)




# Developing Management/ Organizational Factors(2) (2014/08/03)

**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

Convert the problems (in Problem Tree) by reversing to functions.



## Developing Management/ Organizational Factors(2) (2014/08/03)

F0

Prevent occurrence of fall accident in this project.

F1

Prevent the adverse effects due to hazardous chemicals to workers.

F2

Prevent accidents due to worker's excessive fatigue.

F3

Eliminate unsafe work situation in works at height.

**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

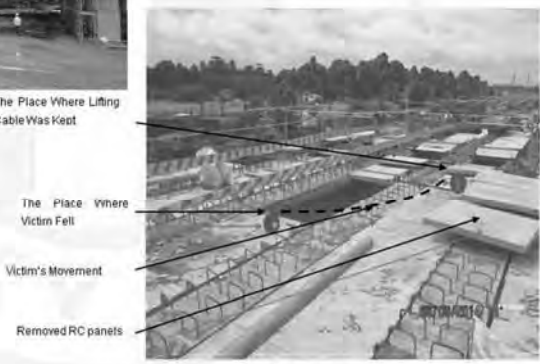
**(Basic Function & Second Level Functions)**

# Root Cause Analysis of the Accident

# 3. Falling from the Girder (2014/08/06)

## The Accident : Falling from the Girder


View of the Accident Site




Accident Location

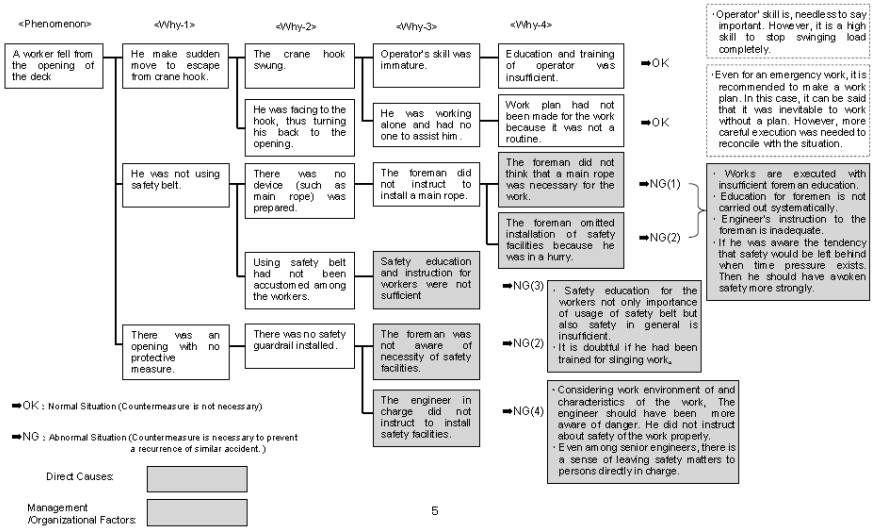
## Understandings of the Accident (2014/08/06)

【 Time Sequence Chart of the Accident】

| Time | Victim (Ramasamy) | 2 workers (Grinding)) | Foreman | 2 workers (Height Adjustment) | Crane Operator |
|---|---|---|---|---|---|
| 07:00 | Waited on the ground (Reason unknown) | They started working removing RC panel for height adjustment on the deck. | | | |
| | | They started grinding the removed panels. | | They started adjusting work of panels at a separated place. | |
| 08:32 | He went up to the deck. | | Foreman instructed the victim to remove 4th panel. | | |
| | He moved to the location to pick up lifting cables | | | | |
| (3 minutes to Accident) | | | He sent signal to the crane operator. | | The operator moved the crane hook to place where 4th panel was placed. |
| | He was going to put the cables to 4th RC panel. | | | | |
| 08:35 | He tried to escape from swinging crane hook, and move backward and fell from the opening. | | | | |

# Understandings of the Accident (2014/08/06)

## Pursuit of Root Causes by the Why-why Analysis Chart

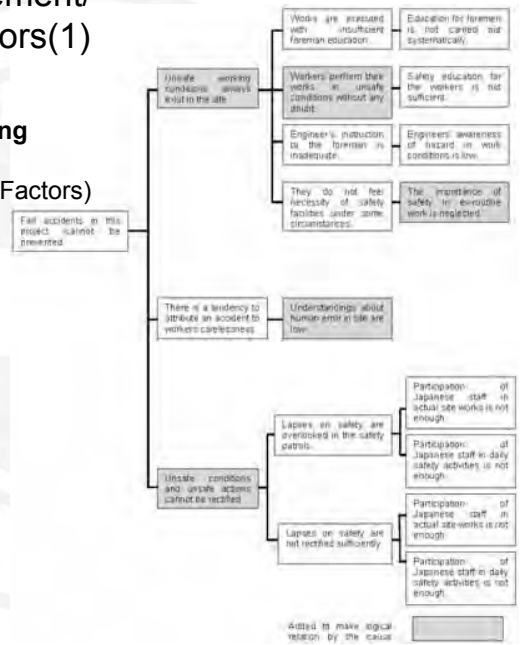





# Developing Management/ Organizational Factors(1) (2014/08/06)

**[A Problem Tree Leading to the Accident]**

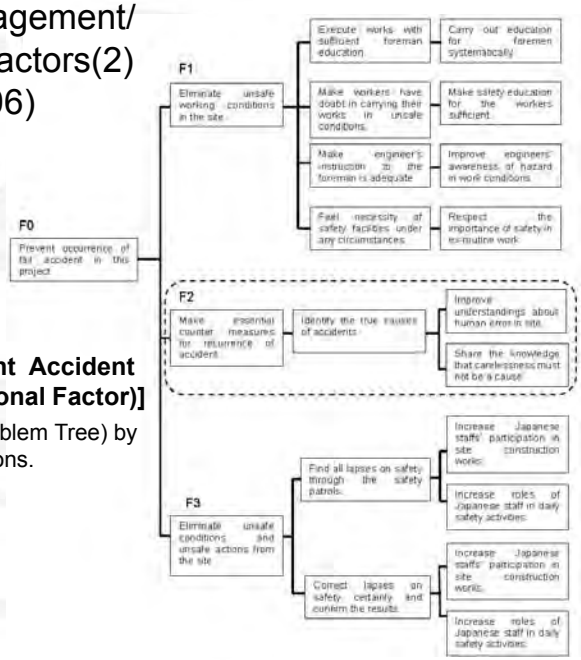
(Management/Organizational Factors)



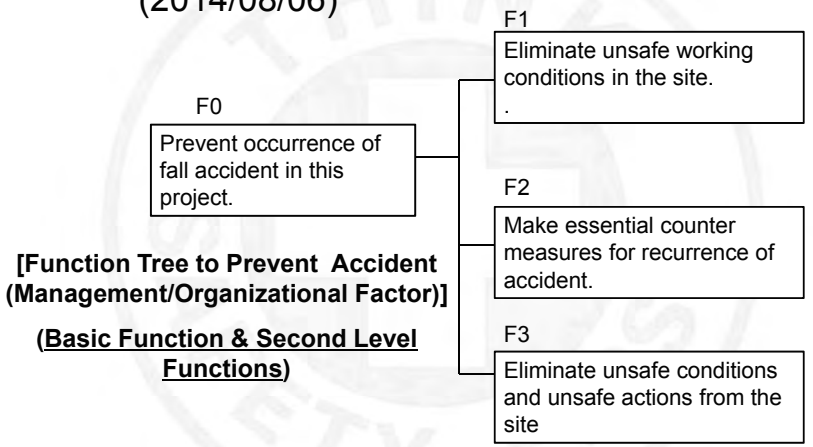

# Developing Management/ Organizational Factors(2) (2014/08/06)

**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

Convert the problems (in Problem Tree) by reversing to functions.




# Developing Management/ Organizational Factors(2) (2014/08/06)



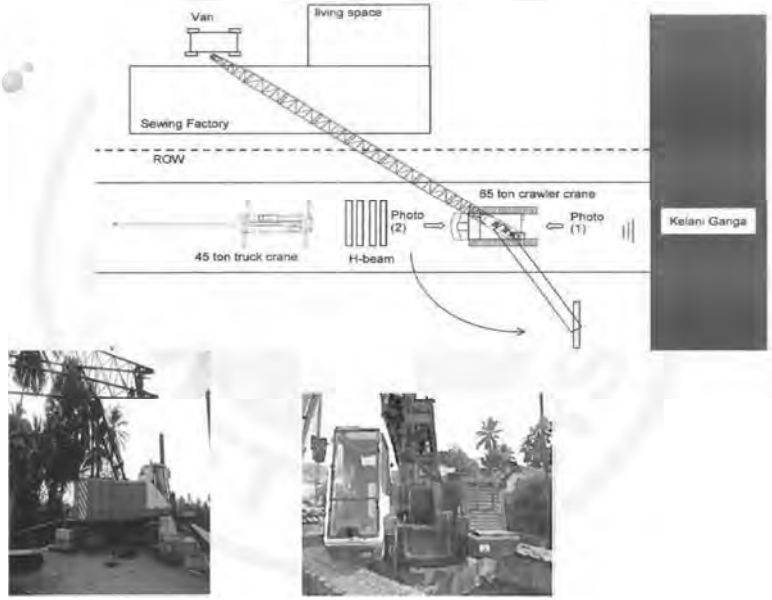

**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

**(<u>Basic Function & Second Level Functions</u>)**

# Root Cause Analysis of the Accident

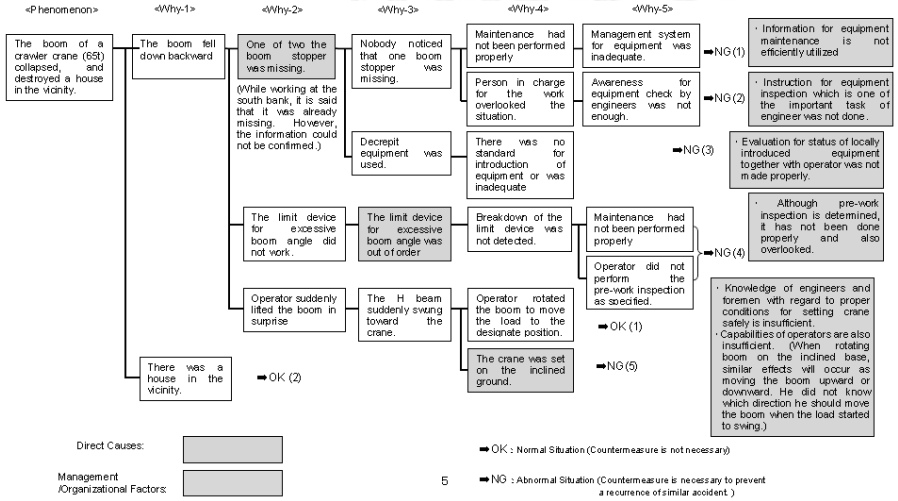
# 4. Accident Caused by a Broken Boom of the Crane (2013/02/01)

## The Accident Caused by a Broken Boom of the Crane




## Understandings of the Accident (2013/02/01)

### Pursuit of Root Causes by the Why-why Analysis Chart

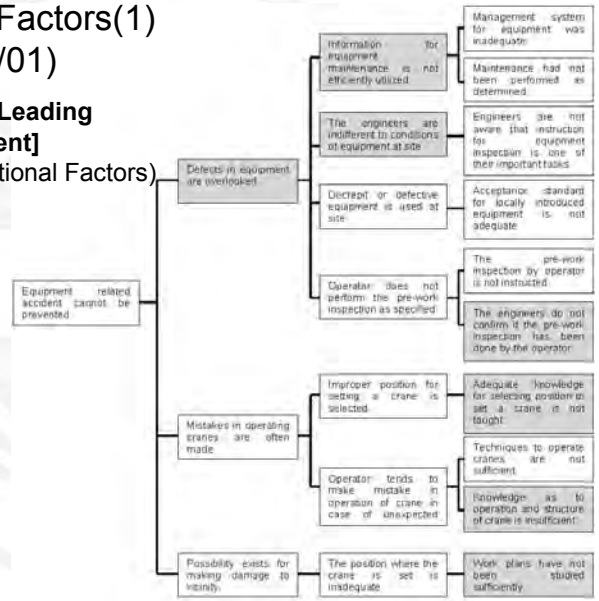




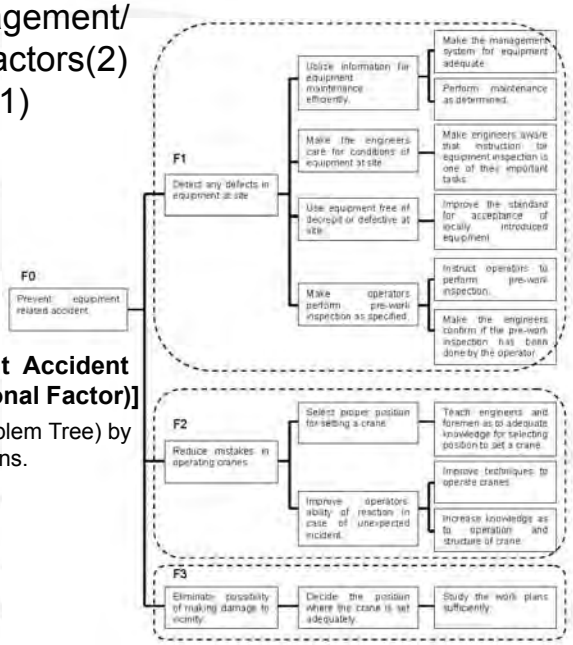

## Developing Management/ Organizational Factors(1) (2013/02/01)

**[A Problem Tree Leading to the Accident]**

(Management/Organizational Factors)



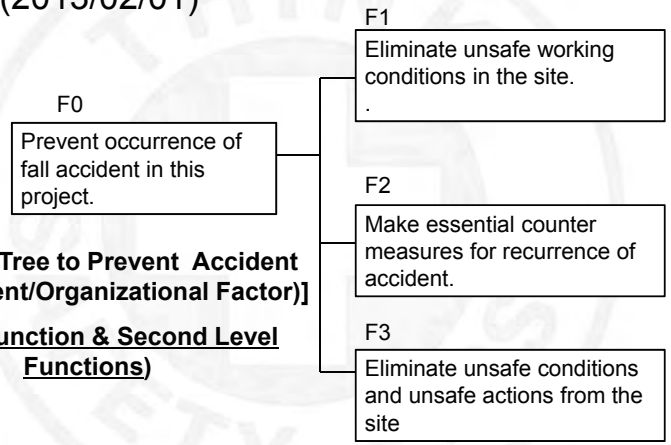
Developing Management/ Organizational Factors(2) (2013/02/01)




**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

Convert the problems (in Problem Tree) by reversing to functions.

Developing Management/ Organizational Factors(2) (2013/02/01)



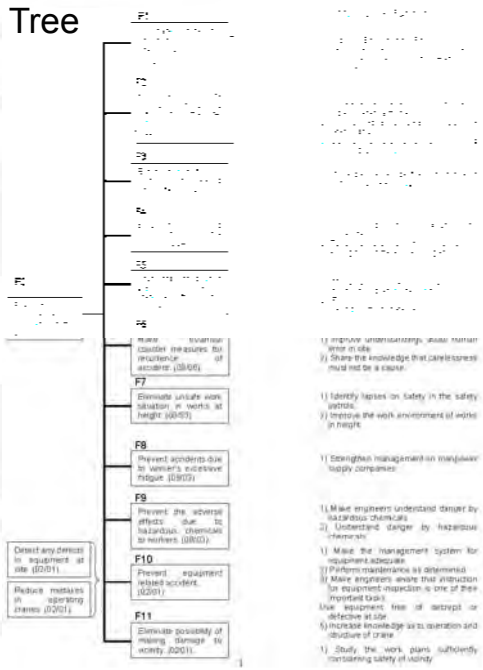

**[Function Tree to Prevent Accident (Management/Organizational Factor)]**

**(Basic Function & Second Level Functions)**

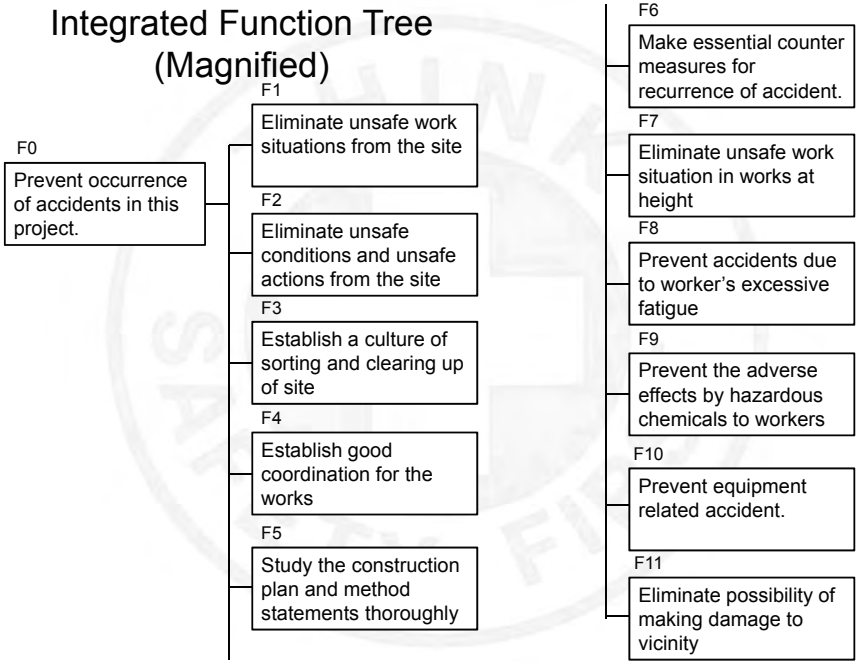
# Outer Circular Highway Northern Section 1 Project

# Integrated Analysis of Four Accidents and Recommendations

Integrated Function Tree



## Integrated Function Tree (Magnified)




## Management/Organizational Factors Derived from 4 accidents in OCH2 Project (1)

| Accident | Management Factors | Organizational Factors |
|---|---|---|
| Accident by Broken Boom of Crane (2013/02/01) | 1) Evaluation system for locally introduced equipment together with operator did not exist.<br>2) Maintenance of equipment had not been performed properly.<br>3) There was not a system supervisors could obtain information as to equipment maintenance.<br>4) Instruction to operators to carry out pre-work inspection was not given nor was it not confirmed. | 1) Supervisors and engineers did not think of inspecting themselves the condition of equipment.<br>2) Knowledge of engineers and foremen regarding setting and operating cranes was not enough. |
| Accident by Toppling of PC Girder (2014/03/14) | 1) Safety patrol did not function; thus, unsafe conditions at site were overlooked.<br>2) Safety activities were not able to cover whole construction site due to its size.<br>3) Engineer's instruction to foremen was not sufficient. (Particularly at night shift work.) | 1) Importance of good coordination between different work teams was not well recognized.<br>2) Awareness of sorting and clearing up the site thoroughly was not shared through the site.<br>3) Awareness for importance of foreman education was low.<br>4) Awareness of necessity for participating in site works and safety management was not enough.<br>5) The necessity to include safety plan in the method statement was not recognized. |

## Management/Organizational Factors Derived from 4 accidents in OCH2 Project(2)

| Accident | Management Factors | Organizational Factors |
|---|---|---|
| Accident of Falling from Pier by Passing Out (2014/08/03) | 1) Work hours of workers at site were not monitored and controlled.<br>2) Safety measures for works at height are left to supervisors' discretion and were not adequate.<br>3) There was no safety plan for works using hazardous chemicals. | 1) Because of direct hiring system, it was difficult to control manpower supply companies for management of working hours.<br>2) Awareness of hazard in a work at height prior to start of the work was low. |
| Accident of Falling from the Girder (2014/08/06) | 1) Safety facilities were not enough.<br>2) Usage of safety gear such as safety belt was not recognized as mandatory by foremen.<br>3) The foreman did not perform his primary duty of supervision as he was acting as signalman. | 1) Awareness for importance of foreman education was low.<br>2) Among engineers and foremen, awareness of the tendency that accident would increase under time restriction was low. |

## Management Factors For Safety in OCH2 Project

| Management Factors | Significance |
|---|---|
| 1. Factors in Safety Management at Site | |
| 1) Safety patrol did not function; thus, unsafe conditions at site were overlooked. | ◎ |
| 2) Safety activities were not able to cover whole construction site due to its size. | ○ |
| 3) Safety measures for works at height are left to supervisors' discretion and were not adequate. | ◎ |
| 4) Usage of safety gear such as safety belt was not recognized as mandatory by foremen. | ◎ |
| 5) There was no safety plan for works using hazardous chemicals. | ○ |
| 2. Factors As to Engineers and Foremen | |
| 1) Engineer's instruction to foremen was not sufficient. (Particularly at night shift work.) | ◎ |

| Management Factors | Significance |
|---|---|
| 2) The foreman did not perform his primary duty of supervision as he was acting as signalman | ◎ |
| 3. Factors in Equipment Management | |
| 1) Evaluation system for locally introduced equipment together with operator did not exist. | ◎ |
| 2) Maintenance of equipment had not been performed properly. | ◎ |
| 3) There was not a system supervisors could obtain information as to equipment maintenance. | ○ |
| 4) Instruction to operators to carry out pre-work inspection was not given nor was it not confirmed. | ○ |
| 4. Other Factors for Work Execution | |
| 1) Work hours of workers at site were not monitored and controlled. | ○ |

# Organizational Factors For Safety in OCH2 Project

| Organizational Factors | Significance |
|---|---|
| 1. Factors As to Safety Awareness and System | |
| 1) Awareness of necessity for participating in site works and safety management was not enough. | ◎ |
| 2) The necessity to include safety plan in the method statement was not recognized. | ◎ |
| 3) Among engineers and foremen, awareness of the tendency that accident would increase under time restriction was low. | ○ |
| 4) Supervisors and engineers did not think of inspecting themselves the condition of equipment. | ○ |
| 2. Factors As to Hiring System | |
| 1) Because of direct hiring system, it was difficult to control manpower supply companies for management of working hours. | ◎ |

| Organizational Factors | Significance |
|---|---|
| 3. Factors As to Roles and Abilities of Engineers and Foremen | |
| 1) Awareness for importance of foreman education was low. | ◎ |
| 2) Awareness of hazard in a work at height prior to start of the work was low. | ◎ |
| 4. Other Factors for Work Execution | |
| 1) Importance of good coordination between different work teams was not well recognized. | ◎ |
| 2) Awareness of sorting and clearing up the site thoroughly was not shared through the site. | ◎ |
| 3) Knowledge of engineers and foremen regarding setting and operating cranes was not enough. | ○ |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 1

| Item | Nos. of Recommendation |
|---|---|
| 1. Awareness of Safety | 4 |
| 2. Organization for Safety Management | 3 |
| 3. Safety Plan and Execution | 4 |
| 4. Safety Management Activities | 5 |
| 5.Education and Enlightenment of Safety | 2 |
| 6. Hiring and Management of Labor Force | 2 |
| 7. Others | 2 |
| Total | 22 |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 1

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 1. Awareness of Safety | 1) The top management (the Contractor, the Owner and the Consultant) exercises a strong leadership in enhancing safety awareness, and took initiative in acting to materialize the “Safety First” principle.<br>2) Practice an education and enlightenment which agree with the present situation of education and safety awareness level of the local workers’ to establish the safety works.<br>3) Establish a structure for the supervisory personnel (foremen and supervisors) who are either foreigner or local can gain professional knowledge from Japanese safety experts in order to improve their ability of foreseeing danger. | |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 2

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 1. Awareness of Safety | 4) Considering absolutely most of accidents are caused by human errors (the lack of coordination and communication is one of the human errors), enhance understanding of the human errors and work on preventing accidents based on it.. | |
| 2. Organization for Safety Management | 1) The safety management section must be under the direct control of the Project Director. Give the section strong authorities to instruct other sections for safety improvement.<br>2) Clarify the roles and authorities of the Safety Manager and Safety Officers to pursue compatibility of execution of the project and safety of the works. | 1) After March 2014, the safety management organization was reviewed and positioned directly under the Project Director.<br>The safety section was also reinforced with additional safety personnel together with a permanent Japanese safety engineer.<br>A safety expert was also dispatched from Taisei’s Tokyo head office in August and has been helping safety management activities effectively. |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 3

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 2. Organization for Safety Management | 3) The Owner clarifies the principle of safety of the Project. The Consultant establishes the organization for safety management and the system to cooperate with the Contractor's safety management organization to materialize the effective safety activities. | 3) The Owner, RDA has a great interest in safety management in the Project designating safety personnel. |
| 3. Safety Plan and Execution | 1) Make a concrete and detailed safety plan which agrees with the present situation that many workers are unskilled when studying the Method Statement. In addition, establish the structure in which inspections by the Consultant prior to the start of the work includes inspection of safety measures, and perform inspection as determined.<br>2) In future STEP projects, the above shall be clearly stipulated in the contract document. | |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 4

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 3. Safety Plan and Execution | 3) In the study of the above safety plan, involve not only the engineer in charge for the section/work but also foremen to make the plan suitable to the actual work conditions.<br>In addition, this is effective enhance the sense of responsibilities of foremen in their roles.<br>4) Establish the system of executing and confirming the safety measures as planned. The present Safety Plan is merely a general content, and not a plan to guarantee the safety of a specific work in the specific construction site. | 3) Studies of construction methods for the selected six hazardous works have been done involving foremen. An effective result of the education for foremen has been recognized. |
| 4. Safety Management Activities | 1) Share the idea that the one of the major purpose of daily site patrol is safety management among all staff and personnel. | |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 5

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 4. Safety Management Activities | 2) Give the priority to safety measures even if it causes delay of the work in order to establish "Safety First" and practice it in the site.<br>3) In order to improve the effectiveness of the safety patrol by the Consultant, strengthen coordination and cooperation between the Consultant and the Contractor.<br>4) Improve daily safety activities such as the morning meeting and the tool box meeting.<br>5) Make several tens of second of time for the silent prayer at the end of the meeting exampled above for the safety of the day. | 3) These safety activities have been practiced since March 2014. |

# Recommendation for OHC2 Project
## Management/Organizational Factor in Safety Management 6

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 5.Education and Enlightenment of Safety | 1) Make much of the education specifically for foremen considering the status of the local work force, perform it systematically.<br>2) Give the workers an education for basic matters of safety. Make foremen always instruct them through the site work about safety repeatedly. (Usage of safety gears and avoiding unsafe acts, etc.) | 1) Although a systematic education program is not available yet, the importance of the education of foremen is well recognized, and is conducted as needed.<br>2) The basic education of safety for the workers has been conducted; however, it has not been producing affirmative effects. |
| 6. Hiring and Management of Labor Force | 1) Due to the situation that subcontractors in this country have not grown enough yet, the direct hiring of work force is inevitable. However, the Contractor has to exercise any necessary management such as the working time of workers to prevent accidents due to excessive fatigue. | 1) According to the contract of the manpower supply, the confirmation of the status of workers of their working time is on the Contractor. However, that role has not been done by Taisei so far. |

# Recommendation for OHC2 Project

## Management/Organizational Factor in Safety Management 7

| Item | Content of Recommendations | Comparison with the Present |
|---|---|---|
| 6. Hiring and Management of Labor Force | 2) Considering the situation of the local workers that there are many unskilled or unqualified workers, provide fundamental/practical education agreeing their skill levels and work environment and work methods. | 2) According to the contract of the manpower supply, the education of workers for the safety rules at the site is to be done by the manpower supply companies. |
| 7. Others | 1) Make all personnel and workers understand that sorting and clearing up are the fundamental factors to ensure the safety. Promote the movement of sorting and clearing up the site.<br>2) Eliminate defective equipment from the site by evaluate the status of the equipment especially brought in by supplier based on the evaluation standard. | 1) Presently the site condition has been improved at the tidiness point of view by designating special team for cleaning. The movement of sorting and clearing up has not initiated yet in this site. |

Appendix-6 Accident Analysis for ODA Construction Projects
<The Guidebook of Root Cause Analysis >

# Accident Analysis for ODA Construction Projects

## <The Guidebook of Root Cause Analysis >

~ Table of Contents ~

Preface

Accidents have been occurring frequently in the ODA construction projects. The number and characteristics of the accidents are more concerned in comparison with those in the domestic situation of Japan. It can be inferred that the situation would be affected by various conditions in the countries concerned, however it is strongly required to work out sincerely to improve the situation.

It would be meaningful to look back the history of the construction accidents in Japan. The number of fatalities in the construction industry in the 1970s was around 2,500 a year. It decreased to the level of 350 a year in the 2010s.

As for the factors of the decrease, the following can be given;

(1) Establishment of laws such as the Industrial Safety and Health Law and technical standards
(2) Development of equipment, facilities and tools which enable to work safely
(3) Establishment of construction method and promotion of manpower-saving works and upsizing of equipment
(4) Establishment of work procedures
(5) Establishment of safety activities and implementation of effective safety education
(6) Improvement of safety standard in the construction industry

In the developing countries in general, the factors above mentioned are not established yet and there are many conditions obstructing to prevent construction accidents. Actually, even though accident analysis has been done and countermeasures been taken in the ODA construction sites, the situation is far from the fundamental improvement.

But the difficulty of decreasing the number of fatalities in Japan below 350 a year implies the limit of traditional analysis and countermeasure planning. It may be caused by the deficiency of the method that elimination of superficial direct causes is made much account and results in making the fundamental improvement difficult.

This guidebook is purposed to obtain fundamental countermeasures to prevent recurrence of accidents by pursuing the causes of the accident in deep by using the root cause analysis method and clarifying management/organizational factors behind the direct causes.

The guidebook also shows a procedure to materialize the “To-be” state (an ideal state) of not only the construction works but also the site organization and management beyond the countermeasures which would be planned by simply reversing the direct causes.

We hope that this guidebook will help to improve the safety awareness and to prevent construction accidents in developing countries.

# 1. Root Cause Analysis

## 1.1 Root Cause Analysis and Construction Accidents

The purpose of the root cause analysis in preventing construction accidents is to analyze the management/organizational factors behind direct causes of the accident concerned and to take measures to improve safety activities, and also clarify the following matters based on the facts.

(1) Results of the phenomenon: accident, disaster on the human body

(2) The phenomenon which was happened: the situation, the progress of the incident including factors which mitigated the effect and factors which aggravated the effect as well.

(3) Direct causes: human factors relating to the occurrence of the phenomenon, problems on the technical process

(4) Background factors (indirect factors): what the factor behind the direct causes (in many cases, it would be a management factors) was.

(5) Organizational factors: It includes a problem in the system relating to individual process which failed to prevent occurrence of the direct cause, a problem relating to the entire management, or a problem in safety culture and organizational culture. They are obtained through the analysis of the hiding factors and include management factors.

Most of occupational accidents including the construction industry occur when human factors (unsafe actions) meet material factors. Therefore, analysis of an accident is usually conducted focusing on those factors.
But in many cases, the causes which are obtained through the analysis are direct causes and they tend to remain only superficial when the insight into the accident is not enough. Then, the true cause is not recognized and even irrelevant countermeasures are taken for the result or the phenomenon by the accident. As a result, similar accidents would recur or accidents with the same true cause would occur in different manner.

The root cause analysis aims to break through the situations.
It enables to develop permanent countermeasures for preventing recurrence of the similar accident by clarifying the real direct causes and the management/organizational factors existing behind the direct causes as well.

## 1.2 Organizational Factors in Root Cause Analysis

Table-1 Organizational Factors and Its Point of View

| Organizational Factor | | Point of View |
|---|---|---|
| Middle Management Factors | Factors Relating to the Operation and Management of Construction Site | [Organization management in the section levels (objectives, strategies, establishment of QMS, manuals, etc.)], [Observance of rules], [Learning organization (handing down of expertise and skills)], [Personnel management], [Communication], [Procurement management (communication and management with suppliers)], [Human resource management (roles and responsibilities, selection and appointment, capabilities, education and training)], [Engineering management], [Work control], [Change management (management in organization change, change management of works], [Incompatibility management], [Corrective actions], [Document management]<br>These become possible organizational factors when irrelevancies and lacking in concreteness and effectiveness relate to the matters concerned. |
| Business Management Factors | Factors Relating to the Business Management of the Head Office | [Commitment by top management], [Operation (status of management, structure, objectives, strategies, decision-making by the head office, etc.)], [Personnel operation], [Company policy and standard of compliance], [Communication between the head office and sites], [Self-evaluation (or third-party evaluation)]<br>These become possible organizational factors when irrelevancies and lacking in concreteness and effectiveness relate to the matters concerned. |
| External Environmental Factors | Factors Relating to the External Environment of the Organization | [Economic situation], [Corresponding policy for regulations], [External communication], [Public reputation]<br>These become possible organizational factors when effects by them relates to the matters concerned. |
| Personal Factors | Factors Relating to Awareness, Will and Attitude etc. of Individuals Forming the Organization and Group | [Knowledge and skill], [Leadership], [Will and carefulness for safety], [Will for management], [Consideration for site workers], [Motivation and stress]<br>These become possible organizational factors when defects by them relates to the matters concerned. |
| Group Factors | Factors Relating the Groups (Management, Department, Section and Work Team etc.) Forming Each Hierarchy of the Organization. | [Communication within and between groups], [Knowledge and learning of groups], [Group's thoughtlessness and decision by specific person's will]<br>These become possible organizational factors when adverse effects by them relates to the matters concerned. |
| Organizational Mental Factors | Common Value of People in Organization (Whole Company, Site, Group, etc.) Developed in Long Period of Time as Way of Thinking and Action which Appear as Awareness, Recognition and Action (Organizational Culture). | These become possible organizational factors when they relates to the matters concerned. |

(Source: [Guideline for Regulatory Body to Evaluate the Result of Root Cause Analysis by Business Operators] by Nuclear Regulatory Commission: [Point of View for Organizational Factors in Root Cause Analysis] Modified and Added by the Study Team)

## 2. Method of Root Cause Analysis

### 2.1 Selection of Technique for Root Cause Analysis

1) Techniques for Root Cause Analysis

There are three representative techniques that can be applied for the root cause analysis.

(1) 4M5E Matrix Analysis

4M5E matrix analysis is a method that was developed from the 4M4E matrix analysis method which has been used in various industries. It aims for individuals in the work site to analyze troubles he encounters including minor near misses and enable to find factors from broad point of view and develop appropriate countermeasures.

4M means Man, Machine, Media and Management. It derives factors in accordance with the 4M classification form the problematic phenomenon. 5E means Education, Engineering, Enforcement, Example and Environment. It applies countermeasures to each factor.

This method has an advantage that anyone even who is not an expert in analysis can use relatively easily. On the other hand, it has a disadvantage that the analysis tends to become illogical when the number of factors grows too many.

(2) Cause Effect Diagram

Cause Effect Diagram is a diagram that shows the relationship between causes and factors in a tree shape (so-called the fish borne diagram) and is often used in QC circle activities. It has a disadvantage that the team members tend to decide the causes and the contribution ratios only by their experience and one-sided opinion.

It is rather suitable only to presume possible factors but still it will be difficult to derive factors properly and without oversight.

For the cause effect diagram analysis, there is a process to follow. First of all, correcting information, then inferring and enumerating factors/causes and lastly developing countermeasures. Generally, factors are easy to become many, and it is required to verify every one of them.

(3) Why-why Analysis

Why-why Analysis is a method that systematically derives and narrows down based on the fact the true factors which cause the problematic phenomenon by repeating “Why?” This method was developed by Toyota Corporation through their Kaizen activity. It is said that the true cause can be gained by repeating “Why” five times at most. And it is very effective not only for manufacturing but services and indirect works.

Why-why Analysis has a particular advantage that even inexperienced staff can think logically because the method is relatively simple and easy to understand.

From the above comparison, “Why-why Analysis” is used in this Guidebook.

2) Outline of "Why-why Analysis"

Why-why Analysis is a way of thinking to aim for a fundamental solution of the problem by pursuing causes for problematic phenomenon (result or effect) deeper in order to clralify the true cause. The approach that repeats "why" is rather simple and easy to understand, however, it requires deliberate posture and training to derive causes in full keeping logicality of cause and result.

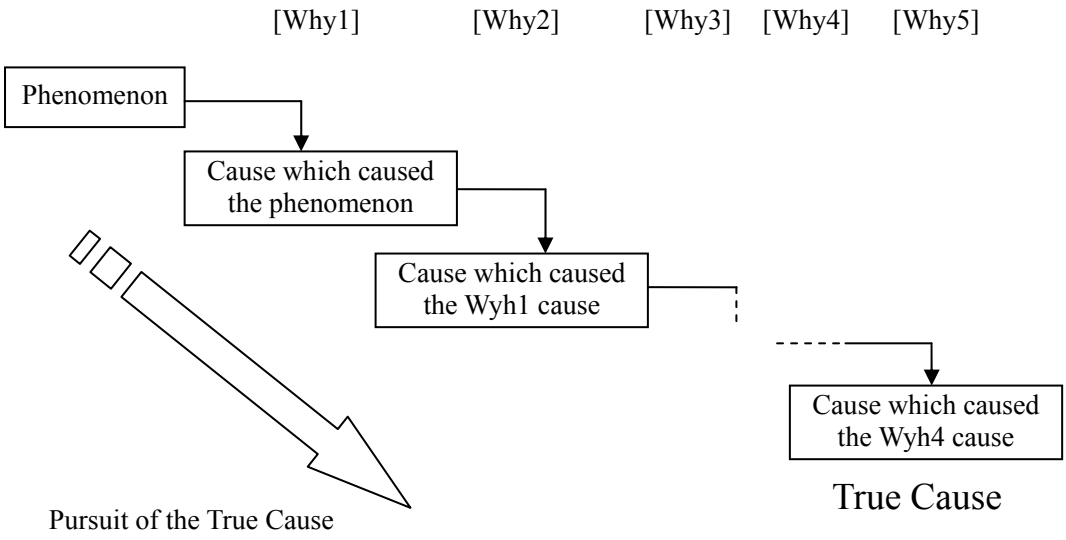
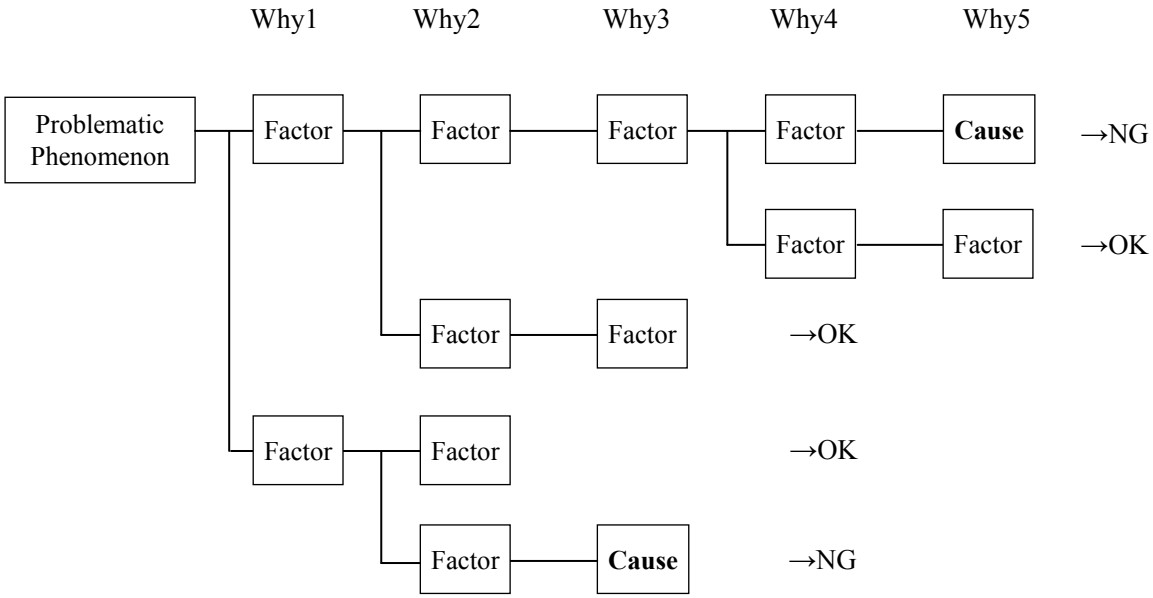



Fig.-1 Why-why Analysis: Basic Line of Thinking




OK：No countermeasure is required as it is a normal state.

NG：Countermeasures are required as it is abnormal state.

Fig.-2 Image of Why-why Analysis Diagram

☛ Rules and Tips of Why-why Analysis

(1) The sentence to answer “why” must be short and simple so that everyone can have the same image from the sentence. Only one subject shall be used in a sentence and the expression must be concrete such as “somebody did something” avoiding vague expression.

(2) The first “Why 1”shall be started form the fundamental factor of the phenomenon. For the “Why 1”, explicit factors which developed the phenomenon shall be derived. (It is recommended to express not the situation but actions which caused the problem.)

(3) For the “Why 1”, both the generating factor (the direct factors which caused the phenomenon) and the outflow factor (the direct factors which overlooked the mistake) must be listed separately.

(4) Confirm the logic of “cause and result” by reading the diagram reversely from the right to the left. Confirm if the upper level phenomenon always occurs when the lower level phenomenon occurs.

(5) List up all factors which cause the “Why”. List all “Whys” in full which are in parallel relations.

(6) For the “Why”, describe only the abnormal situation (out of a normal situation). For example, the reason that he was busy is not abnormal. But if the workload over 150% of normal state lasted for more than one week, it can be said abnormal situation.

(7) Avoid psychological human factors. Do not raise personal matters. Concentrate the “Why” to the facilities and management that countermeasures can be applied.

(8) Repeat “Why” until the factor becomes clear to which countermeasures against recurrence can be applied.

3) Utilization of Value Engineering (VE)

(1) Problem Solution and VE

If the direct causes or the management/organizational causes become clear, planning of the countermeasures against the causes will follow. However, people tend to get satisfied in general, by developing countermeasures which only handle the superficial phenomenon by reversing the causes or factors. These countermeasures could be sometimes effective, however, it is clear that an attitude to pursue the possibility of every countermeasure and select/construct the best one in order to achieve the essential solution of the problem.

For this purpose, Value Engineering (VE) can be used as an effective tool.

VE is a method and thinking process to create alternative ways to achieve the necessary functions with zero-base thinking by understanding the object with its functions (purpose/role) as its essence.

VE can handle everything which has purposes (functions) and uses resources such as cost, time and so on.

In VE, improvement of value which is determined as a balance of functions and resources is recognized as the solution of a problem. And there is a process to follow for VE to obtain the solution of the creative problems.

“The creative problem” means almost all the problems exist in the real world. The process for solving the problem is, first of all, realizing the existence of the problem from the phenomenon or its result, and secondly, defining the problem clearly in order to recognize the essence of the problem.

This is a quite important step.

After defining the problem, ideas are searched widely to solve the problem, and then the best solution will be determined by relative comparison based on the conditions. It must be kept in mind that there is no right answer of the one and only in any creative problems.

The process for solving creative problems is shown below.

Recognizing Problem : Perceive the existence of problem from the phenomenon or its result

↓

Collecting Information : Collect related information to understand the situation

↓

Analyzing Information : Understand the essence of the problem by analyzing the information

↓

Generating Ideas : Generate ideas freely for solving the problem

↓

Developing Ideas : Develop ideas by organizing and combining

↓

Constructing Solutions : Build up solutions by combining ideas

↓

Evaluating Solutions : Evaluate solutions for their effectiveness

The procedure of VE study exactly and systematically follows this process. Thus, VE is quite a superior methodology for the study team to enable to choose the best solution.

(2) Functional Analysis in Root Cause Analysis

In Value Engineering methodology, the essence of the object is recognized as a systematic aggregate of functions. The diagram of functions is called “Function Tree”. VE draws the ideal form (to-be) of the object, and achieving the “to-be” form is regarded as solution of the problem.

(a) Problem Tree

In the root cause analysis, after the management/ organizational factors become clear, the problem tree is constructed from the factors using the logic of “Result ← Cause” to visualize what kind of adverse results are caused by those factors.

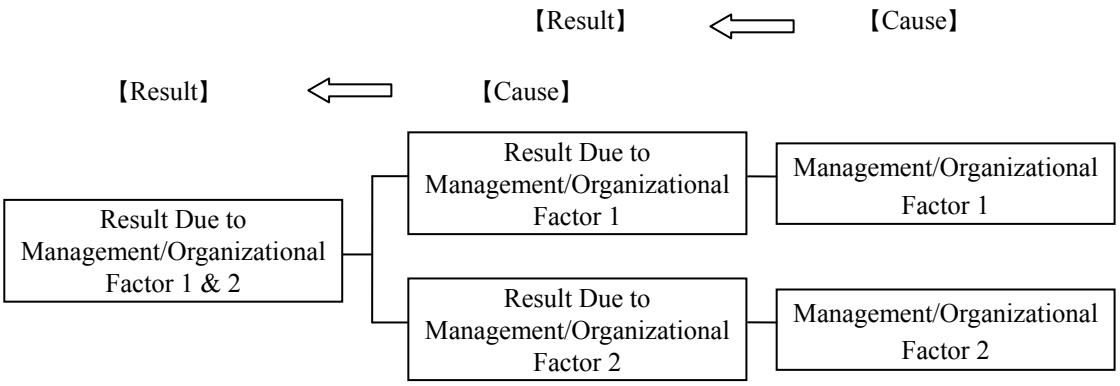



Fig.-3 Problem Tree: Basic Line of Thinking

(a) Function Tree

The function tree can be made by reversing the expressions of every component (factor/phenomenon: they are usually negative expression such as “is (do) not ~” or “is insufficient” etc.) in the problem tree.

Example:

[There is not system to confirm safety] → [Establish a system to confirm safety]

[Education for foremen is not enough] → [Enhance education for foremen]

The functions converted from the problem are structured in a shape of tree in logic of “Purpose ← Measure or Why ← How”. This diagram is called “Function Tree” and it shows the ideal form of the object (to-be form). By achieving the function groups in the function tree, the highest function (basic function) can be materialized. On this account, many ideas must be searched based on the function (concept), and the best measure to achieve the purpose will be created using those ideas.

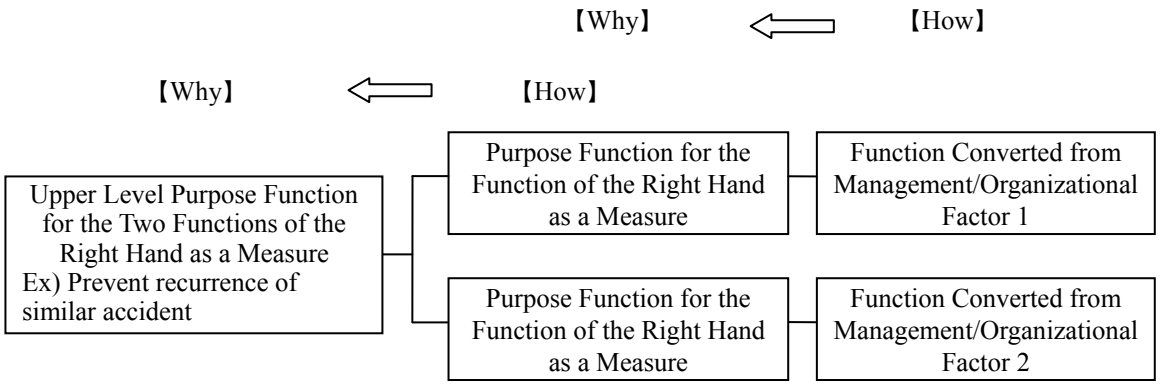



Fig.- 4 Function Tree: Basic Line of Thinking

## 2.2 Procedure of Root Cause Analysis and Study of Countermeasures

The flow and procedure of the root cause analysis of accidents and development of countermeasures to prevent recurrence is as follows;

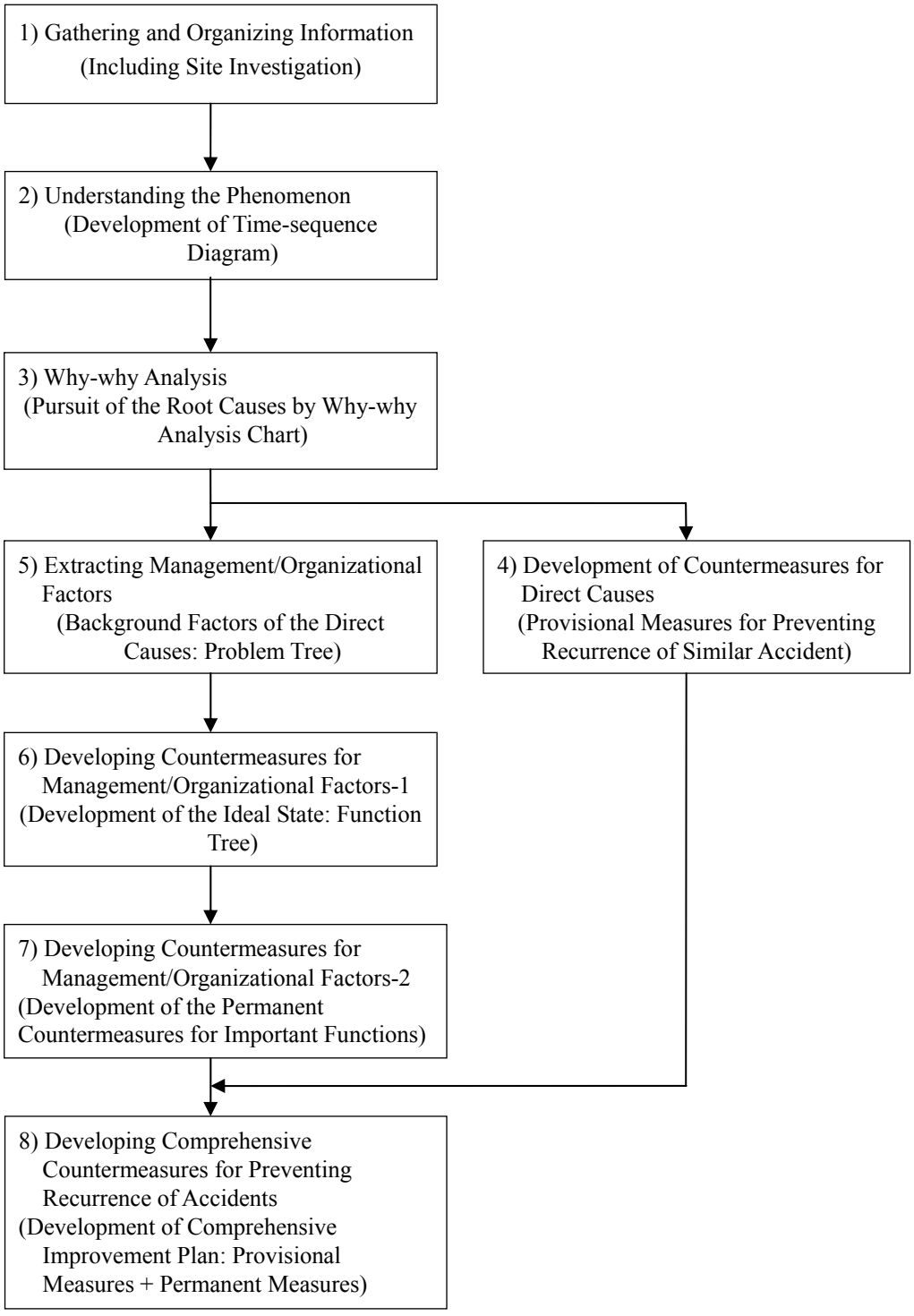



Fig.- 5 Study Flow of Root Cause Analysis and Countermeasures

## 2.3 Implementation of Root Cause Analysis

1) Gathering and Organizing Information

Prior to the analysis, following information must be gathered and organized to fully understand the accident and other circumstantial situation.

(1) Accident situation (photographs, illustration of the situation and others)

(2) Time sequence and changes before and after the accident

(3) Site situation and changes before and after the accident

(4) Status and changes of equipment and facilities, etc.

(5) Behavior of people concerned, relationship of persons' roles, status of communication

(6) Testimony (verbal evidence) of person concerned, especially of the witnesses

(7) Others

2) Understanding the Phenomenon (Development of Time-sequence Diagram)

Make the time -sequence diagram based on the information to visualize how the accident occurred with the passage of time and persons' behavior concerned.

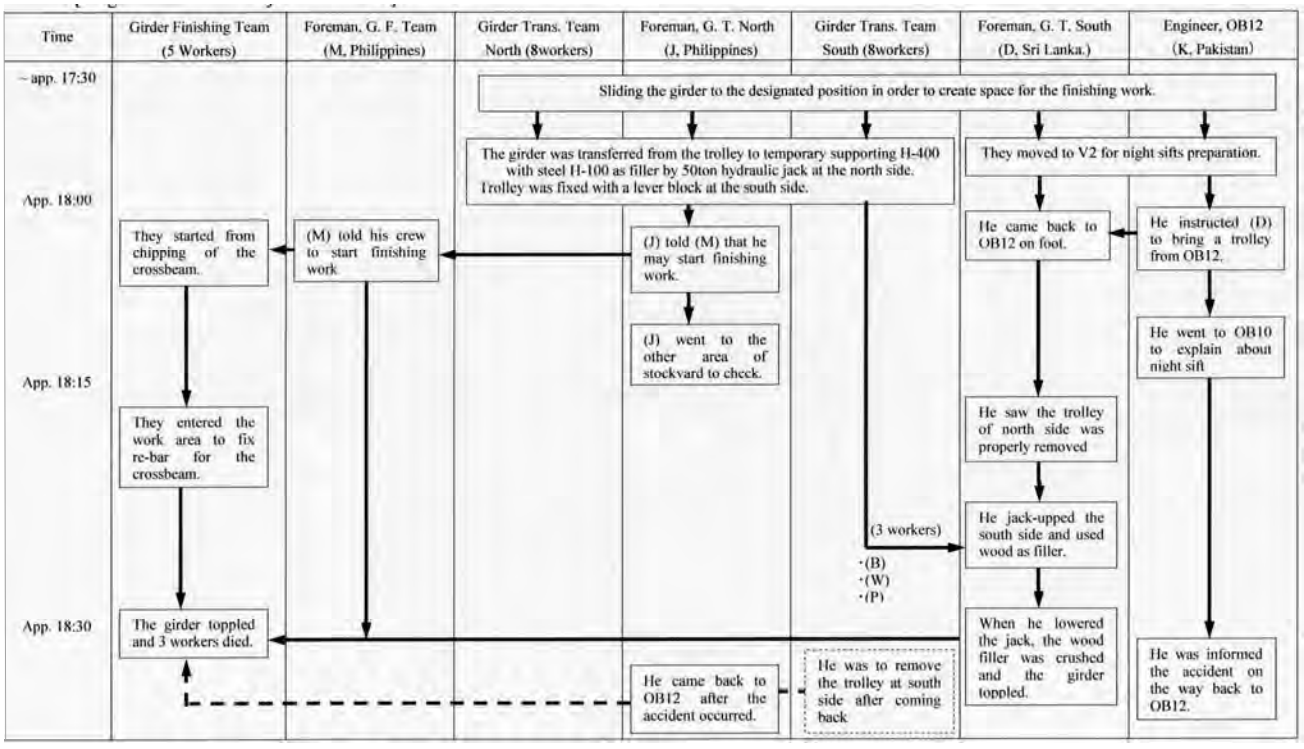



Fig.-6 Time Sequence Diagram

3) Why-why Analysis (Pursuit of the Root Causes by Why-why Analysis Chart)

In “Why-why Analysis” first of all, consider logically why the phenomenon concerned was caused, then, the cause becomes “Why1”. And what caused the “Why1” becomes “Why2”. By repeating this thinking, the why-why analysis diagram can be structured pursuing the deep causes until management /organizational factors become clear.

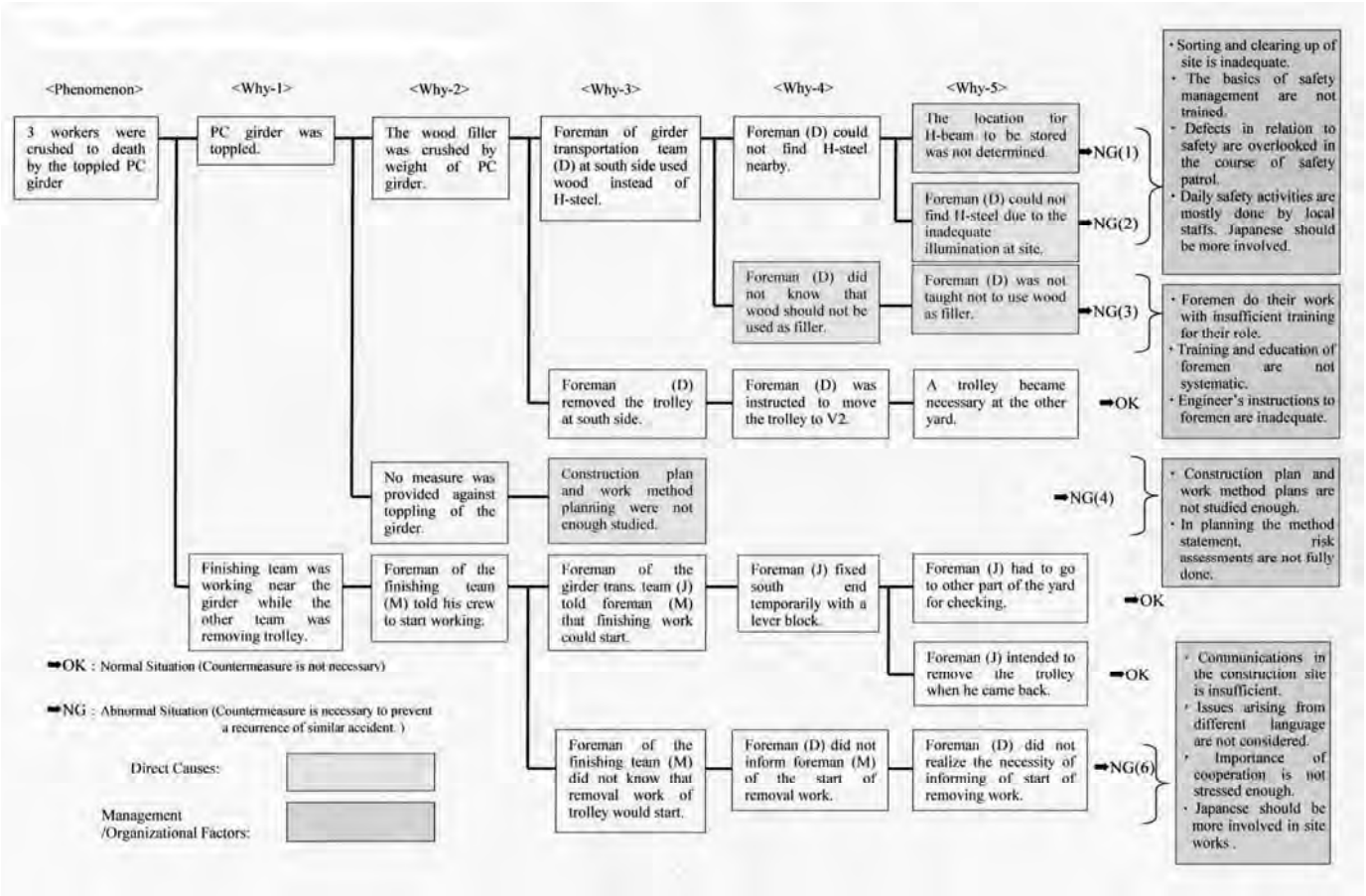



Fig.- 7 Why-why Analysis

Generally speaking, the true cause can be clarified be repeating “why” five times at most. However, when an abnormal situation becomes clear (shown as “NG” in the example), consider carefully the management/organizational factors that had raised the situation and then fill them in the right end frames.

4) Development of Countermeasures for Direct Causes

(Provisional Measures for Preventing Recurrence of Similar Accident)

It becomes possible to identify the direct causes from the why-why analysis diagram. However, it often happens to make insufficient countermeasure for preventing recurrence of accident if the superficial causes be recognized mistakenly as real direct causes.

Thus it is very important to decide carefully which level of causes (Why1 to Why5) are the true direct causes.

Countermeasures for direct causes are the provisional measures to prevent similar accident and it must be noted that they are not intended as permanent measures to assure preventing recurrence of the accident. This is the reason that clarifying management/organizational factors and planning the permanent countermeasures is indispensable.

And also, the planning of countermeasures for direct causes tends to satisfy the people with superficial measures which are merely reversing so-called direct causes. This is considered one of the biggest problems in the past activities for preventing recurrence of accidents.

It is very important to make a plan for countermeasures multilaterally utilizing the why-why analysis diagram.

Table-2 Countermeasures for Direct Cause (Example)

(Provisional Measures for Preventing Recurrence of Similar Accident)

| Direct Causes derived from Why-why Analysis (shown in yellow in the chart) | Countermeasure 1 | Countermeasure 2 | Countermeasure 3 |
|---|---|---|---|
| 1. Foreman (D: who is directly responsible for the accident) did not know that wood should not be used as filler. | Prepare a series of practical method statement showing every predictable risk and prohibited action. | Explain to and make the foremen fully understand the work, how to perform it and what they never are allowed to do. | |
| 2. The location for H-beams to be stored was not determined. | Keep everything in order in the site and clarify the locations where materials, equipment and tools are to be stored. | At the start and the end of the day, foremen shall check the numbers and location of objectives with his crew and record them daily. | |
| 3. Foreman (D) could not find H-steel due to the inadequate illumination at site. | Investigate and act quickly to create safe work environment by providing proper illuminations. | To achieve a safe work environment, recheck the site wholly from various points of view and confirm appropriateness of illumination. | |
| 4. Construction plan and work method planning were insufficiently studied. | Each aspect of work that contains dangerous factors shall be studied with special care and the result shall be reflected in both the construction plan and method statement. | At the planning stage of the work, risk assessment shall be practiced, and countermeasures if necessary, shall be included in the plan. | Reliable measures preventing toppling of girder shall be planned as quickly as possible and be applied at site. |
| 5. Foreman (D) did not realize the necessity of informing the finishing team of start of removing work. | Make it a strict rule that the finishing work and other works which involve dangerous factors such as transporting girder shall not be done simultaneously. | Foremen must confirm that the site is clear of personnel except workers involved in the work directly. | |

5) Extracting Management/Organizational Factors (Background Factors of the Direct Causes: Problem Tree)

There often exist management/organizational factors as background factors of the direct causes. It is important to cross-examine what kinds of results are caused by them. When pursuing the upstream result from the management/organizational factor obtained by the analysis, rather it does not mean to go back simply along the why-why analysis diagram to the original phenomenon in many cases.

It is necessary to clarify the reason why similar accident cannot be prevented by pursuing the upper result caused by the factors using the logic of "cause and result". The problem tree is powerful tool to visualize the relationship of causes and results. Figure below shows an example of the problem tree.

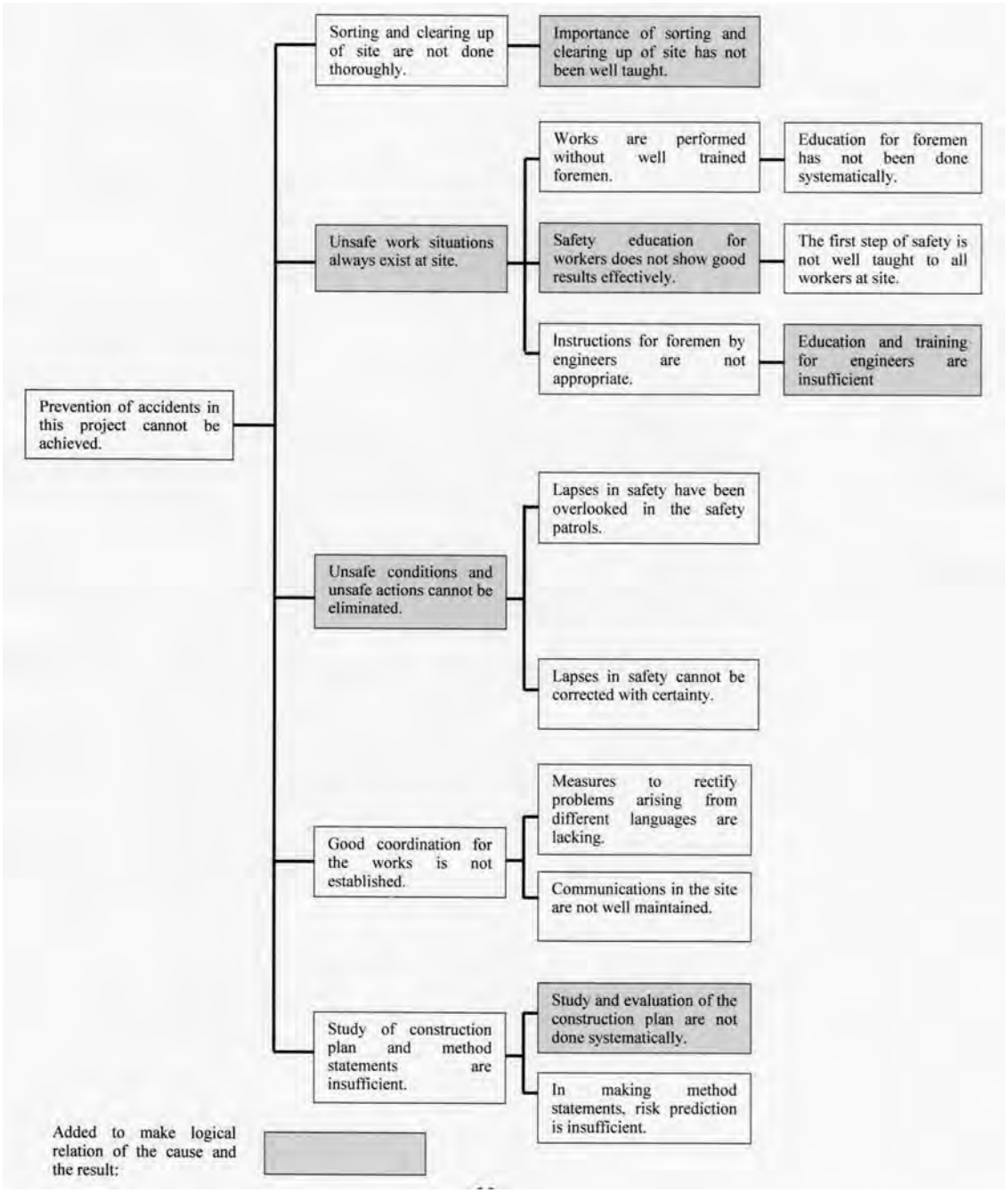



Fig.- 8 Problem Tree (Example)

6) Developing Countermeasures for Management/Organizational Factors-1

(Development of the Ideal State: Function Tree)

By reversing the expressions of the problems in the problem tree, they can be converted to the functions to be performed to achieve the purpose.

This is the function tree which systematically shows structures the relationship of the function to achieve the most significant purpose ("the basic function").

The expression of functions is described basically by a verb and a noun, such as "Establish rules". (Some nouns can be used at the same time if necessary.)

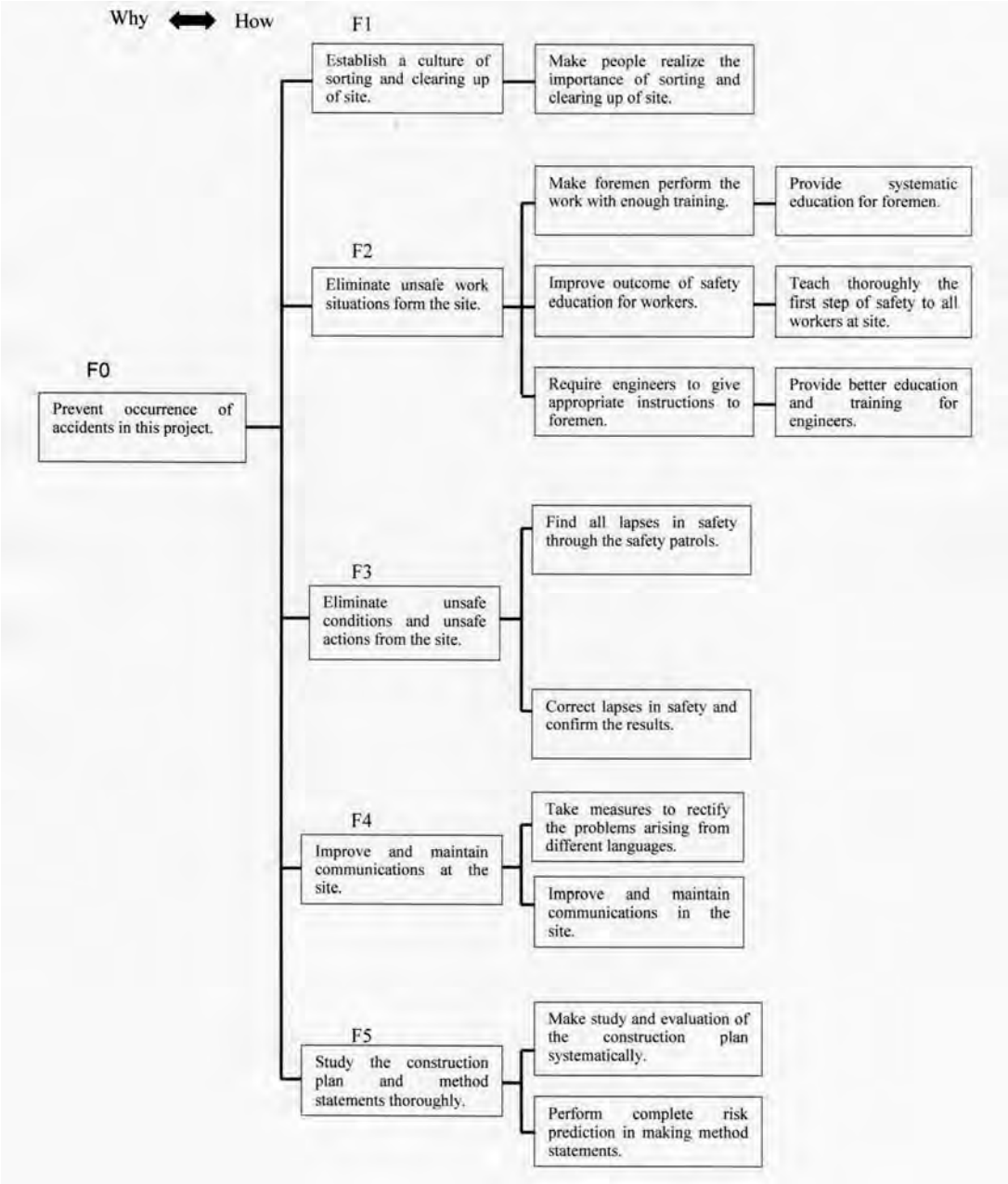



Fig. - 9 Function Tree (Example)

7) Developing Countermeasures for Management/Organizational Factors-2

(Development of the Permanent Countermeasures for Important Functions)

(1) Evaluation of Importance of Function Groups

In the function tree, there are some function groups (a group of functions that have close relations each other when they have a certain function as a common purpose. F1~F5 shown in figure-9 are the function groups). The upper most function (the basic function) is expected to achieve when those necessary function groups are achieved. Planning measures to achieve all the functions would not be effective and economical (VE requires resources such as manpower and time) because there are always differences in importance between the function groups.

Recognizing what the important function is will assure effective execution of study and also give the team a good clue for the planning of permanent countermeasures.

Evaluation of the order of importance among the function groups (F1~F5) can be done by Forced Decision Method.

Table-3 Evaluation by Forced Decision Method

| | F1 | F2 | F3 | F4 | F5 | Total | Rank |
|---|---|---|---|---|---|---|---|
| F1 : Practice sorting and clearing up of site completely. | | 0 | 0 | 1 | 0 | 1 | 4 |
| F2 : Eliminate unsafe work situations from the site. | 3 | | 1 | 3 | 1 | 8 | 1 |
| F3 : Eliminate unsafe conditions and unsafe actions from the site. | 3 | 0 | | 3 | 1 | 7 | 2 |
| F4 : Improve and maintain communications at the site. | 0 | 0 | 0 | | 0 | 0 | 5 |
| F5 : Study the construction plan and method statements thoroughly. | 1 | 0 | 0 | 3 | | 4 | 3 |

[Forced Decision Method]

Compare importance of the functions from the customer's point of view by pairing each function.

Weight is given to the importance of the difference between functions.

(When the difference is large: 3 points, when the difference is small: 1 points)

(2) Generating Ideas

Taking the above rank of importance of the functions in to account, generate ideas freely as many as possible for each function group. (Functions for which ideas are generated include the lower level functions being positioned at the right side of the group.)

For idea generation, the brainstorming method is widely used. The method is effective when the famous four rules are strictly observed.

(a) No criticism of ideas: Evaluation must be done only later. No criticism on ideas of others as well as your own ideas.
(b) Freewheeling: Free ideas are respected. Generate ideas considering viewpoints of ideas.
(c) Quantity than quality: Quantity is more important than quality of ideas. Quality follows quantity.
(d) Improvement and combining ideas of others: It is recommended to utilize ideas of other members.

An example of ideas generated is shown in the table below.

Table - 3 Ideas (Example)

| Rank | Function Group | Idea |
|---|---|---|
| 1 | F2: Eliminate unsafe work situations from the site. | (1) All staff and local engineers shall fully understand that education of foremen is critical.<br>(2) Review and reconstruct the training and education of foremen.<br>(3) Make a systematic plan for training and education of foremen.<br>(4) Staff and engineers shall cooperate to ensure proper and coordinated training content.<br>(5) The education plan includes content that urges foremen to have strong sense of responsibility.<br>(6) Review the education and training for new entrant to the project.<br>(7) Practice safety education regularly.<br>(8) When any part or procedure of the work is changed, the changed work method must be shown as specifically as possible.<br>(9) Give opportunities to improve knowledge and capabilities of the engineers who direct works at the site.<br>(10) Provide training to engineers to improve risk prediction capability.<br>(11) Engineers taking charge must join the safety patrol at any time.<br>(12) Engineers shall study the method statement thoroughly to identify any chance of hazard in the work.<br>(13) Make a system to revise and improve a method statement in case any improper matter exists.<br>(14) Provide safety education tools and materials for workers.<br>(15) Investigate education tools used in Japan, and translate appropriate ones to local language.<br>(16) Recommend foremen find out hazards hidden in the work and report them to relevant engineers.<br>(17) Staff (Japanese) should not necessarily accept the local manner of doing work, but rather share the problems with the engineers and improve them.<br>(18) Staff (Japanese) practice “pointing and calling” movement and spread it among engineers and foremen. |

| | | |
|---|---|---|
| 2 | F3：Eliminate unsafe conditions and unsafe actions from the site. | (1) Indicate defects in workmen's clothes and PPE on a regular and sustained basis.<br>(2) Arrange working environment so that safety belts can be used readily. ( main rope for safety belts, device for decreasing frequency of changing the position for safety belts etc.)<br>(3) Conduct a surprise safety patrol periodically.<br>(4) Direct rectification of any lapse immediately in front of the safety patrol team.<br>(5) Japanese staff practices more actively in the safety meeting to increase their participation in the safety matters.<br>(6) All Japanese staff from the project manager to junior staff shall conduct a daily site patrol, including a safety point of view.<br>(7) During the daily safety patrol, a safety armband must be worn.<br>(8) The safety engineer will report the results of the safety patrol conducted by staff in charge of safety to the project manager and advise him of the important findings.<br>(9) With regard to any unsafe situation, the staff in charge of safety makes correction plan in cooperation with the safety engineer within the same day.<br>(10) Establish not only execute measures to correct lapses but also confirm and report the corrections.<br>(11) Conduct safety patrols making important points for the day clear.<br>(12) In the elimination of unsafe conditions, consider essential review of the method of the work, too.<br>(13) Regarding lapses pointed out by the safety patrol, conduct not only execution of the correction but also evaluation of the result of improvement.<br>(14) Record the names of workers and foremen who were cautioned for their unsafe actions and consider penalties to them when the cautions are accumulated.<br>(15) In the morning meeting, Japanese staff speak out actively not rely on the local staff.<br>(16) Contrive to improve safety knowledge and ability for predicting hazards in the morning meeting and other occasions.<br>(17) Spare short period for meditating to pray safety at the end of the morning meeting in order to awake safety works again.<br>(18) Check workers clothing and safety gears in the morning meeting and ban improper workers from the work for the day.<br>(19) In the safety meeting or safety education, make a foreman present his safety theme given beforehand.<br>(20) Make engineers express in the meeting that he will execute his task with what kind of safety target. |
| 3 | F5：Study the construction plan and method statements thoroughly. | (1) Determine the degree of the planning by clarifying what the crucial works are in the project.<br>(2) Planning shall be made considering safety/hazard will change by the construction/work method.<br>(3) In planning method statements, utilize risk assessment.<br>(4) For the hazardous works, study countermeasures and measures for improvement thoroughly.<br>(5) In making the construction plan, make the most of all organizational capabilities as a company not relying on individual or small group's ability.<br>(6) The construction plan must be evaluated by more than two experienced engineers with similar construction project.<br>(7) Establish the system of evaluation and approval for the construction plan.<br>(8) Collect and utilize data of construction plans of similar projects.<br>(9) Never rely on a single example of construction plan of similar work. |

| | | |
|---|---|---|
| | | (10) Make use of examples of accidents in similar works and reflect them in the construction planning. |
| 4 | F1 : Practice sorting and clearing up of site completely. | (1) Initiate 5S movement. (Seiri (sorting), Seiton (clearing up), Seisou (sweep), Seiketsu (sanitary), Shitsuke (discipline))<br>(2) Reserve time for sorting, clearing up and sweep the site every morning and evening.<br>(3) Determine location for storing of each piece of equipment, materials and tools.<br>(4) Designate person (persons) responsible to confirm the level of neatness of the site.<br>(5) Designate the above person alternately in the group.<br>(6) Give award to the group/section which is evaluated as good by the safety patrol.<br>(7) Educate all people that safety is always based on an orderly, organized site.<br>(8) Place many placards to recommend sorting and clearing up the site.<br>(9) Make a weekly (monthly) target regarding orderliness of the work site.<br>(10) Recommend workers to offer ideas to their foreman regarding orderliness of the work site.<br>(11) The foreman reports ideas and who offered them to his senior, the senior record it as nominee for an award.<br>(12) Excellent work activities shall be presented in the monthly safety meeting.<br>(13) Make a special facility to store materials/tools in the vicinity of the work place.<br>(14) Emphasize the importance of sorting and clearing up of the site at the education for the new entrant. |
| 5 | F4 : Improve and maintain communications at the site. | (1) Japanese staff shall take initiative to greet to everybody in the site including workers.<br>(2) Japanese staff makes effort to be able to call at least all foremen by their names.<br>(3) Japanese staff shall actively talk to foremen who do speak English.<br>(4) Japanese staff shall actively talk to foremen who do not understand English with other foreign foreman as an interpreter.<br>(5) Japanese staff shall make effort to learn local language even a prattle talk.<br>(6) Encourage foremen and engineer to have a party in the work teams or in the work section. Japanese staff should mingle with local workers.<br>(7) Have a party occasionally with the budget of the project.<br>(8) All Japanese staff makes effort to understand the local customs and respect them.<br>(9) Praise workers at the very site when he works very well.<br>(10) Try to find good points of the work or the worker and express a satisfaction for it. |

(3) Rough Evaluation of Ideas ~ Development of Measures

(a) Rough Evaluation of Ideas

Evaluate ideas in each function groups by proper evaluation factors such as the possibility of function realization and the easiness of execution. In this step, the possibilities of the ideas should be respected as much as possible to nurture each idea. Only ideas with no possibility to contribute the function (purpose) will be discarded in this process. Any ideas which have even very slim possibilities shall be brought to the next step.

(b) Development of Measures

i) Develop ideas in each function group by arranging, modifying and combining. (Basic idea concepts)

ii) Synthesize idea concepts by combining in various function groups and make alternative measures.

iii) Alternative measures can also be made in a single function group depending on the direction or needs of study for improvement.

(c) Evaluation to Planning and Execution

a) If there are some alternatives for same function/purpose, select the best measure by relative evaluation using evaluation factors determined in the rough evaluation step.

b) Make a development and execution plan for each measure adopted. The plan must be shown in a manner of 5W1H (What, Who, When, Why, Where, How) and describe the point that special attention to be paid, and method to confirm the status of execution and effect, and also how to follow up the movement.

8) Developing Comprehensive Countermeasures for Preventing Recurrence of Accidents

(Development of Comprehensive Improvement Plan: Provisional Measures + Permanent Measures)

The countermeasures obtained in the previous step for management/organizational factors are regarded as the permanent improvement countermeasures. The integral countermeasures are formed by adding the permanent countermeasures and the provisional countermeasures for direct causes obtained in step 4).

When there are more than single accidents to analyze in the project, the study of planning of the countermeasures to prevent accident can be conducted as follows;

(1) Perform “Why-why Analysis” for each accident.

(2) Make “problem Tree” and “Function Tree” of each accident.

(3) Make an integral function tree by overlaying function tree diagram.

(4) Conduct evaluation of importance of function groups in the integral function tree.

(5) Generate ideas, evaluate the ideas roughly and develop the countermeasures

Appendix-7 Accident Report Form for JICA Projects

**Accident Report Form for JICA Projects**

Note: Incomplete information acceptable for the initial report, subject to updating by collecting further information.

| | | | |
|---|---|---|---|
| Section/Department reporting | | | |
| Date/Time reported (local time) | | | |
| Source of information (e.g. implementing agency, local news) | | | |
| **I. Project Information** | | | |
| 1 | Country | | |
| 2 | Project Name（L/A Ref. No.） | | |
| 3 | Date of Signing Loan Agreement | | |
| 4 | Loan Amount（JPY Million） | | |
| 5 | Implementing Agency | | |
| 6 | Project Outline / Component where the accident occurred (e.g. Civil Works **** Section) | | |
| 7 | Names of Contractor/Consultant concerned (Country of Origin, Subcontractors) | | |
| **II. Accident Information** | | | |
| 8 | Outline of Accident | (1) Date/Time of accident (local time) | |
| | | (2) Place of accident | |
| | | (3) Background & Details of accident (time-sequence diagram & organization charts to be attached) | |
| | | (4) Damages (human damages (as detailed as possible including nationality, etc.), material damages, social impact, etc.) | |
| | | (5) Present State (project continuation/suspension, progress of emergency measures) | |
| 9 | News on accident (if any, name of medium, attach a copy of news) | | |
| 10 | Action taken/to be taken by the persons' concerned | | |
| 11 | Action taken/to be taken by JICA | | |
| 12 | Information sharing with the local Japanese diplomatic mission | | |
| **III. Information on Follow-up Action** | | | |
| 13 | Causes of Accident (in case of serious accident, not only direct causes but also root causes to be analyzed) | | |
| 14 | Lessons (incl. preparation of accident preventive measures/countermeasures, etc.) (to be specifically described so as to enable the project site to confirm the measures) | | |
| 15 | Others | | |