



DAEWOO-TPL JV

CONTRACT AGREEMENT

between

MUMBAI METROPOLITAN REGION DEVELOPMENT AUTHORITY

and

**DAEWOO - TPL JOINT VENTURE
(M/s DAEWOO ENGINEERING & CONSTRUCTION Co. Ltd. &
M/s TATA PROJECTS Ltd.)**

MUMBAI TRANS HARBOUR LINK PROJECT (MTHL)

PACKAGE-2

**Procurement of Mumbai Trans Harbour Link Project (Package 2)
Construction of 7.807 km Long Bridge Section (CH 10+380 – CH
18+187) Across the Mumbai Bay Including Shivaji Nagar
Interchange**

(JICA LOAN: Mumbai Trans-Harbour Link Project (I) ID-P255)

MADE ON 19TH JANUARY 2018

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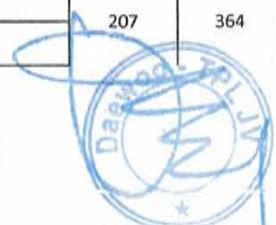
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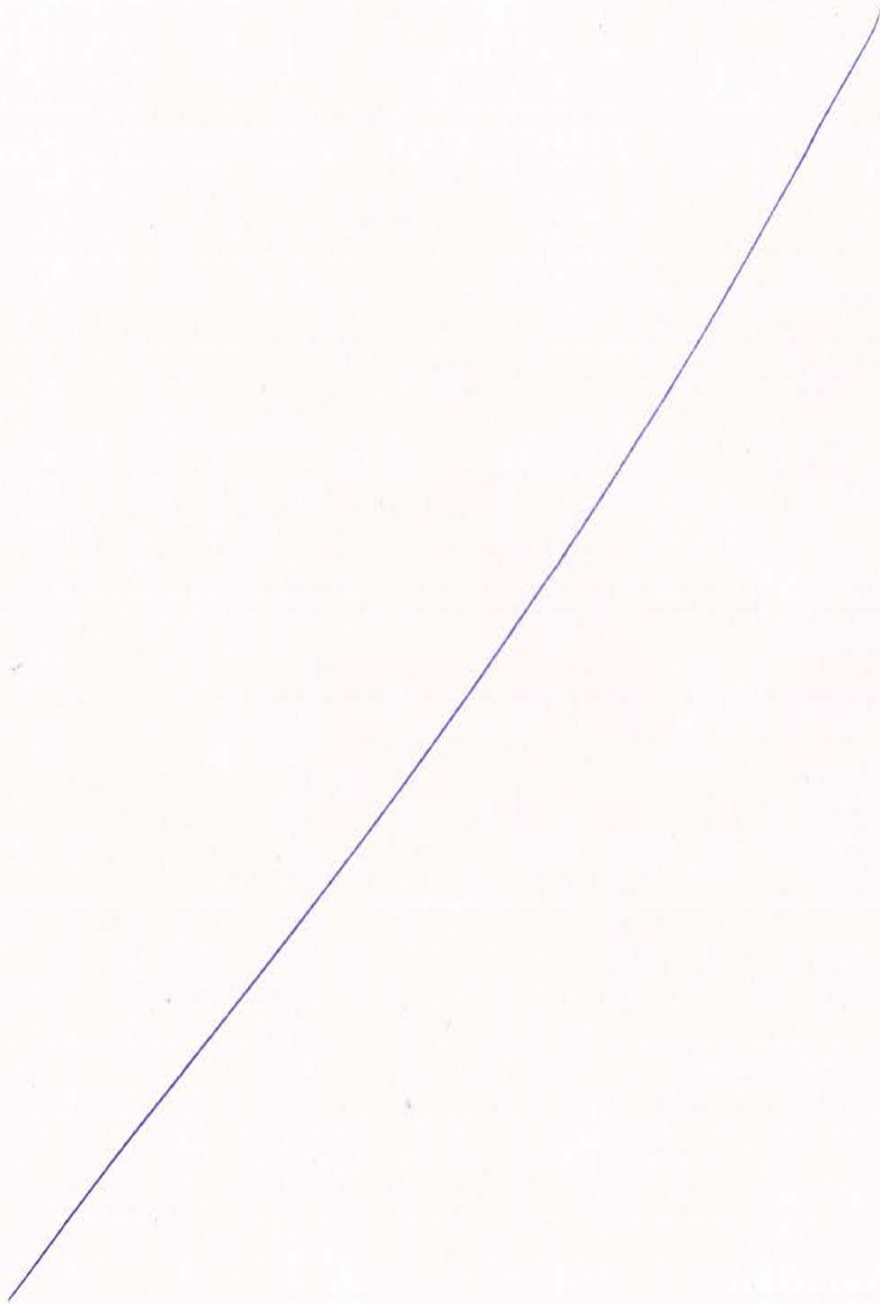
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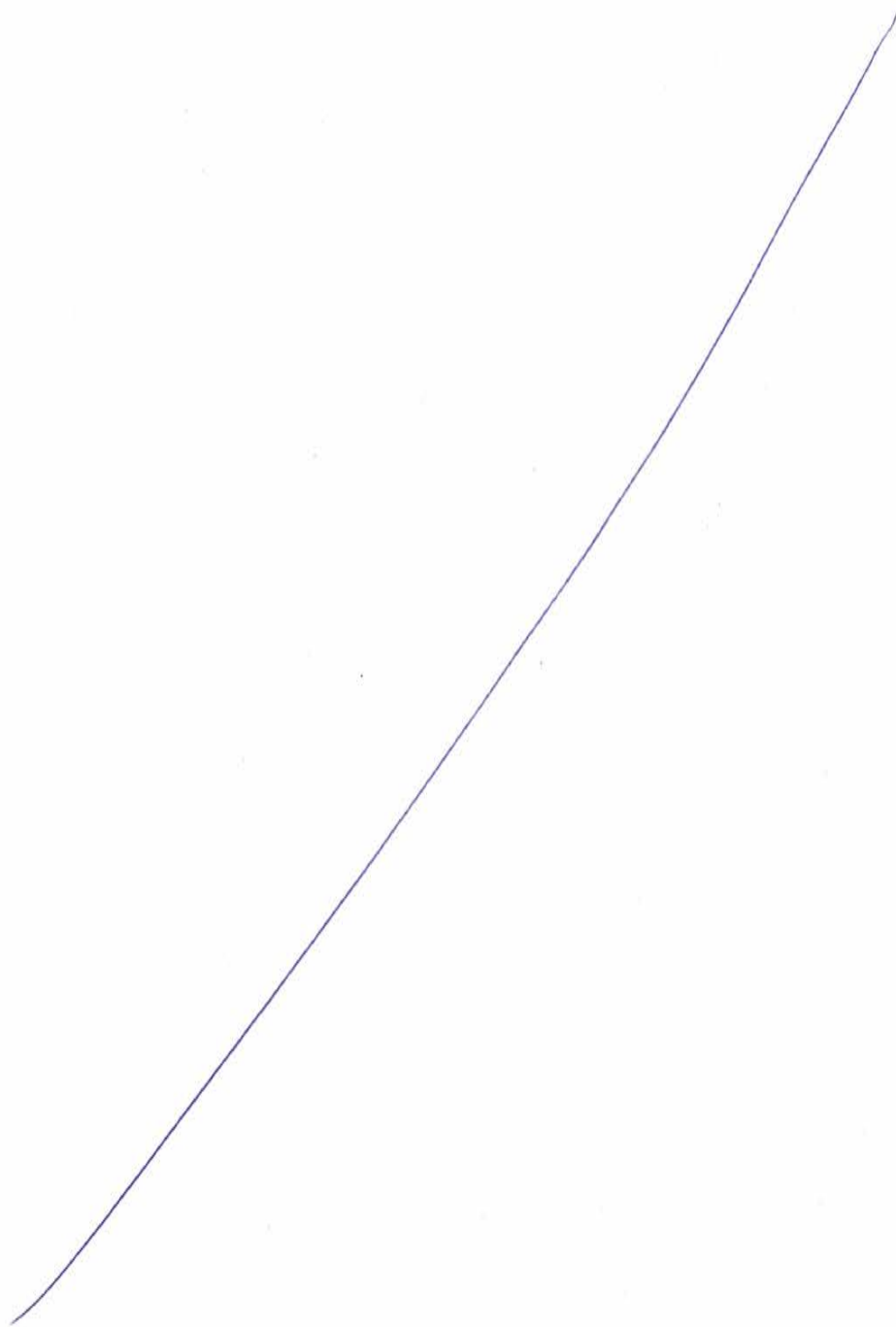
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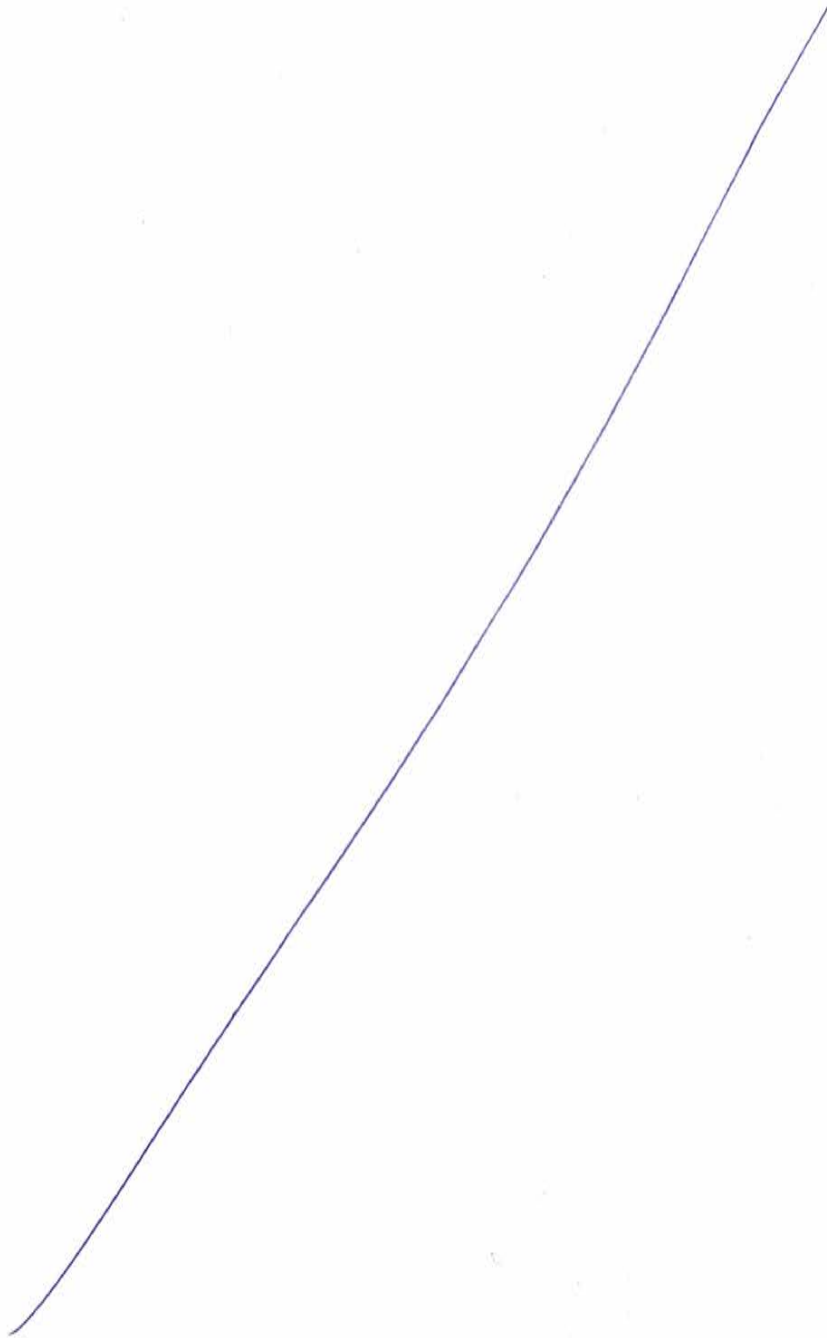


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**Mumbai Trans Harbour Link Project
Package II**

TATA PROJECTS
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TECHNICAL PROPOSAL: HEALTH PLAN

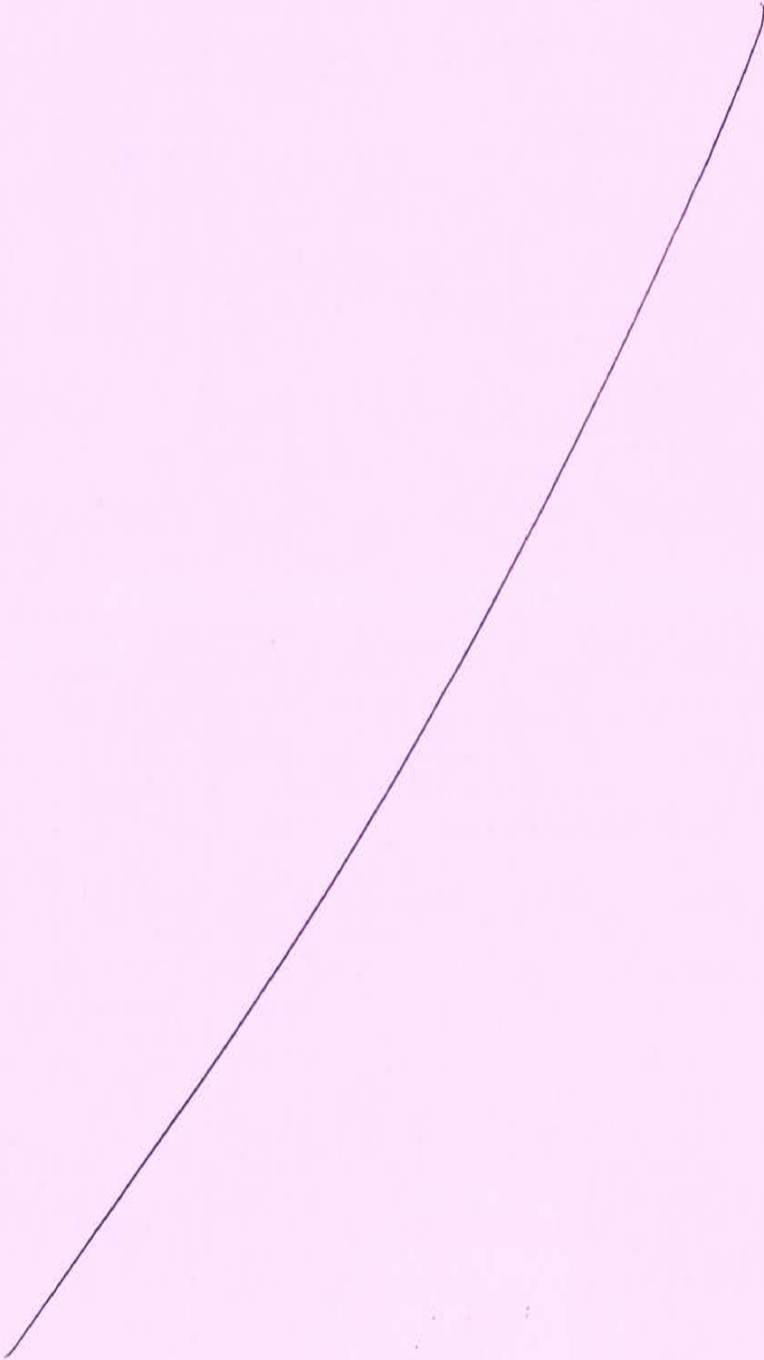
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Project: Mumbai Trans Harbour Link Project (Package-2)
(Construction of a 7.807 km long bridge section (CH 10+380 – CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange)

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**Mumbai Trans Harbour Link Project
Package-2**



OCCUPATIONAL HEALTH PLAN FOR MTHL PACKAGE - 02

Name of work:

Mumbai Trans Harbour Link Project (Package-2) Construction of a 7.807 km long bridge section (CH 10+380 – CH 18+187) across the Mumbai Bay including Shivaji Nagar Interchange.

OHSAS 18001:2007 & ISO 14001: 2004 and MMRDA Conditions of Contract on SHE.



Revision No.	Prepared By	Reviewed By	Approved By	Date Approved
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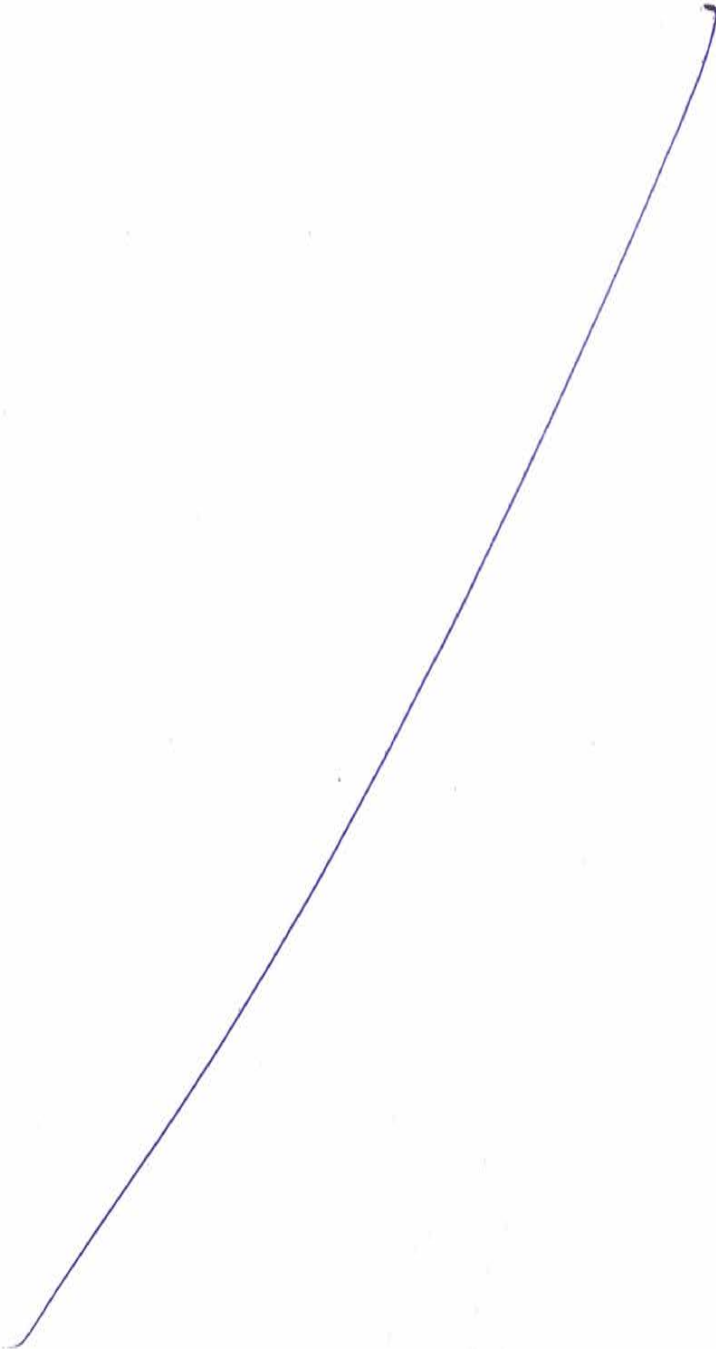
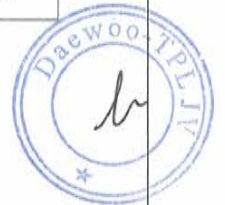


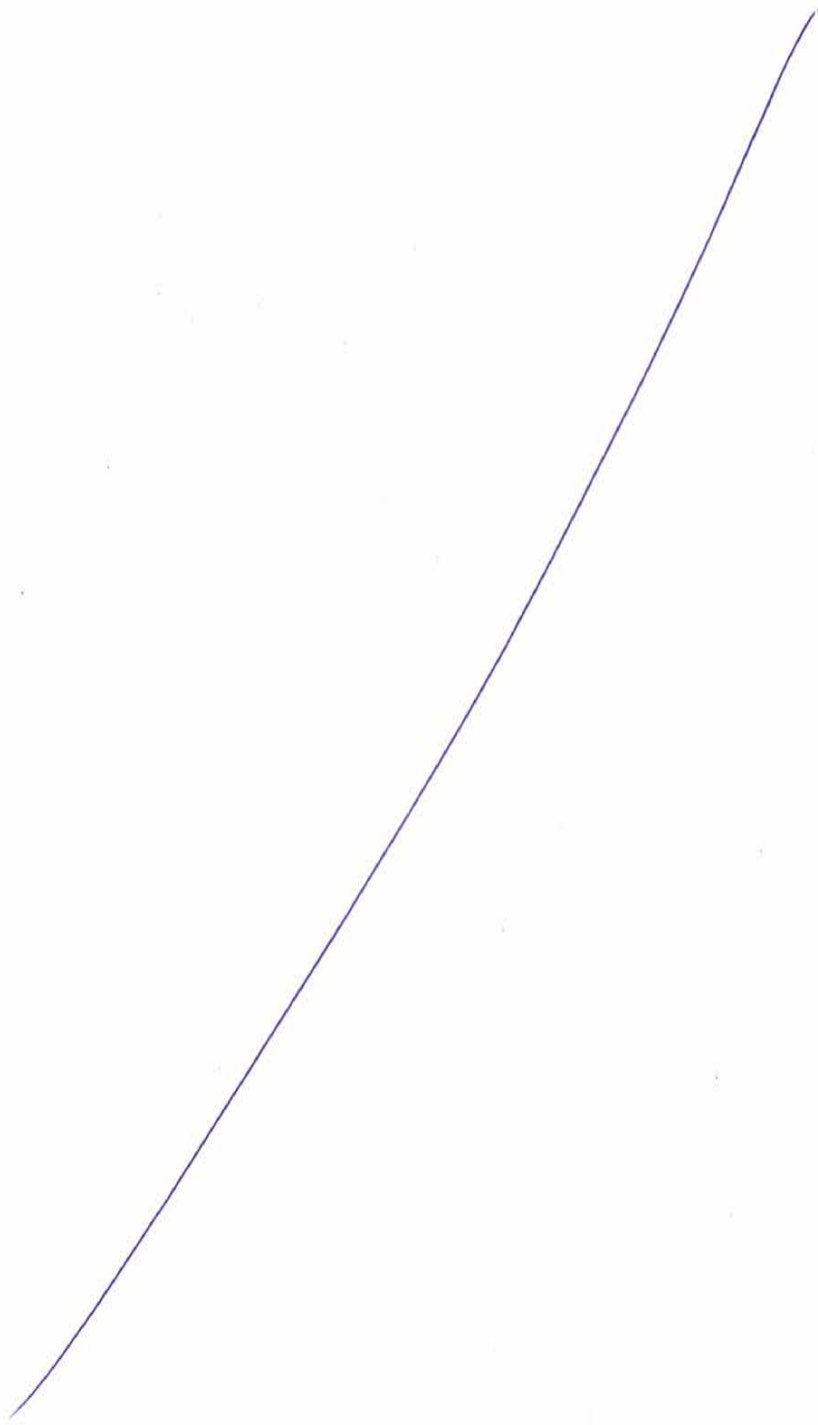
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Mumbai Trans Harbour Link Project Package-2

TATA PROJECTS
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1. PURPOSE

This procedure covers the Project Health Management for the project and specifies the minimum requirements for ensuring a healthful work environment throughout the duration of the project.

2. OBJECTIVES

The health of all personnel on DAEWOO - TPL JV premises shall be protected from adverse health effects that may result from operations and products by

1. Ensuring that the project staff are physically fit for the work
2. Preventing the workers from being exposed to conditions adverse to their health
3. Identifying and managing health risks
4. Communicating health risks and prevention measures to all personnel
5. Training the personnel in project specific health aspects
6. Preparing and implementing a comprehensive sanitation and waste management procedure for the project.

3. DEFINITIONS

Disease: A pathological condition of a part, organ, or system of an organism resulting from various causes, such as infection, genetic defect, or environmental stress, and characterized by an identifiable group of signs or symptoms.

Incubation Period: The time between becoming infected and developing signs and symptoms of a disease

Infectious Disease: A disease due to a specific agent or its toxic products that can be transmitted from an infected person, animal, plant or inanimate source e.g. water, food, soil etc. to a susceptible host.

Infectious Period: The time, during which an infected person can infect others, this varies depending on the disease but can last for several days or weeks (influenza, chicken pox) or for a lifetime.

HAV (Hand-Arm Vibration): Hand-Arm Vibration is the transfer of vibration from a tool to a worker's hand and arm. It can be caused by operating handheld power tools, such as road breakers, and hand guided equipment, such as powered lawnmowers, or by holding materials being processed by machines, such as pedestal grinders, jack hammers.

HIV/AIDS: HIV is an infection caused by the Human Immunodeficiency Virus. A person infected with HIV may look and feel healthy for many years but may still transmit the virus to someone else.

HIV is transmitted through unprotected sex with someone infected with HIV and sharing needles to inject drugs, tattoos and body piercing with contaminated equipment and dyes.



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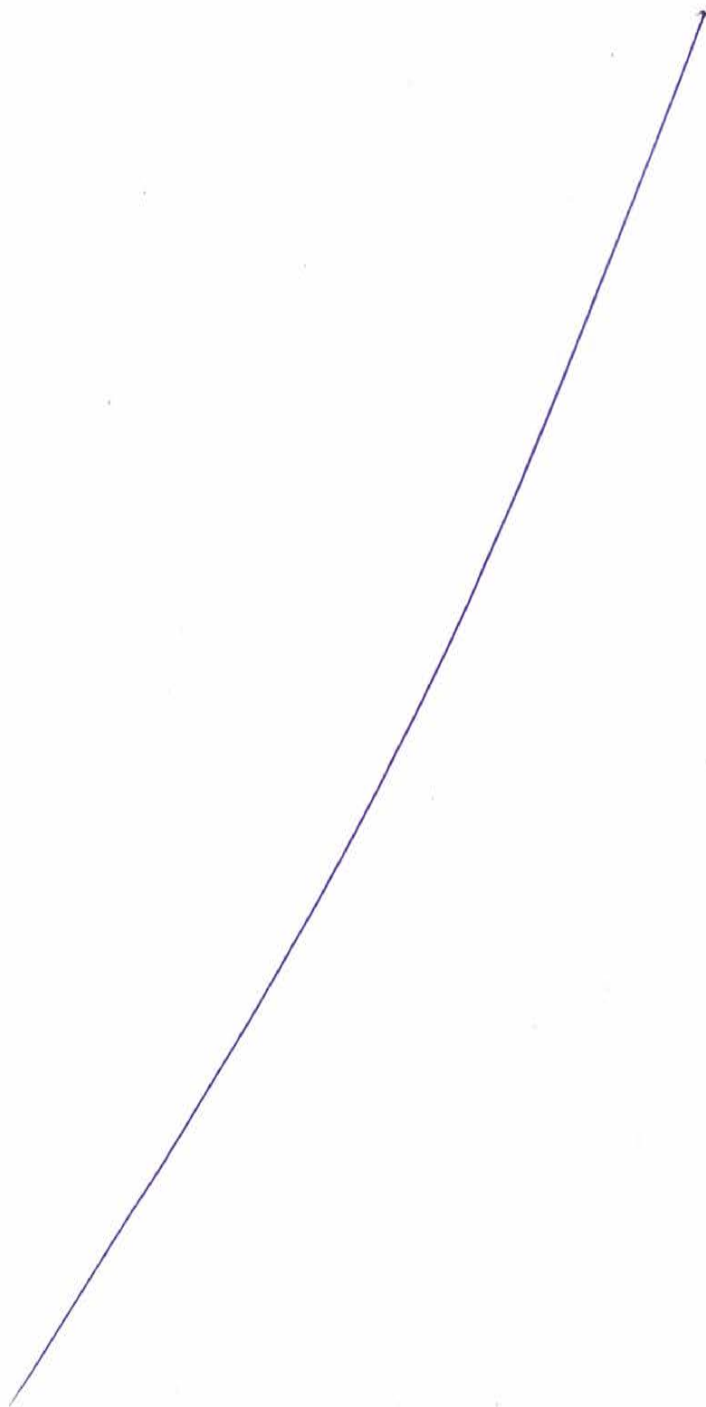


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Package-2**



4. REFERENCES

1. BOCW A - Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act, 1996.
2. The Public Liability Insurance Act 1991 and Rules 1991
3. The Contract Labour (Regulation & Abolition) Act 1970 & The Contract Labour (P&R) Maharashtra Rules 1971
4. The Child Labour (Prohibition & regulation) Act 1986 and Maharashtra Rules 1995
5. Environment Protection Act, 1986 and Rules 1986
6. Air (Prevention and control of Pollution) Act, 1981
7. Water (Prevention and Control of Pollution) Act, 1974
8. The Noise Pollution (Regulation & Control) Rules, 2000
9. Notification on Control of Noise from Diesel Generator (DG) sets, 2002
10. Recycled Plastic Usage Rules, 1998
11. MMRDA SHE Specifications
12. Notification, Central Ground Water Board, Act January 1997
13. The Manufacturing, Storage and Import of Hazardous Chemical Rules, 1989
14. Chemical Accidents (Emergency Planning, Preparedness and 1996 Response) Rules,
15. The Hazardous Waste (Management, Handling & Trans-boundary Movement) Rules, 2007
16. Batteries (Management and Handling) Rules
17. Fly ash utilization notification, Sept 1999 as amended in August 2003
18. Guidelines of Maharashtra Pollution Control Board
19. The works should be undertaken in accordance with the applicable international guidelines, standards and specifications on SHE.

OHSAS 18001-1999: Occupational Health and Safety Management System.

ISO 14001-2004: Environmental Management Systems.



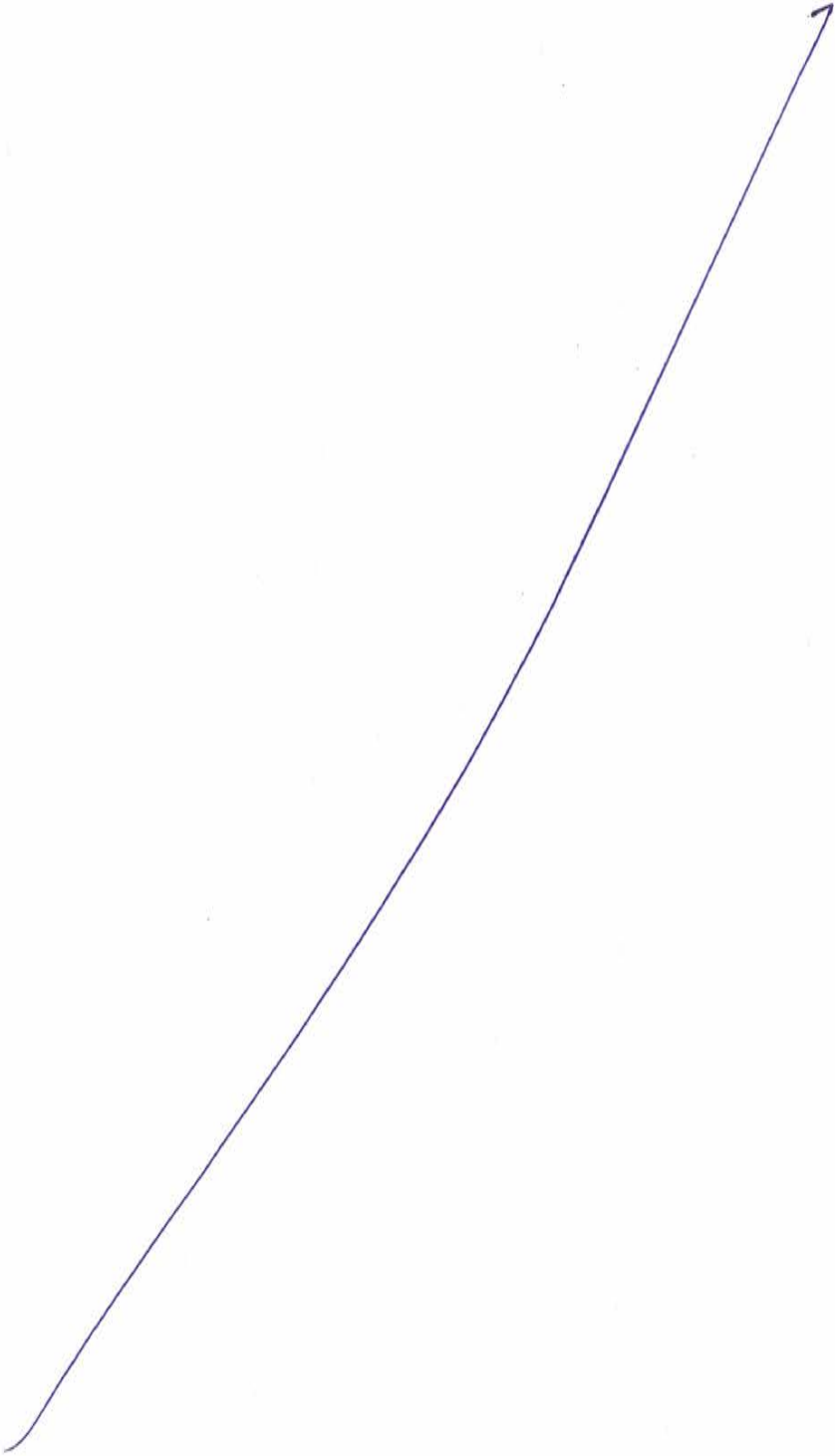
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Mumbai Trans Harbour Link Project Package-2

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5. RESPONSIBILITIES

Project Manager

Has the overall responsibility for ensuring the Site and the temporary facilities is a healthful work environment. He shall provide all necessary support including selection and recruiting suitable staff, services and necessary materials required by the medical team at the project.

HSE Manager

He/she shall be responsible for the preparation of the Health Procedure in coordination with the Employer's HSE Manager and local authorities.

The HSE Manager is responsible for the implementation and management of the Health Procedure at the Project. He delegates his responsibilities to the Health & Environment Coordinator, who shall work in coordination with the medical personnel appointed to the Project. The Health & Environment Coordinator is responsible for monitoring the facilities, identifying non-conformances and recommending improvements.

Occupational Health Officer

Must possess a valid certificate and be prominently identified on site

- Render treatment of minor injuries which do not need treatment by an Occupational Health Officer.
- Render first aid treatment for the purpose of preserving life and minimizing the consequences of injury and illness until such help is obtained from an Occupational Health Officer.
- Assist to clearly identify every first aid box or container placed in a location that is well illuminated and easily accessible.
- Check on a monthly basis, all first aid boxes or container assigned to him/her, to ensure that it is fully equipped and all items in the box or container are usable. Replenish if necessary.
- Maintain and keep clean the first aid treatment room Allocated in every site.
- Maintain a log of all treatment rendered and report to the Project Chief SHE Manager.
- Participate in All emergency drills and exercises.
- Assist in accidents/incidents investigations by providing accurate accounts of treatment rendered to injure.
- Ensure that there is no Mosquito breeding in sites



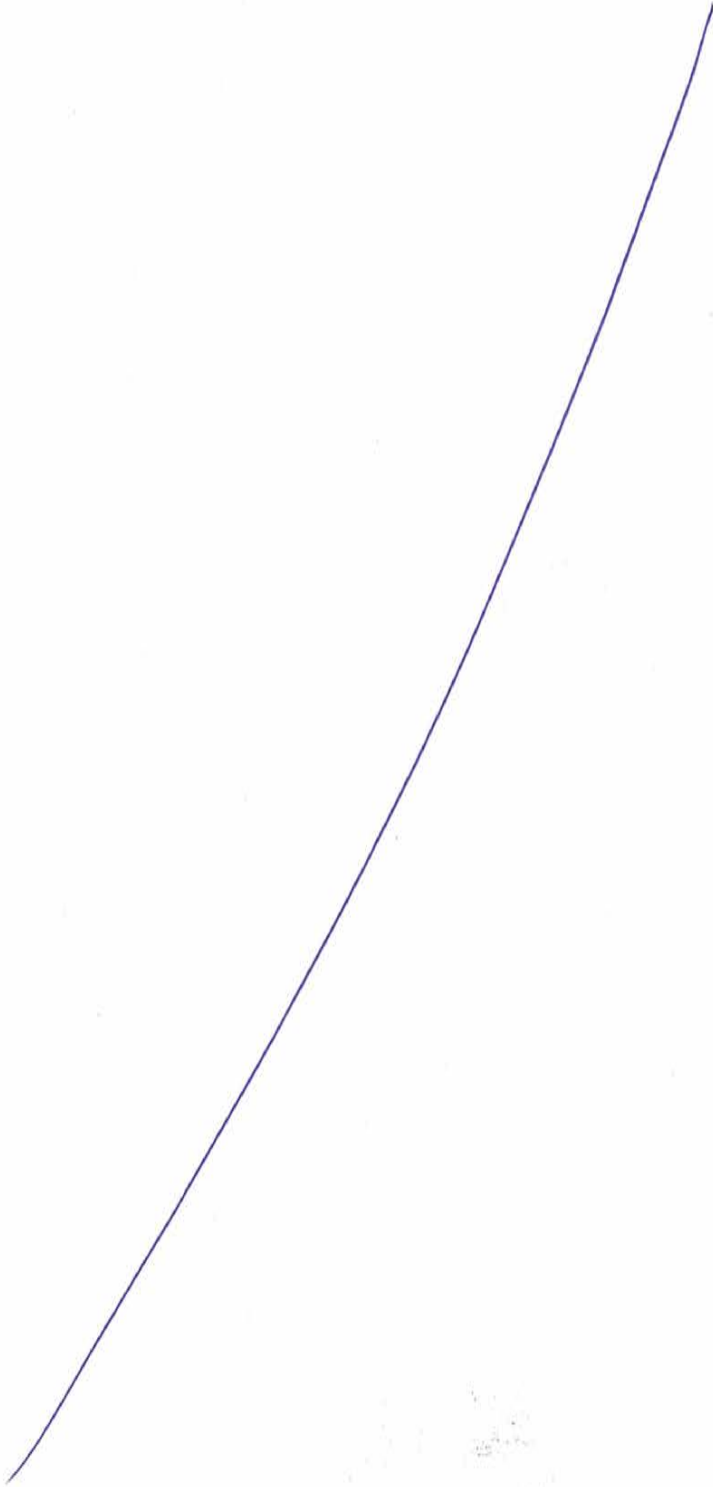
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- Make site based periodic health checkup for all employees & Workmen in sites.
- Report all First aid / Injuries to SHE Manager on twice in a month.
- To organize various health camps for employees & workers.
- To have a tie-up with nearby hospitals for any medical emergency or trauma.
- Tie up with any Authorized waste disposal to dispose all the biomedical waste generated.

First Aider

The responsibilities of the appointed First Aider will vary slightly depending on the nature of the office in which they work. However, irrespective of their office's individual circumstances, each First Aid office must:

- Maintain their First Aid accreditation to the level of 'Provide First Aid' by a Registered Training Organization;
- Consistent with the First Aid Code of Practice complete CPR refresher training every 12 months;
- Provide first aid within their office to all persons when required;
- Undertake quarterly checks of the office first aid kit to ensure it is compliant with the checklist including disposing of expired items safely and in a manner which prevents their use by any other person;
- Assist with any incident investigations and unresolved issues connected with the use of first aid supplies, or action by the Site Safety Officer at the site; and
- Promote good WHS practice within the site.
- Hygiene/Infection Control
- All First Aid staff are reminded to take precautions to avoid infection and must follow basic hygiene procedures. Staff have access to single-use disposable gloves and hand washing facilities, and should take care when dealing with blood or other body fluids and disposing of dressings or equipment.



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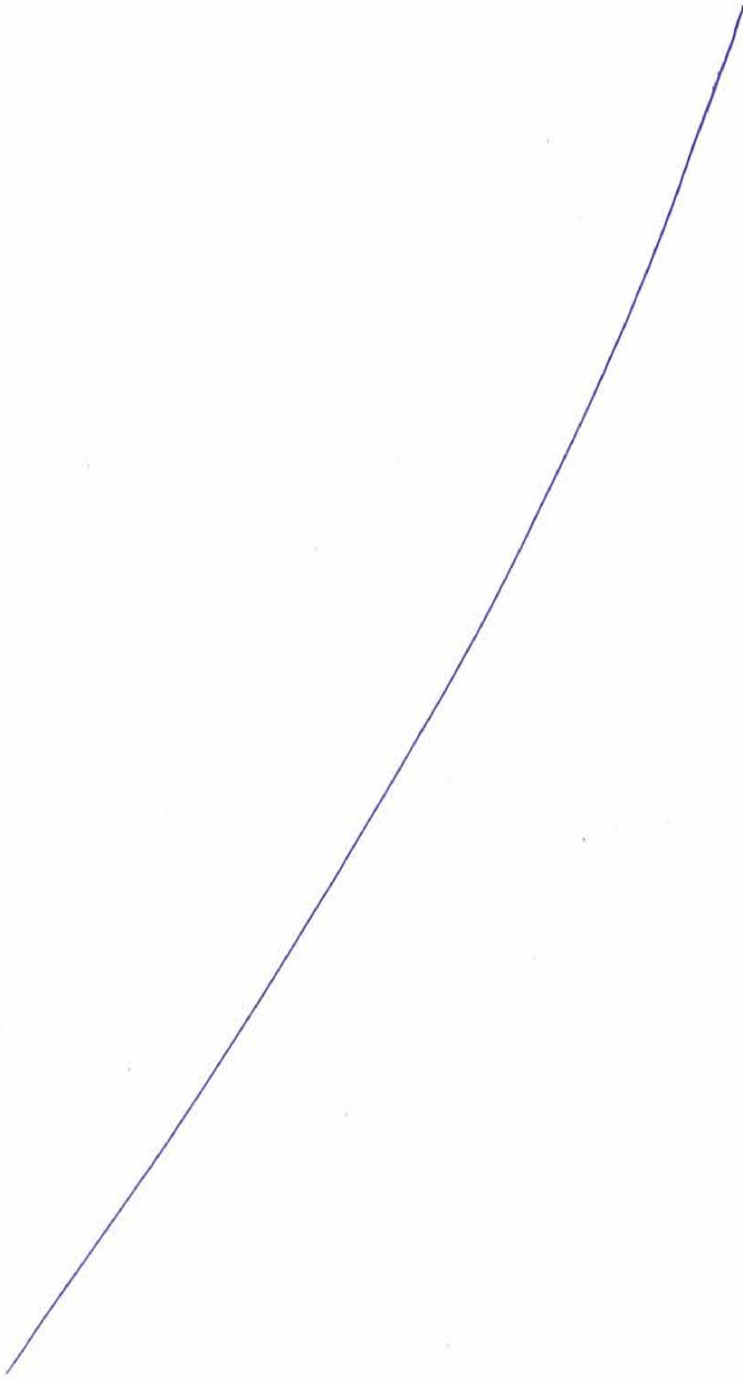
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6. ASSIGNMENT OF PERSONNEL AND WORKERS

6.1 General

All project personnel and workers shall be medically examined to ensure that they are in good health and fit for the work before they are mobilized at the project. DAEWOO - TPL JV should appoint doctors, preferably with knowledge of the working environment. A medical examination register shall be kept in the Project Clinic.

6.2 Medical Examination

A Certificate of Fitness shall be issued to each worker. The medical examination shall be the responsibility of each subcontractor, and for DAEWOO - TPL JV personnel. DAEWOO - TPL JV and Subcontractor HSE Groups and the Project Clinic shall file the Certificates of Fitness of their employees.

Workers fitness shall be assessed by the Doctor after prolonged absence from work due to sickness or injury.

Minimum medical standards for fitness examination and frequency are specified in Attachment 2.

Medical examinations to ensure the fitness of an individual for a particular job shall be classified as one of four categories:

Medical examinations	Employees	Results
Pre-employment examination	All	<ul style="list-style-type: none"> • Fit without restriction • Fit with specified restriction • Unfit • Awaiting specialist assessment
Pre-placement examination	As required	
Periodic medical examinations (Health surveillance)	All	
Fitness to work examinations	All	

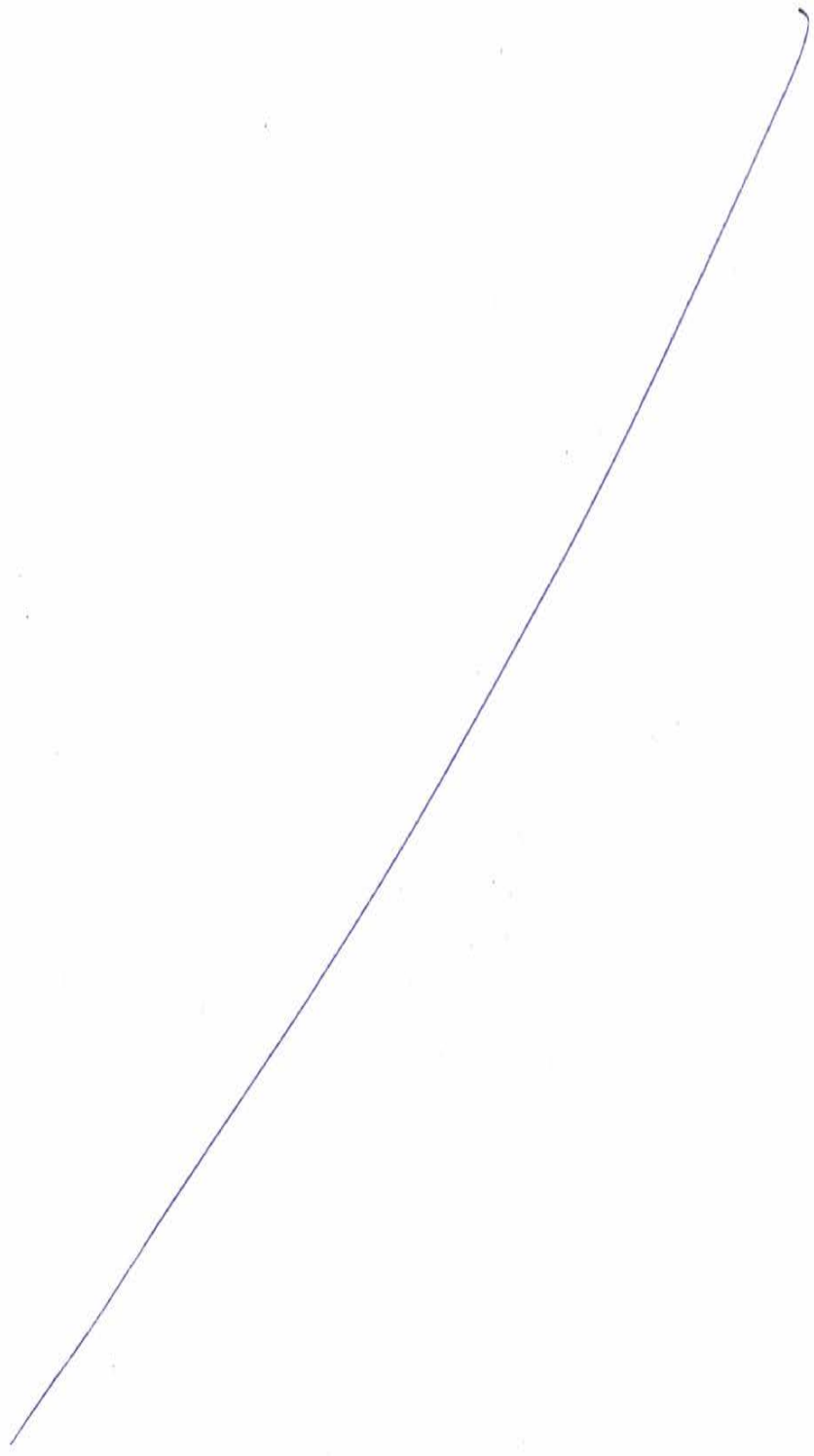
6.3 Food Handlers and Cleaning Personnel

Everyone working in food handling areas and living quarters shall maintain a high degree of personal cleanliness and wear suitable, clean and protective clothing.



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**Mumbai Trans Harbour Link Project
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No one who is carrier of a disease transmittable through food, or whilst afflicted with infections, sores and the like, shall work in food handling areas or living quarters.

All food handler personnel shall be supervised, instructed and trained in food hygiene.

In addition to pre-employment medical examination, food handlers and cleaning personnel shall be medically examined every six months (Attachment 2).

7. ALCOHOL AND DRUGS

Alcohol will not be allowed at the site or offices. Drugs will not be tolerated in any of the project locations.

Employees and workers are required to be free from drugs and have the responsibility not to be impaired by alcohol while working. Personnel shall inform their supervisor prior to using prescribed drugs on the job.

Any manager or supervisor has the authority and the responsibility to take appropriate action if they believe a person on the project premises is impaired by alcohol or drugs.

DAEWOO - TPL JV alcohol and drug policy shall be explained to all personnel at the time of employment and at the Project HSE Induction Training.

7.1 Drug Testing

The testing for drugs involves the analysis of urine or other body samples (saliva, hair). This requires a system which incorporates a chain of custody and analysis procedures and a defined role for the designated medical representative which guarantees sample and result validity and confidentiality.

A medical staff (doctor/nurse) with knowledge of substance abuse can interpret the laboratory result. Interpretation of a confirmed positive drug test by the medical staff must be based on medical interview, a review of the employee's medical history and records, and a review of any other relevant biomedical factors. If the employee has a legitimate medical explanation for a confirmed positive test, the medical staff must report that test to the employer as negative.



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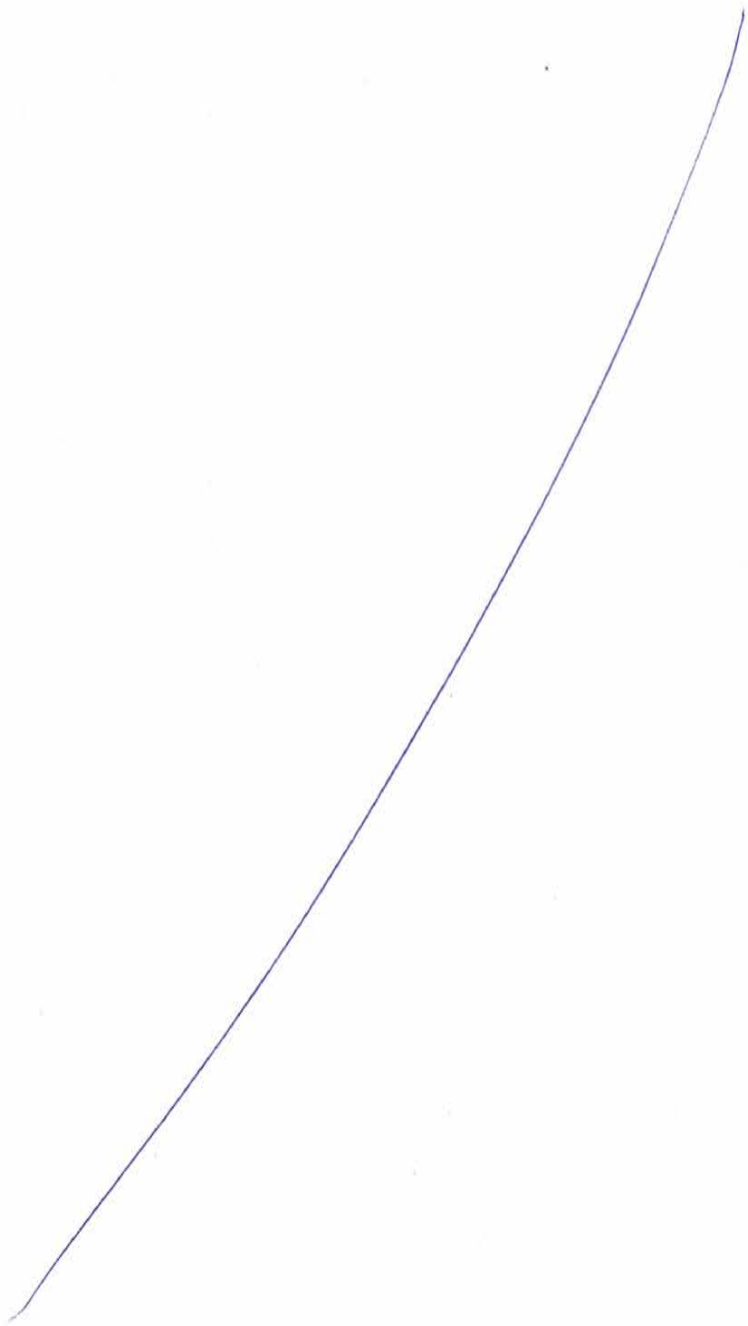
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7.2 Alcohol Testing

The recommended testing method for alcohol use is the measurement of breath alcohol concentration. This is a non-invasive and relatively simple method, which can be used in most locations and operating conditions. Confirmatory blood alcohol testing is usually not required for properly performed breath analysis when checking compliance with a company maximum allowable breath alcohol concentration. However, it may be needed for legal or other reasons.

7.3 Circumstances to testing Alcohol and drug

Consideration should be given to testing for substance abuse under the following circumstances:

- Pre-employment testing of all applicants;
- For cause testing at management discretion:
 - Post incident,
 - Substances found on site,
 - Suspected substance abuse,
 - Behavior hazardous to personnel, operations or environment;
- Random testing:

Random testing is a method of auditing compliance with the substance abuse policy. Random testing may be most appropriately applied to designated risk-sensitive positions.

 - Testing should apply equally to all personnel in risk sensitive positions, both employees and others.
 - The selection of individuals for testing must be demonstrably random.

8. HEALTH TRAINING

8.1 First Aid Training

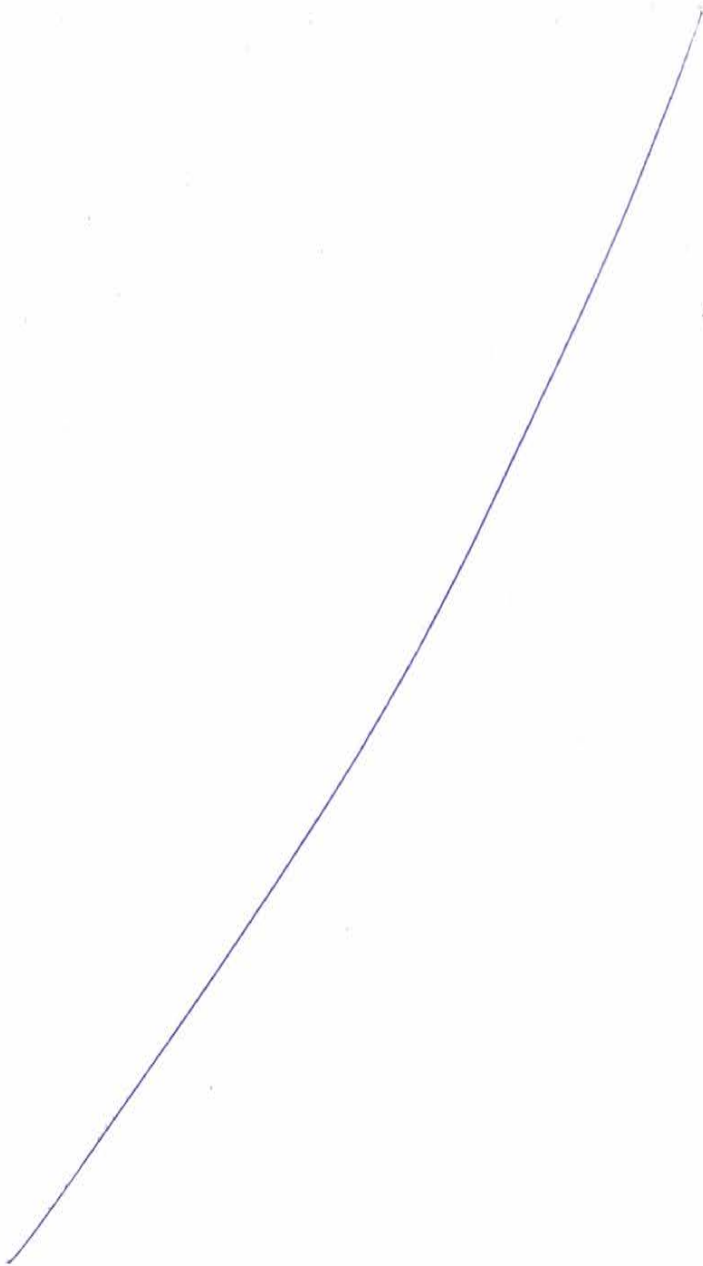
Personnel selected from the workforce, one for every 100 people and mainly supervisors and foremen, shall be trained in first aid in order to support the medical personnel in case of multiple injuries or simultaneous accidents in different places of work.

These personnel shall receive basic training in first aid at the work site, in particular for electrocution, burns, heat stroke, bleeding and CPR. Certified medical personnel shall conduct the training.

Further, the personnel shall receive basic information related to first aid assistance, survival procedures, "do's" and "don'ts" in case of accidents, and information related to the main health



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hazards of the area. Refresher first aid courses shall be carried out at regular intervals at the work site. And first aiders must also have a working knowledge of MSDSs.

Recommended Advanced First Aid Training conducted for all of project medical personnel from authorized course providers.

8.2 Hazardous Substances Training (Hazard Communication Program – HAZCOM)

As part of the HSE training, workers shall be informed of the hazards they are likely to encounter when working with hazardous substances. The training shall cover the following:

- Hazardous materials that will be used at the project
- Material Safety Data Sheet (MSDS) and their content
- Exposure to, and handling of, hazardous substances
- Storing and container labeling
- Hazardous waste collection and disposal.

As part of the Job Safety Analysis, after the identification of hazardous substances that may be used, the workers shall be trained, using the relevant MSDS, in the use and handling of these hazardous substances, including the use of proper tools and PPE for handling the materials and first aid techniques in case of exposure or ingestion.

8.3 Heat Stress / Cold Stress

Heat stress / Cold stress awareness training shall be provided as part of the HSE induction training.

8.4 Tropical Disease Mitigation

The medical personnel shall conduct education courses on the prevention, prophylaxis, and diagnosis and treatment.

8.5 First Aid Procedure Training

As part of the HSE training, the workers shall be informed and become familiar with the procedure for reporting and requesting the intervention of first aiders and medical personnel.



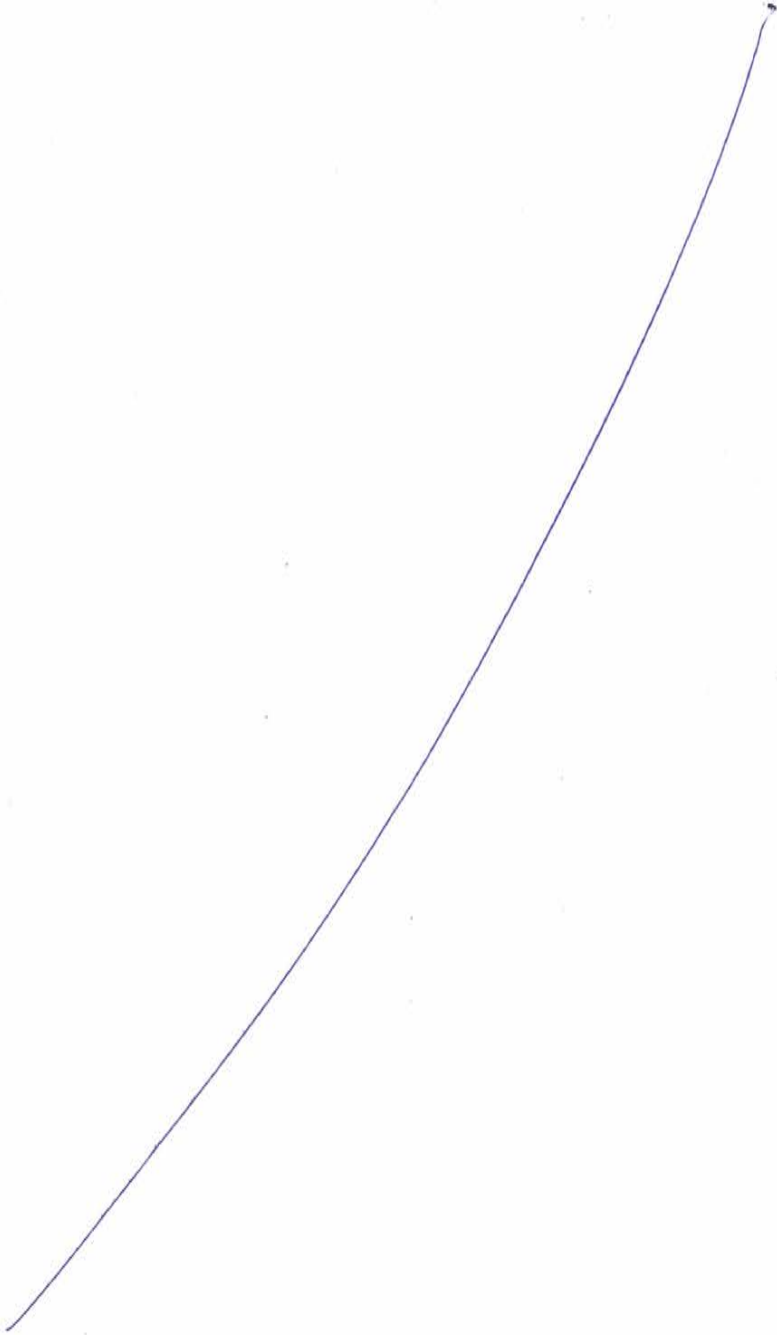
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8.6 Training Records

Records of the training, specifying names of the trainees, the name of course, the date, and the name of the instructor, shall be kept and filed by the HSE Manager.

Employees who receive the training shall be given stickers for their hard hats identifying their level and classification of the training.

9. HEALTH HAZARDS IDENTIFICATION

Major health hazards identified and prevention and mitigation measures are listed in Attachment 4.

Assessment and evaluation process shall ensure compliance with all aspects of the occupational health and that lessons learnt are incorporated in the specific plans, procedures and method statements.

10. HOUSEKEEPING AND THE ENVIRONMENT

10.1 General

The site and work areas and the Temporary Facilities shall be maintained to a high standard of housekeeping at all times in order to;

- Secure clear access
- Eliminate potential sources of fire
- Maintain a safe and healthful work environment

All supervisors, including the Subcontractors, shall conduct daily inspections. In addition, periodic inspections by the Safety Committee shall be conducted.

10.2 Potable Water and Sanitation

DAEWOO - TPL JV shall provide an adequate supply of potable water and sanitary facilities for the workforce at various locations on the Project. Locations will vary, depending on the progress of the work. Drinking water shall be provided in sealed containers along with Common cups.

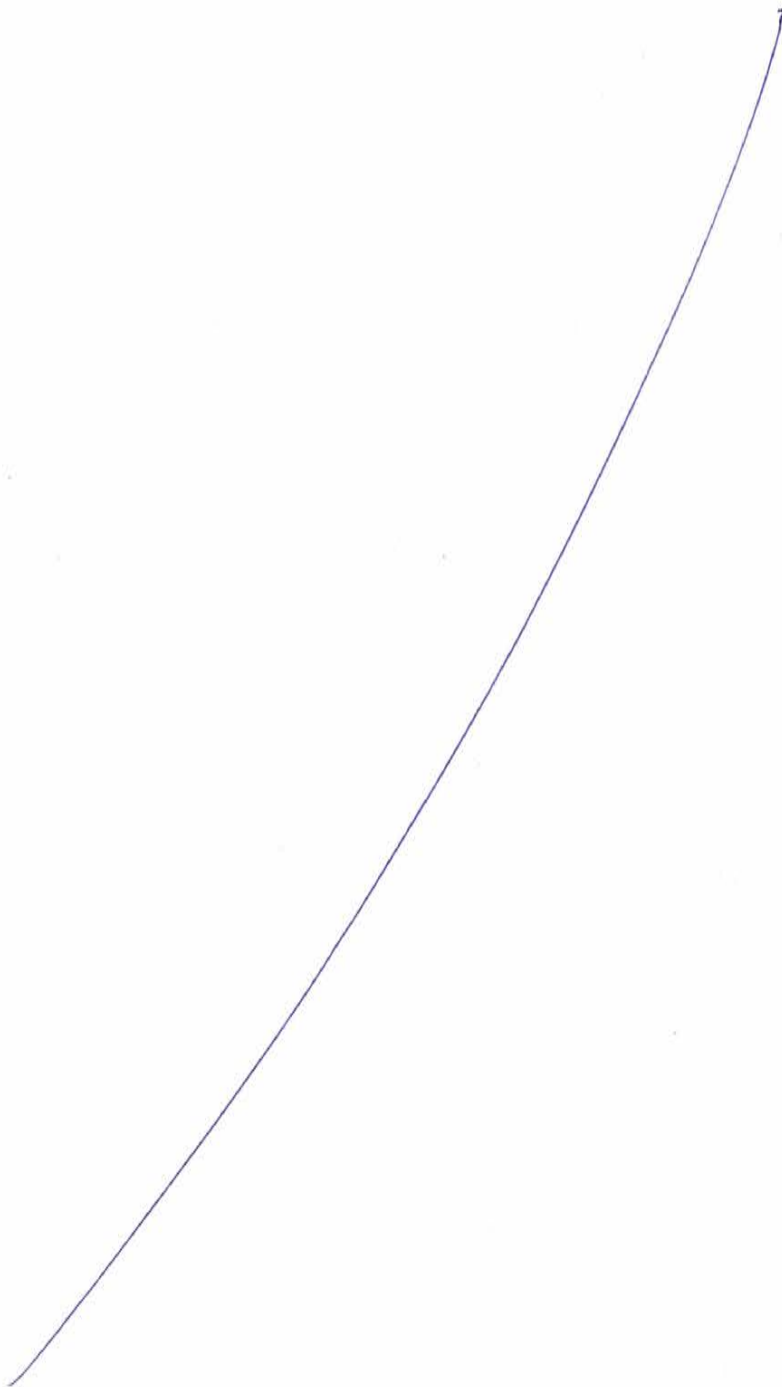
If potable water is not supplied in sealed containers, but in bulk, a biweekly test shall be performed to ensure the quality of the water. Water at the camp will be supplied from an existing well and treated.

Tests to verify the quality of the water will be carried out monthly.



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Toilets shall be located at designated areas only. All toilet facilities shall be cleaned and disposal services for the toilets provided on a continuous basis. One toilet shall be provided for each 25 workers and located within a reasonable distance to each work area.

10.3 Air

Exhaust fans shall be used when working indoor or enclosed space.

10.4 Noise

As far as practical, low noise/silenced construction equipment shall be used. Where noise at work areas exceeds 85 db., barriers and warning signs specifying the use (mandatory) of ear protectors shall be installed.

10.5 Hazardous Materials and Substances

Hazardous materials shall be stored on impermeable pads with full containment.

Paints, solvents and other hazardous materials shall be stored in shaded, dry, well-ventilated areas located away from offices, workshops and hot work areas. Storage shall be done in accordance with the MSDS and the vendor recommendations.

Up-to-date MSDS shall be available at the project for all hazardous chemicals and substances brought to the project. The MSDS shall be provided by the suppliers of such hazardous chemicals and substances and filed by the Project HSE Manager and the Doctor at the Clinic.

11. CAMP FACILITIES

Daewoo – TPL JV shall

- Ensure emergency Layout is displayed at each room, exit and Assembly point.
- Ensure construction of labor camp can withstand windstorm.
- Ensure provision of fire points with fire plan and fire warden name.
- Ensure First Aid room is fully established and first Aider/Male nurse is deployed on day and night basis.
- Maintain stock of medicines.
- Ensure availability of emergency vehicle for 7 x 24 hours.



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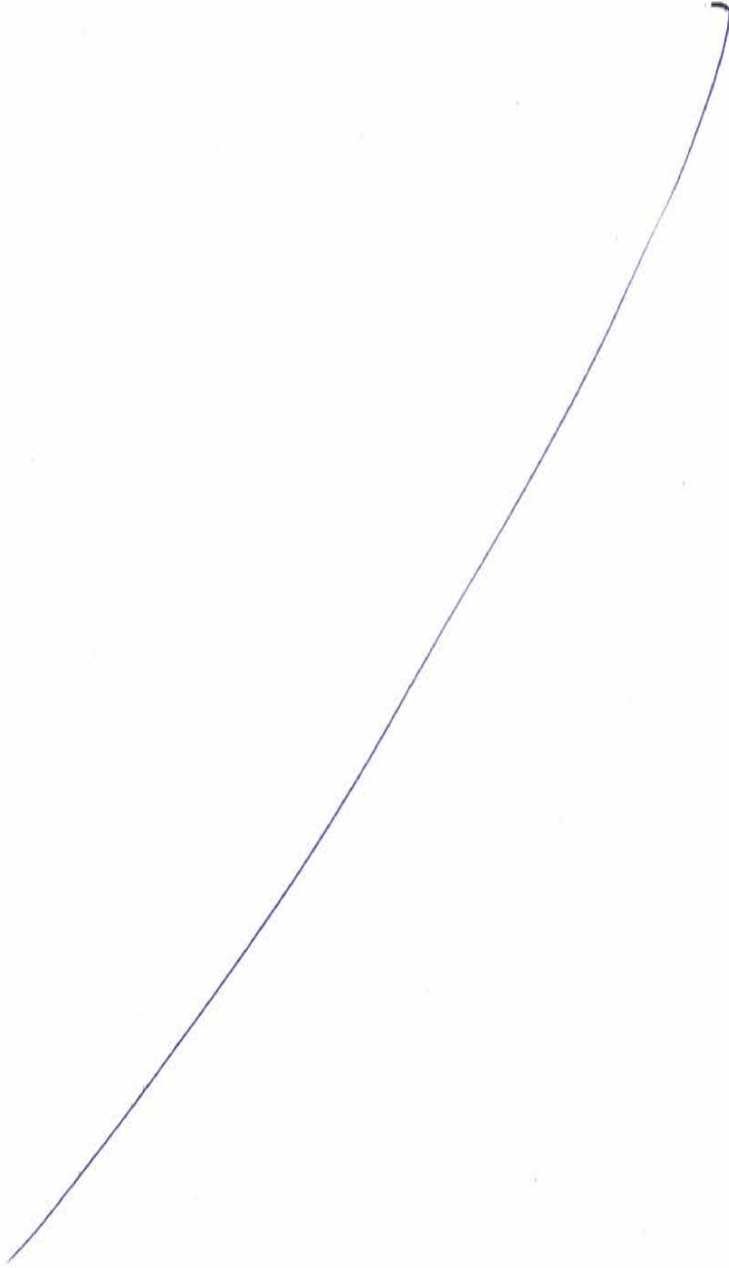


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- Assembly point shall be clearly earmarked and on hearing alarm all labor has to assemble at assembly point and can return back only after ensuring labour camp is safe as per instruction of labor camp.
- Communicate the roles and responsibilities of laborers in case of an emergency.
- Check & get approved all the electrical connections & fittings through a licensed electrician. Provide appropriate ELCB's.
- Ensure availability of drinking water and cleaning of water tanks on regular basis. Records of water tank cleaning shall be displayed at safe location.
- Maintain clean and hygienic condition around the drinking water locations.
- Ensure toilets are sufficient in numbers and cleaning shall be done at regular interval. Records of cleaning schedule shall be displayed at safest location.
- Provide effective drainage system with septic Tanks.
- Ensure that adequate number of bathing and washing facilities are provided with proper drainage system.
- Ensure availability of kitchen/canteen and dining facility.
- Carry out pest control in different areas regularly
- Provide appropriate bins for collecting garbage.
- Dispose off the garbage on regular basis and maintain records.
- Ensure labor camp is as per legal requirement.
- Display camp rules and regulations (Do's and Don'ts) at conspicuous locations.

12.MEDICAL AND FIRST AID

12.1 Medical Assistance

Qualified medical personnel shall be appointed by DAEWOO - TPL JV at the project in order to give first aid and emergency medical care to injured workers. In addition, personnel assigned from among the workforce, mainly supervisors and foreman shall be trained in first aid and holding First Aid Certificates at the ratio of one every 100 personnel.

A first-aid medical care facility with adequate medical equipment shall be installed at the project as part of DAEWOO - TPL JV temporary facilities. All subcontractors shall provide a first-aid facility at site for their employees and workers. The first aid rooms shall include facilities for a man to lie down for



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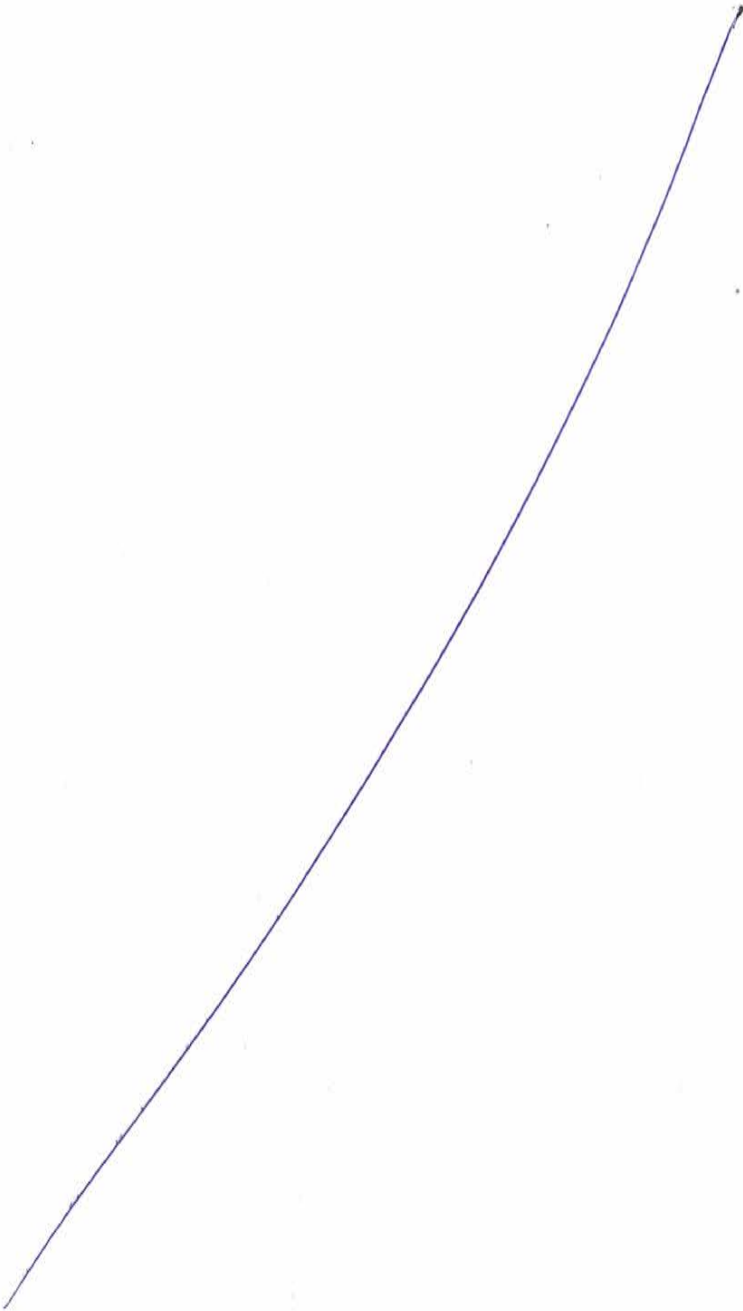
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treatment and be furnished with a large industrial size first-aid box the content of which shall be agreed with Employer. A fully equipped ambulance with a driver will be on stand-by at the Clinic during working hours.

A log of all first aid treatments shall be maintained. The log shall record the name of the treated person, date, time, nature of injury and treatment (Attachment 3). All injuries, regardless of their seriousness, shall be immediately reported to DAEWOO - TPL JV HSE Department.

For serious injuries, arrangements for emergency hospitalization will be made before the beginning of the project activities with the following hospitals:

- Clinic in near City for local workers and expatriates
- Clinic in big City for local workers and expatriates

12.2 First Aid Kits

First Aid Kits shall be located at the site so as to allow easy and quick access. The area supervisor shall be responsible for ensuring that the kit is maintained in serviceable conditions.

The Doctor/Nurse shall specify the basic content of each kit. All items that are required to be sterile shall be individually wrapped and sealed.

One First aid kit shall be provided for each 100 workers and located at the worksite in strategic location(s).

12.3 First-aid Procedure

❖ General

All personnel shall be conversant with the procedure and should be applied when they, or a co-worker working in their area, sustained injury.

❖ Minor Injuries

The injured person shall verbally report to his immediate supervisor the accident causing the injury and seek immediate treatment either by the medical staff or first-aider in charge of a first-aid box within a working area.

The nurse shall then enter the details of the accident on behalf of the injured person in the form for recording first-aid treatments (Attachment 3).



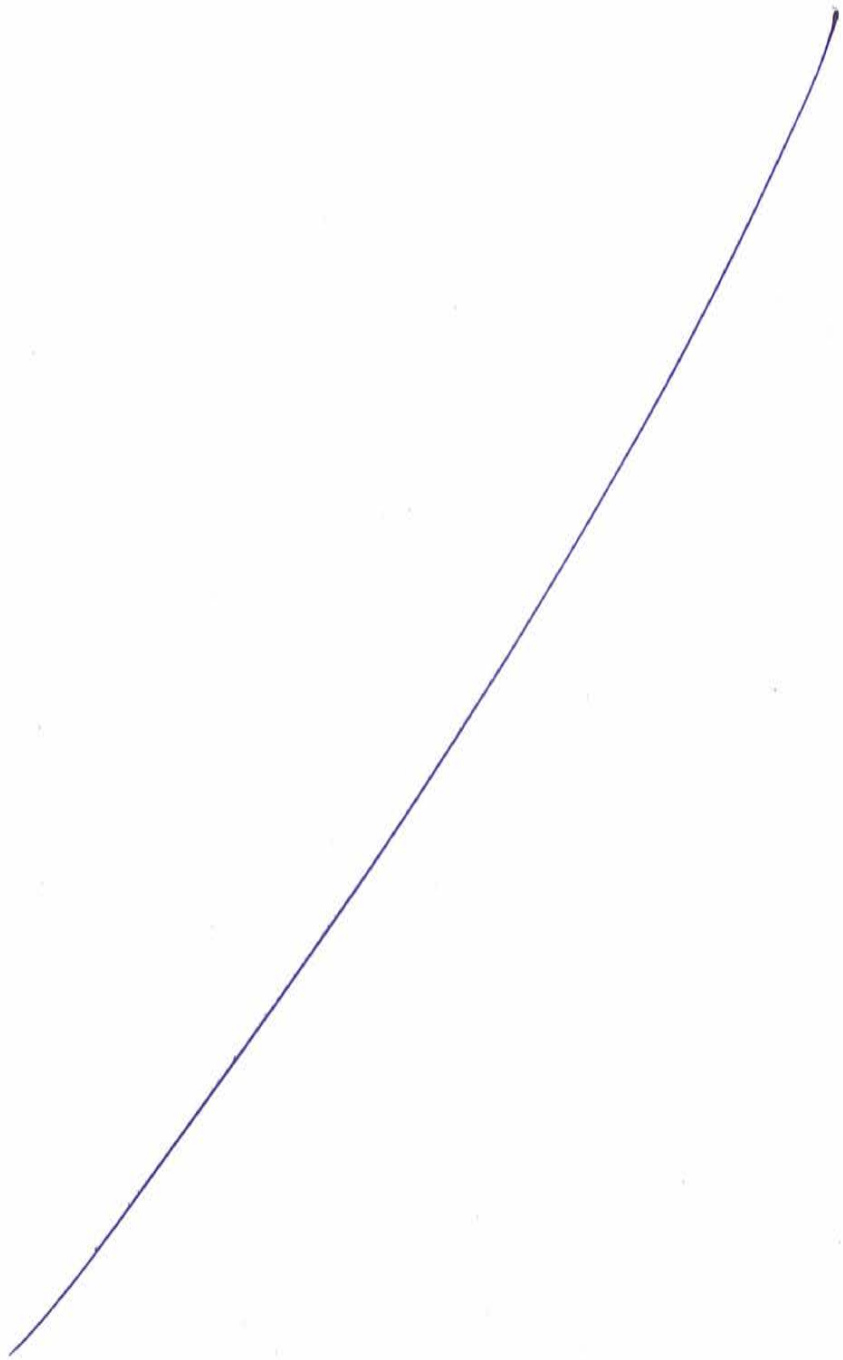
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The immediate supervisor shall also be kept fully informed of the situation. The supervisor, after notifying the HSE Section of the accident, shall investigate, together with the safety representative, and prepare the accident report, thus ensuring that prompt remedial action is taken to prevent a recurrence.

❖ **Serious Injuries**

Supervisor, foreman or other person at the location shall make sure the injured is getting first aid and shall immediately call the ambulance. Unless the injured person is in danger of further injury, such as caving in ditch or falling objects, he shall not be moved until the arrival of the doctor or nurse.

Supervisor, foreman or other person shall immediately notify the HSE Manager and the Construction Manager.

13. EMERGENCY RESPONSE

DAEWOO - TPL JV before the beginning of the project activities will develop an emergency response procedure and identify

1. Responsibilities within DAEWOO - TPL JV organization
2. Coordination with Employer plant operators and HSE personnel
3. General, medical, fire, and specific major incident response requirements
4. Communication system within project and external emergency services
5. Wind speed and direction indication
6. Layout plan showing hazard areas and available equipment
7. Alarms
8. Evacuation and muster areas.

The Project Manager shall ensure, in coordination with Employer, that dedicated teams are organized and trained for response to an emergency arising at the site or the camp. DAEWOO - TPL JV will also have in place an agreement with local Clinic in City for the medical evacuation of personnel.

The basic criteria based on which an emergency communication procedure shall be developed are shown in Attachment 5.



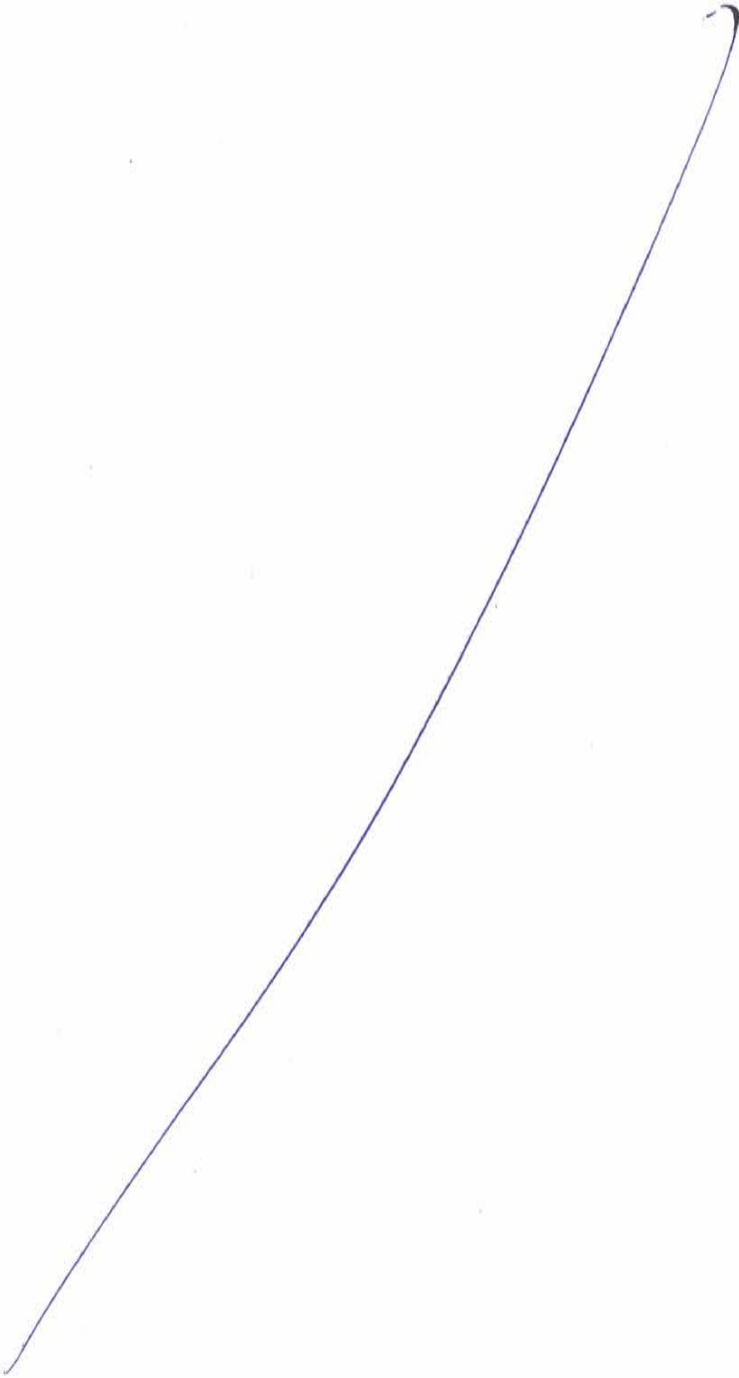
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14. MEDICAL EVACUATION

General Criteria

Evacuation process consists of the following steps:

1. Alert the medical personnel
2. Provide first aid treatment
3. Evaluate of the situation
4. Transport the patient to the nearest medical facilities.

The medical facilities and the means of transportation are selected by the medical personnel based on the conditions of the patient.

15. CONTROL AND INSPECTIONS

The HSE Manager together with the medical personnel will be responsible for the control and inspections of the hygiene of the temporary facilities.

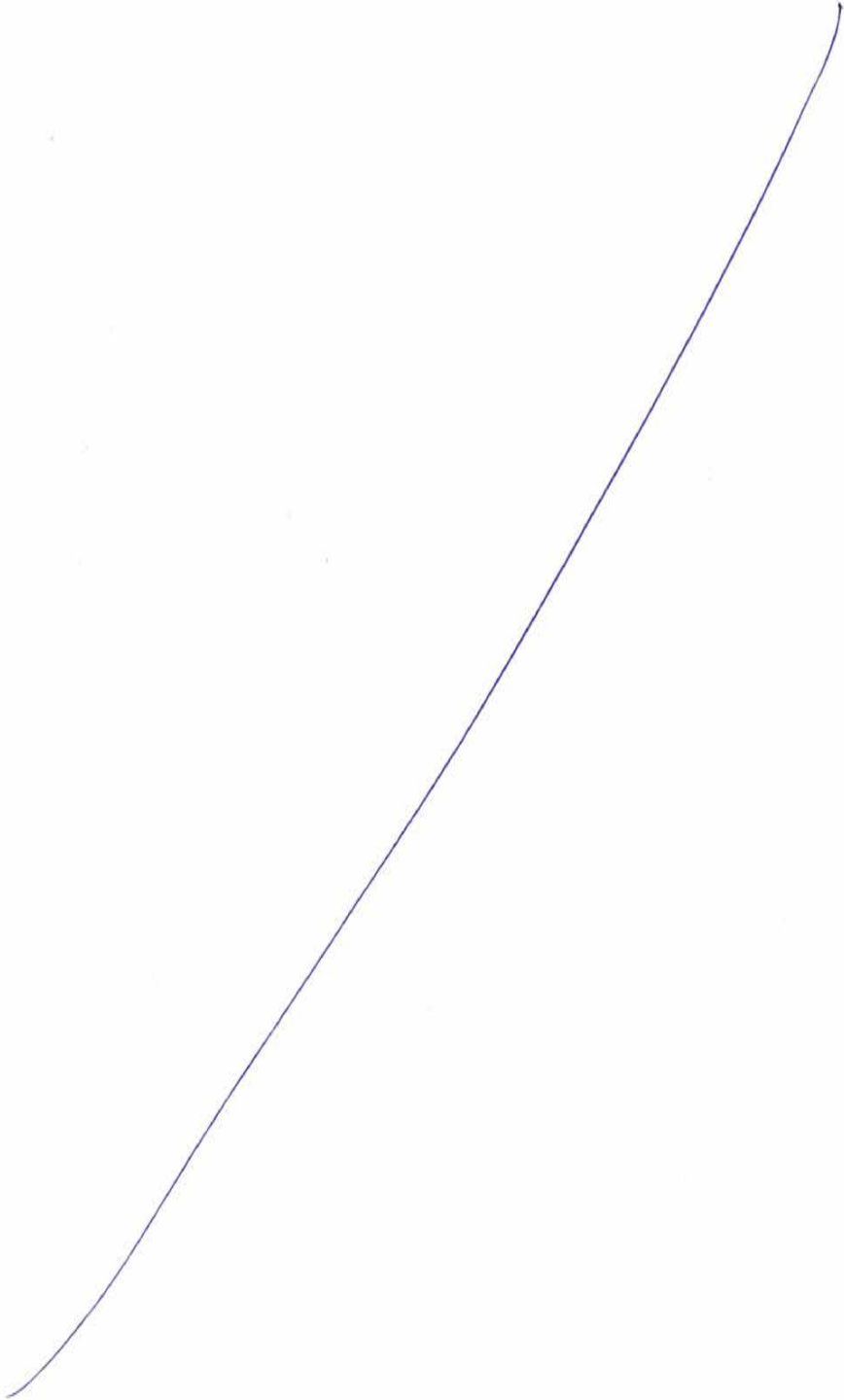
The supervisors will be responsible for the daily inspections of their working areas to ensure that they are clean and garbage and waste are removed.

In addition to HSE audits and HSE Committee inspections, the following inspections and controls shall be carried out.

1. At weekly intervals the medical staff shall inspect the camp facilities and offices, in particular showers and toilets, kitchen and canteen
2. HSE Manager shall regularly inspect vehicles and boats for personnel transportation for cleanliness
3. Water samples will be analyzed as specified in Section 9.2 above
4. Audiometric testing of working areas are carried out by the Health Coordinator at locations in and around areas identified as areas where the noise equals or exceeds 85 dB(A).



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16. RECORDS

DAEWOO - TPL JV shall file the following records:

1. MSDS (HSE Section and Clinic)
2. Employment physical examination (HSE Section)
3. Training records (HSE Section)
4. Individual employee record of injury or illness (At the Clinic)
5. Result of medical examination of food handlers and cleaning personnel (At the Clinic).

17. REPORTING

The HSE Manager shall issue a monthly report covering the following items. A summary of the report shall be included in the Monthly Progress Report as part of the HSE Section.

1. Number and types of cases treated
2. Trend analysis of injuries
3. Result of inspection and audits, both DAEWOO - TPL JV internal and by Employer or Public Authorities
4. Inspection and audits reports (HSE Section)
5. Pest control measures (HSE Section)

18. HIV-AIDS PREVENTION

DAEWOO - TPL JV shall conduct an HIV-AIDS awareness program via an approved service provider, and shall undertake such other measures as are specified in Contract to reduce the risk of the transfer of the HIV virus between and among its personnel and the local community, to promote early diagnosis and to assist affected individuals.

DAEWOO - TPL JV shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education and Communication (IEC) campaigns, at least every quarter, addressed to all the Site staff and labor (including all employees, all Subcontractors and any other Contractor's or Employer's personnel, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behavior with respect to, of Sexually Transmitted Diseases (STD) - or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms



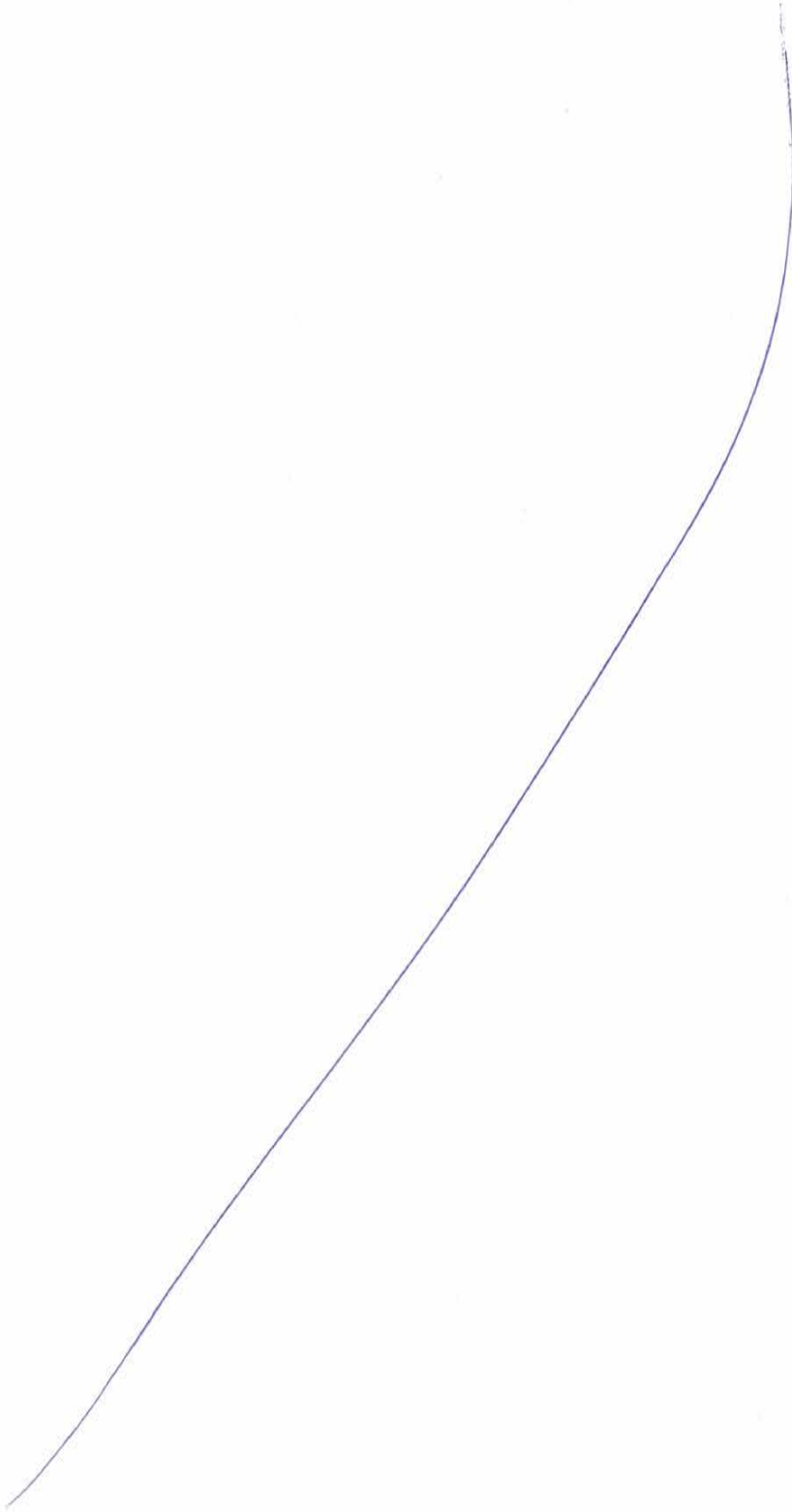
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for all Site staff and labor as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counselling and referral to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labor.

DAEWOO - TPL JV shall provide HIV/AIDS materials and regular courses by qualified personnel. An approved third party shall be engaged to provide support services during construction for HIV & AIDS response. DAEWOO - TPL JV shall prevent commercial sex work through measures such as strict access to work sites, careful work site placement; inclusion of sex workers in corporate social responsibility, initiative and placing construction camps farther from school.

19. ATTACHMENTS

- ATTACHMENT 1: Health Organization
- ATTACHMENT 2: Medical Examination Standards of Fitness
- ATTACHMENT 3: First Aid Treatment Record
- ATTACHMENT 4: Health Hazard
- ATTACHMENT 5: Medical Emergency Communication Flow Chart
- ATTACHMENT 6: Health Activity Procedure
- ATTACHMENT 7: Hygiene Check List



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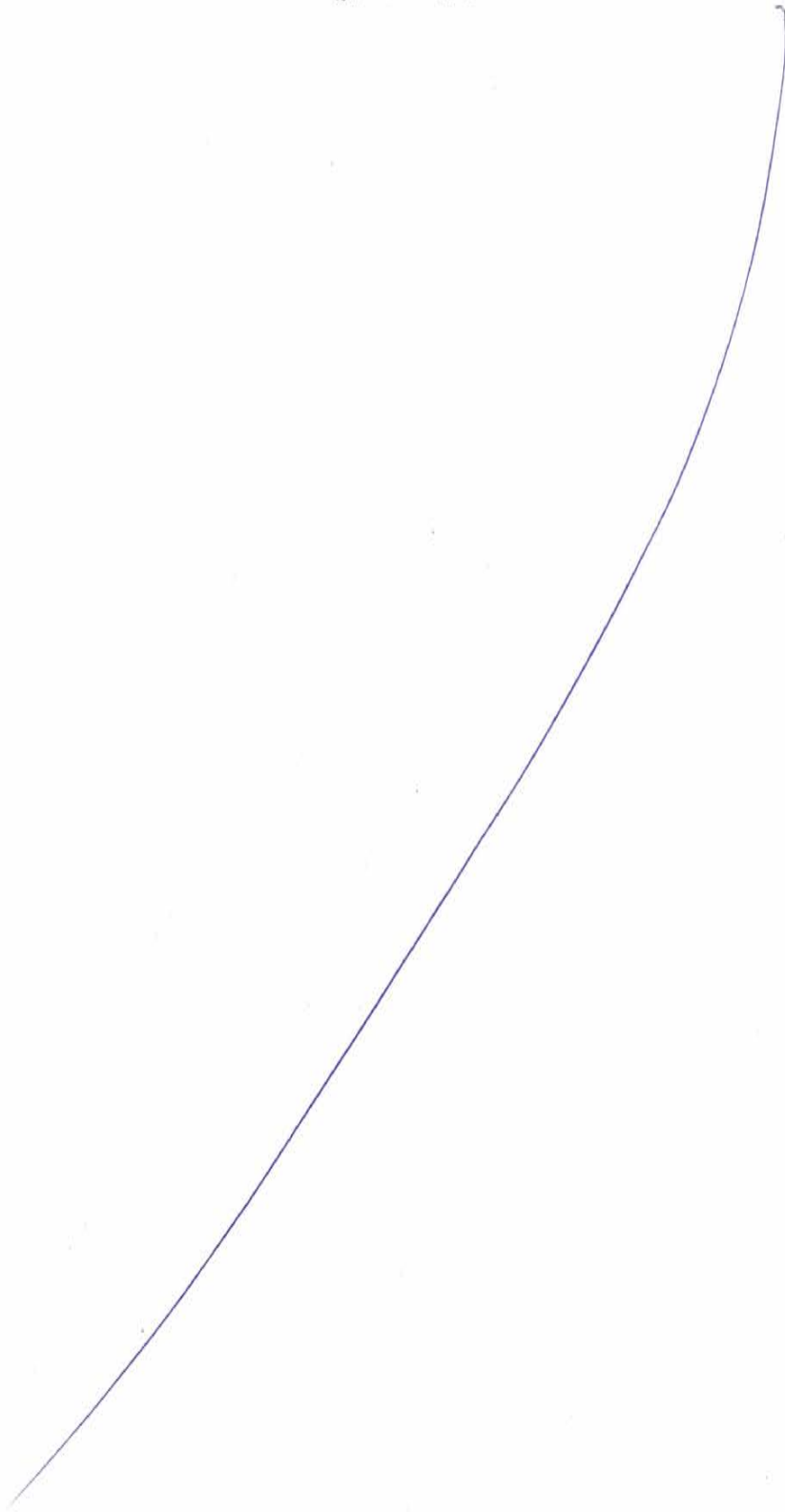
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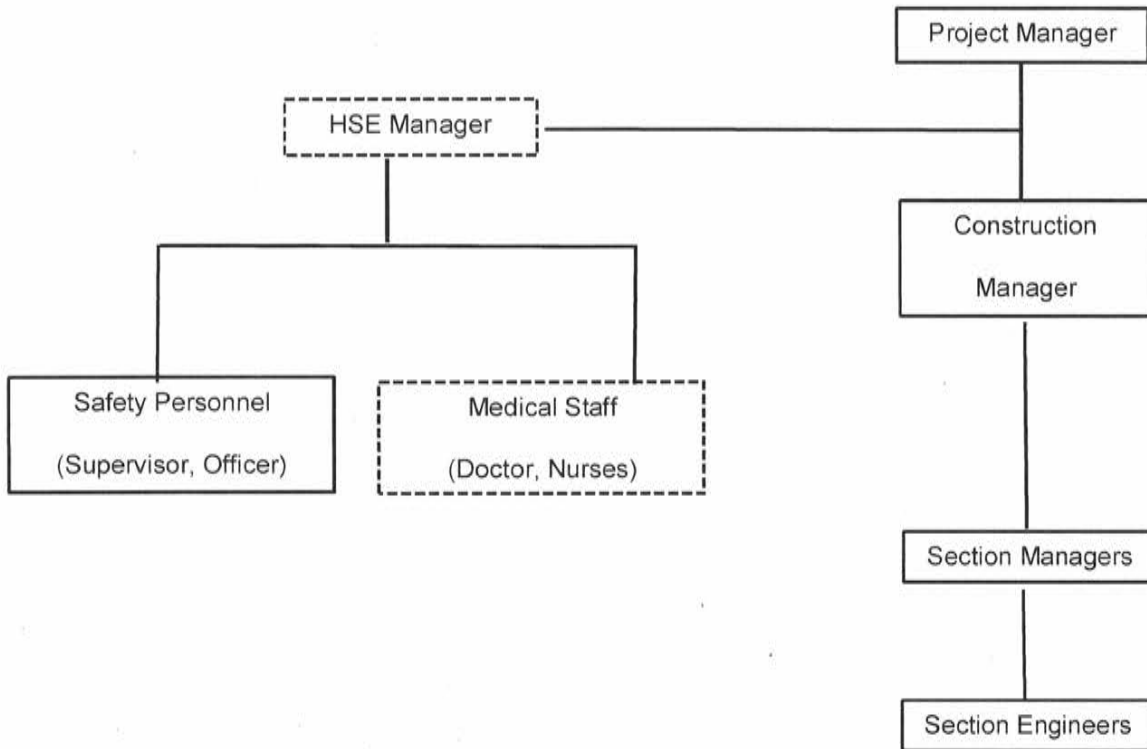




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ATTACHMENT 1: Health Organization



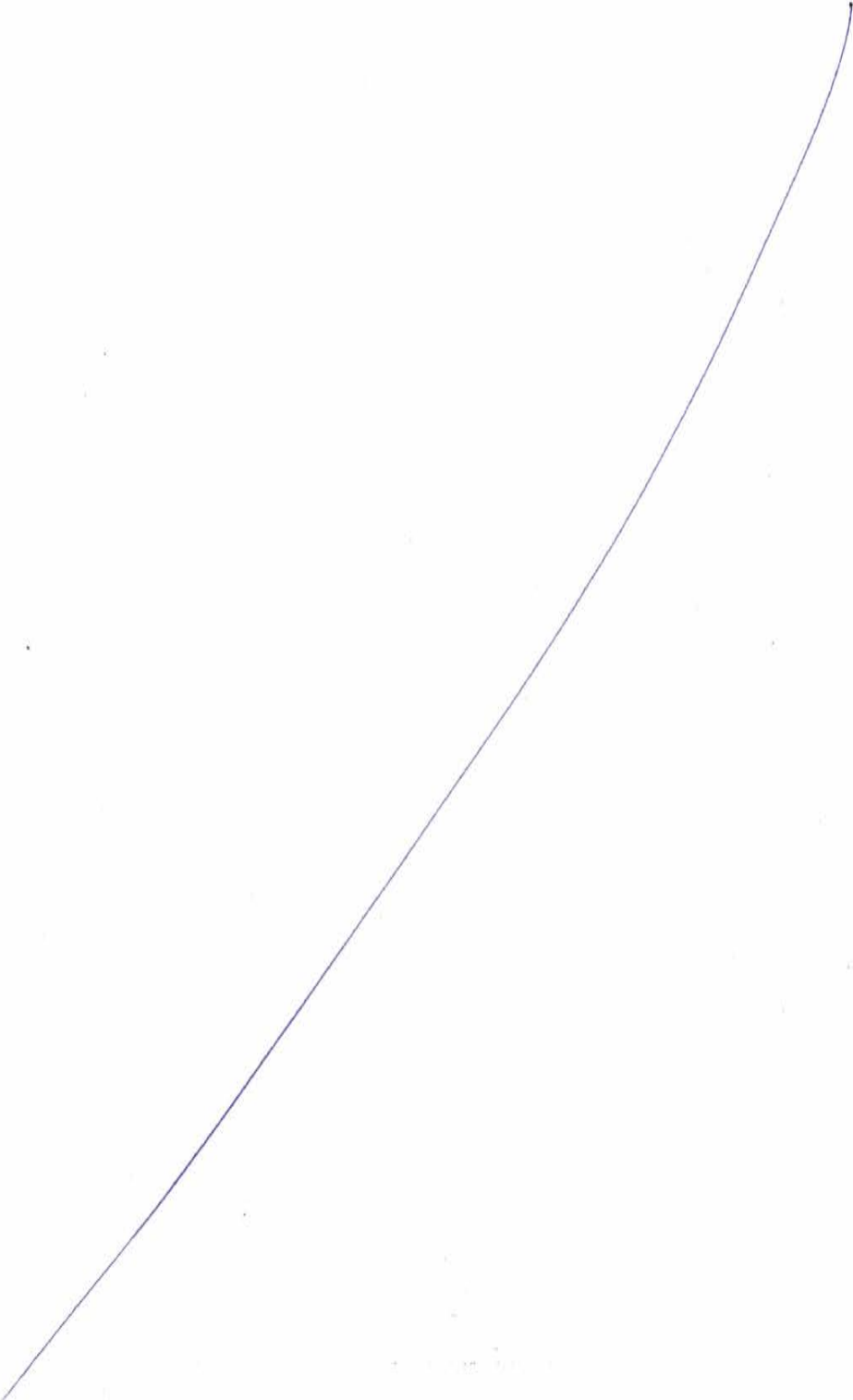
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ATTACHMENT 2: Medical Examination Standards of Fitness

Medical Examination	Pre-employment Examination (1)	Food Handlers & Cleaning Personnel (2)	< 40 Years Age Every 3 Years (3)	> 40 Years Age Every 2 Years (3)
Questionnaire	Yes	Yes	Yes	Yes
Blood test (HIV, Hepa, etc.)	Yes	Yes	Yes	Yes
Stool / Urine	Yes	Yes	Yes	Yes
Audiogram/Vision	Yes	-	Yes	Yes
Physical examination	Yes	Yes	Yes	Yes

Note:

- (1) All personnel
- (2) Frequency of medical examination for food handlers and cleaning personnel is six months
- (3) Heavy duty equipment operators, crane operators and electricians will medically examine once a year.

ATTACHMENT 3: First-Aid Treatment Record

S No	Injured Name	ID #	Trade	Date & Time of Incident	Details of Injury	Treatment	Remarks



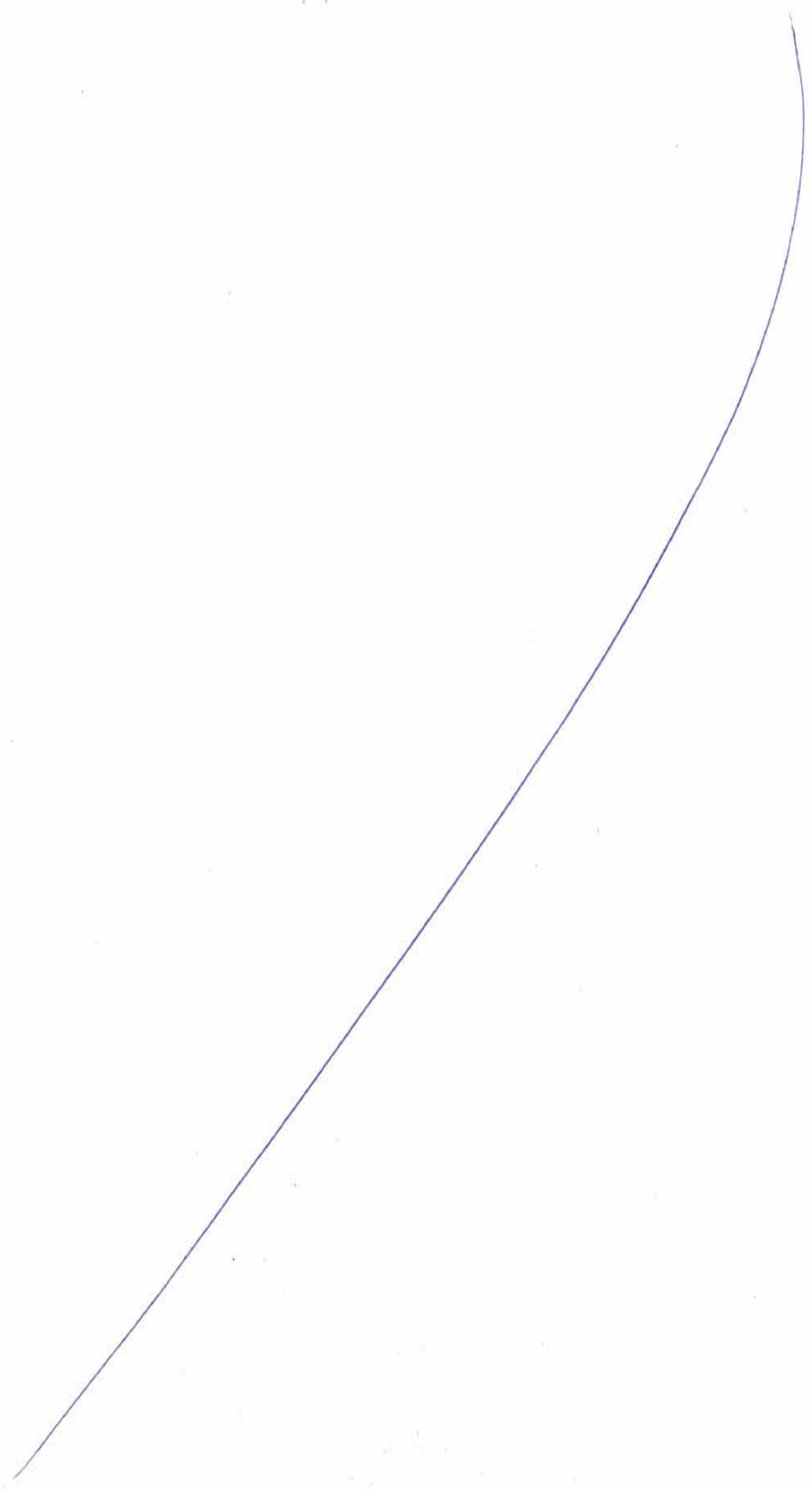






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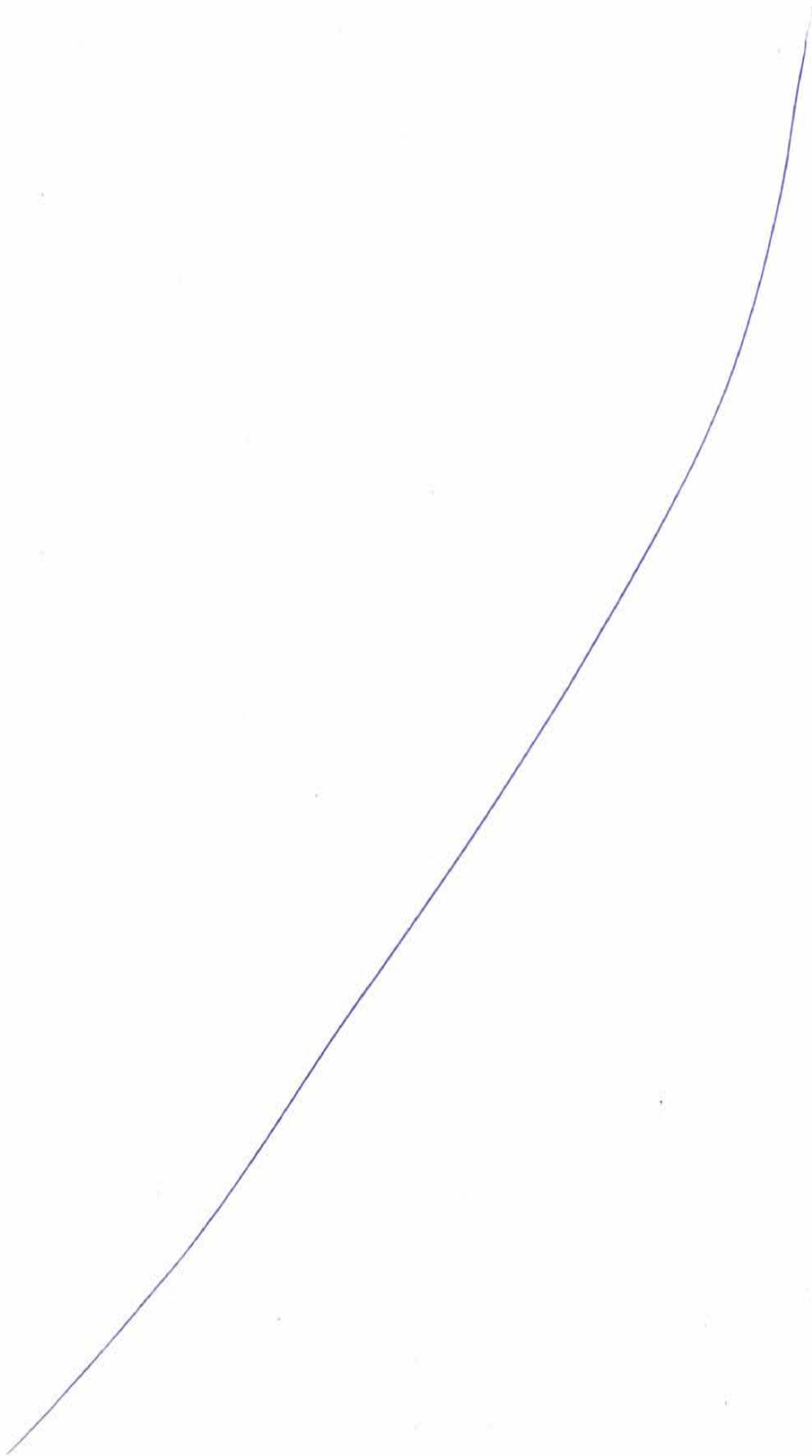


ATTACHMENT 4: Health Hazards

Hazards	Mitigation/Prevention	Remarks
Malaria	<ul style="list-style-type: none"> - Drainage of wet areas/pools that provide conditions allowing mosquito breeding - Vector control, including spraying of indoor work areas/facilities and vehicles - Nets over doors and windows - Mandatory use of long sleeves and trousers - Use of insect repellent over exposed parts of the skin - Chemoprophylaxis 	<ul style="list-style-type: none"> - Temporary Facility Plan to cover drainage of the site/temporary facilities areas drainage - Administration to put in place procedures for vector control - Expatriate personnel shall start malaria treatment before leaving for the project and continue after demobilization for the duration specified in the medication
Yellow fever	<ul style="list-style-type: none"> - Drainage of wet areas/pools that provide conditions allowing mosquito breeding - Vector control, including spraying of indoor work areas/facilities and vehicles - Nets over doors and windows - Mandatory use of long sleeves and trousers - Use of insect repellent over exposed parts of the skin - Vaccination 	<ul style="list-style-type: none"> - Temporary Facility Plan to cover drainage of the site/temporary facilities areas drainage - Administration to put in place procedures for vector control - Vaccination is one of the requirements for getting the entry visa to Nigeria
Typhoid /gastrointestinal infections	<ul style="list-style-type: none"> - Cleanliness of the temporary facilities and the site - Personal hygiene - Quality of food and drinking water - Evacuation and treatment of sewage and drain water - Regular medical examination of the food handlers and cleaning personnel - Regular audits of the temporary facilities conducted by the Health Coordinator and Medical staff 	
Cholera	<ul style="list-style-type: none"> - Cleanliness of the temporary facilities and the site - Evacuation and treatment of sewage and drain water - Personal hygiene - Quality of food and drinking water - Regular medical examination of the food handlers and cleaning personnel - Regular audits of the temporary facilities conducted by the Health Coordinator and Medical staff 	



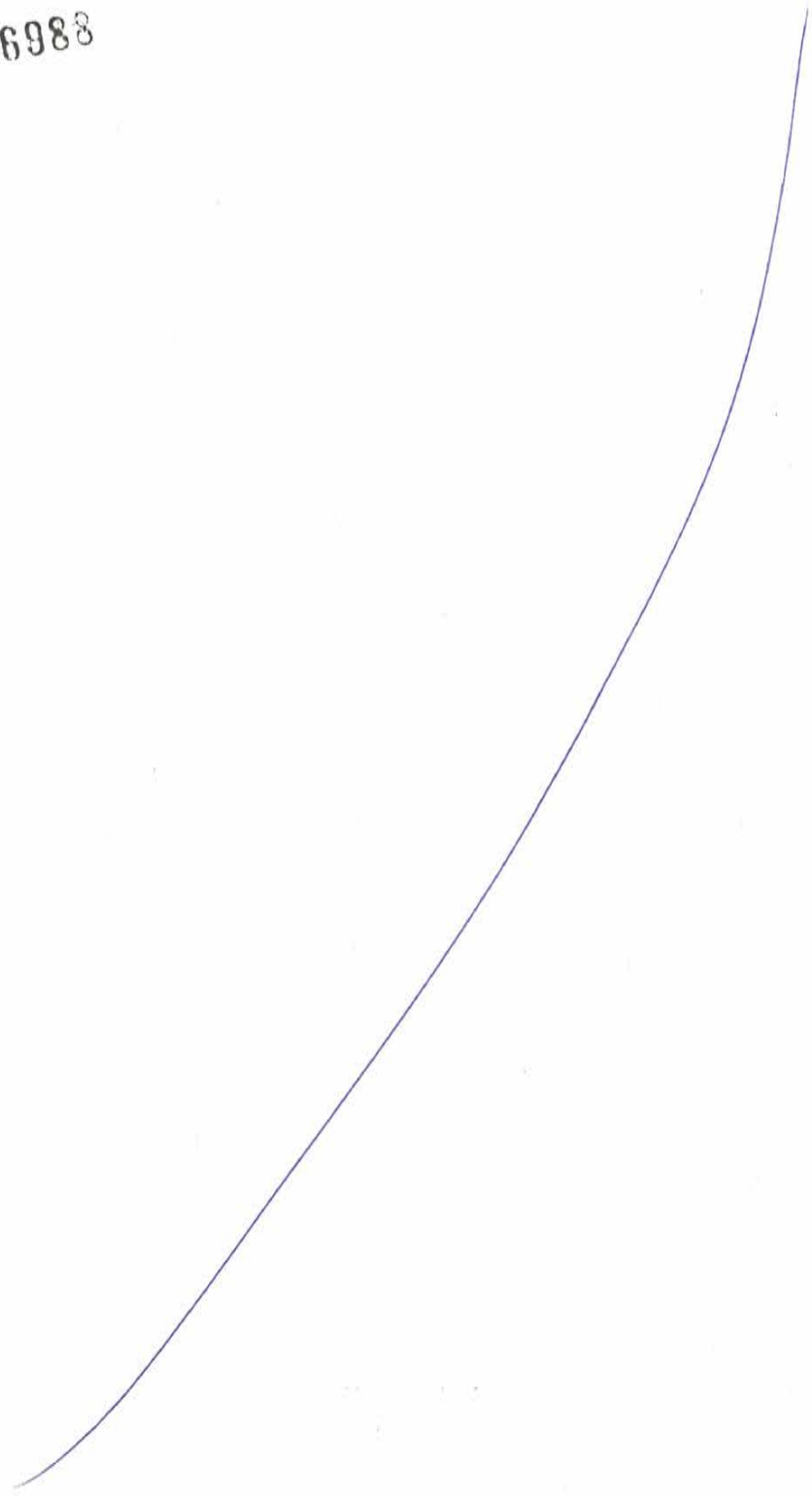
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Hazards	Mitigation/Prevention	Remarks
Hepatitis	<ul style="list-style-type: none"> - Cleanliness of the temporary facilities and the site - Evacuation and treatment of sewage and drain water - Personal hygiene - Quality of food and drinking water - Regular medical examination of the food handlers and cleaning personnel - Regular audits of the temporary facilities conducted by the Health Coordinator and Medical staff 	
Transmissible sexual diseases	<ul style="list-style-type: none"> - Pre-employment medical examination - Education 	
HIV	<ul style="list-style-type: none"> - Pre-employment medical examination - Education 	
Insect and rodents transmitted diseases	<ul style="list-style-type: none"> - Cleanliness of the temporary facilities and the site - Use of waste bins with cover - Daily removal of organic waste - Fumigation 	
Snake bites	<ul style="list-style-type: none"> - Clearing of working areas, lay-down areas and open areas and areas between buildings of high grass and debris - Availability at the site and camp of antidote - Use of high shoes and long trousers - Use of gloves when picking up materials from ground or recesses 	
Heat stress	<ul style="list-style-type: none"> - Evaluation of workplace and activities that present a potential heat stress hazard - Scheduling of potentially hot jobs when heat stress conditions are minimum - Ventilation, shading and appropriate clothing - Availability of drinking water at working areas 	Part of the Job Safety Analysis/Method Statement
Work related diseases	<ul style="list-style-type: none"> - HSE Plan and procedures - MSDS - Education and training - Inspections and audits - Enforcement of procedures 	Assessment and evaluation process shall ensure compliance with all aspects of the occupational health and that lessons learnt are incorporated in the specific plans, procedures and method statements.

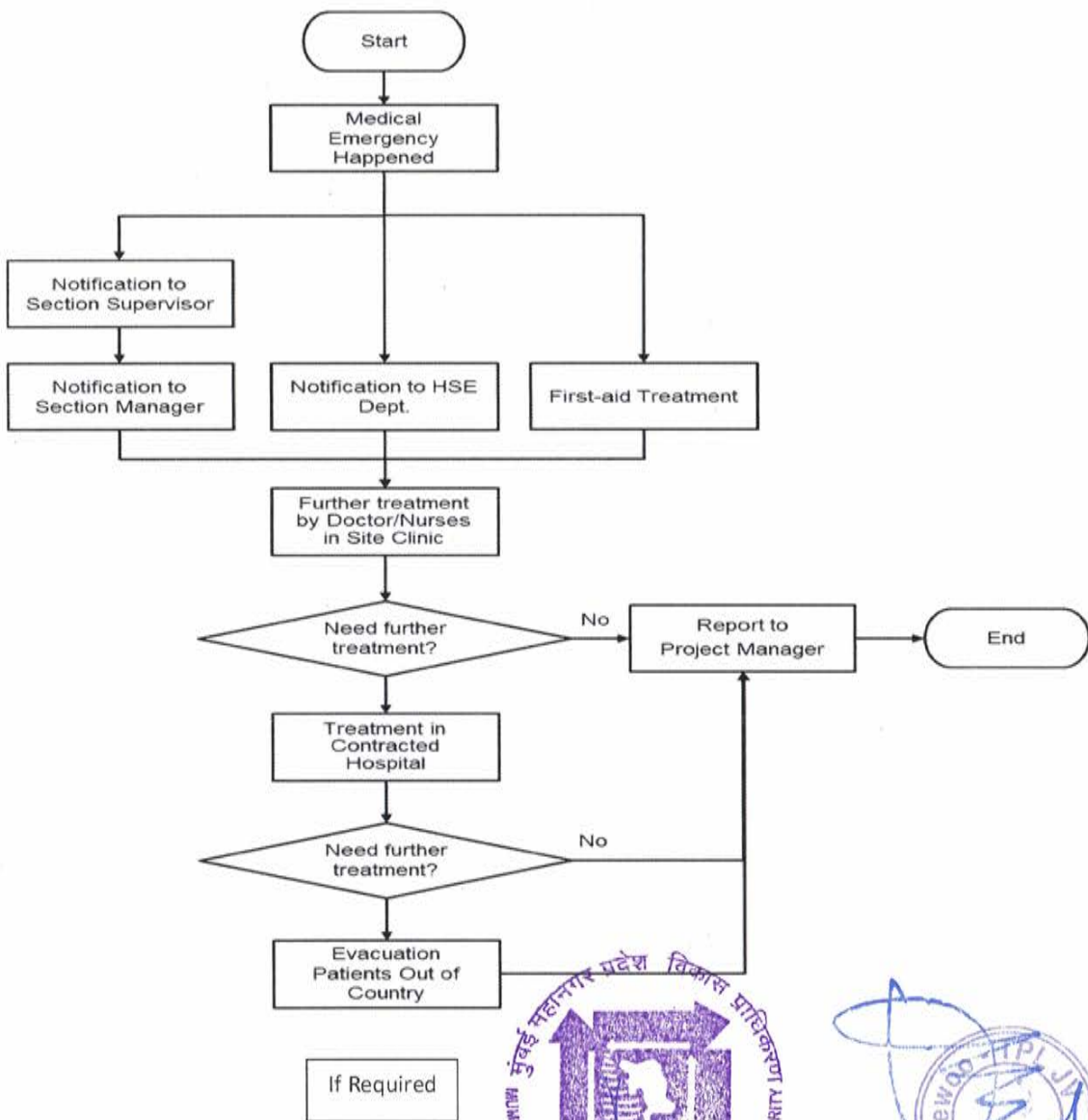
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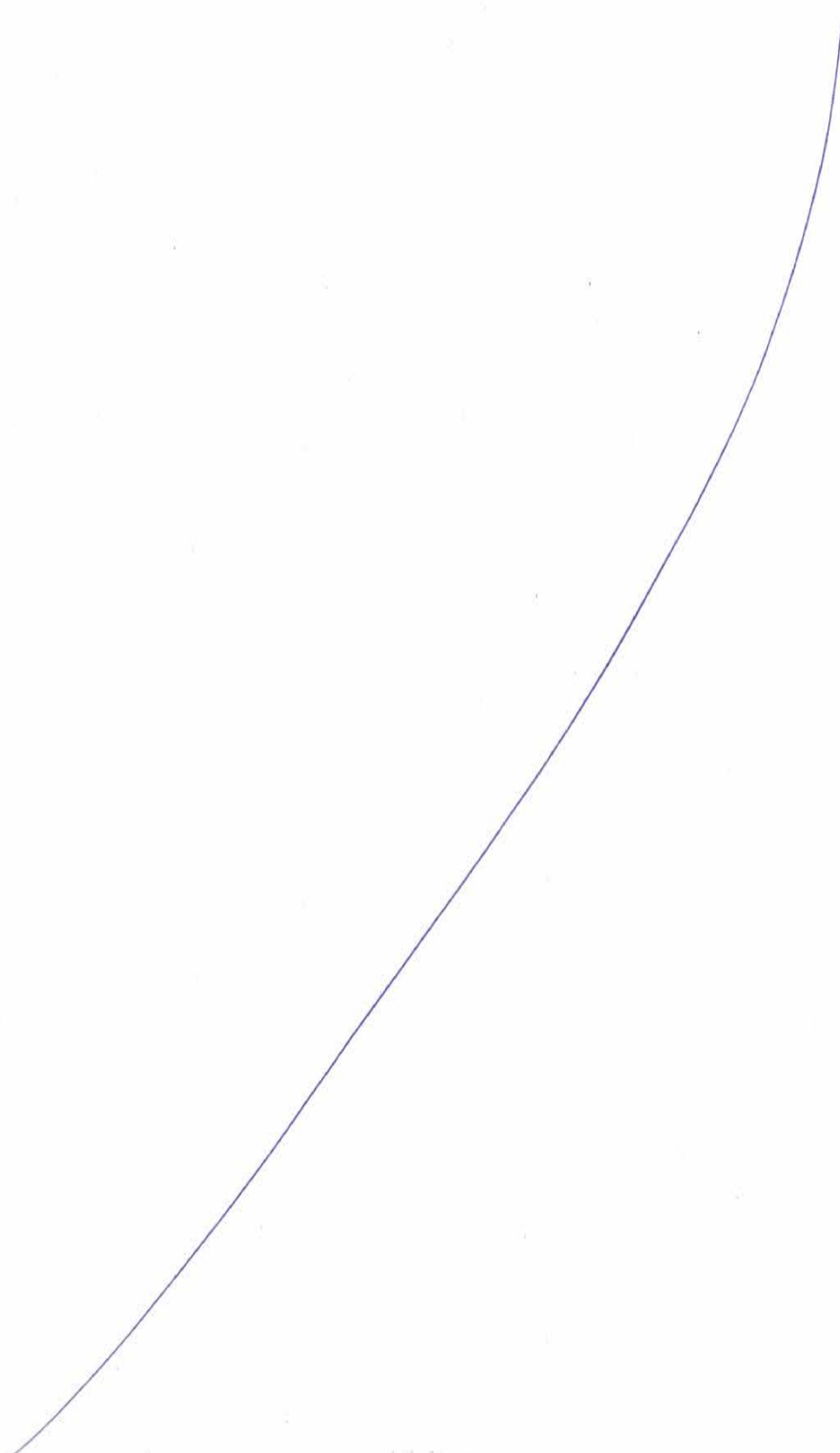


Hazards	Mitigation/Prevention	Remarks
Work related accidents	<ul style="list-style-type: none"> - HSE Plan and procedures - Job Safety Analysis - Education and training - Inspections and audits - Enforcement of procedures 	Assessment and evaluation process shall ensure compliance with all aspects of the occupational health and that lessons learnt are incorporated in the specific plans, procedures and method statements.

ATTACHMENT 5: Medical Emergency Communication Flow Chart



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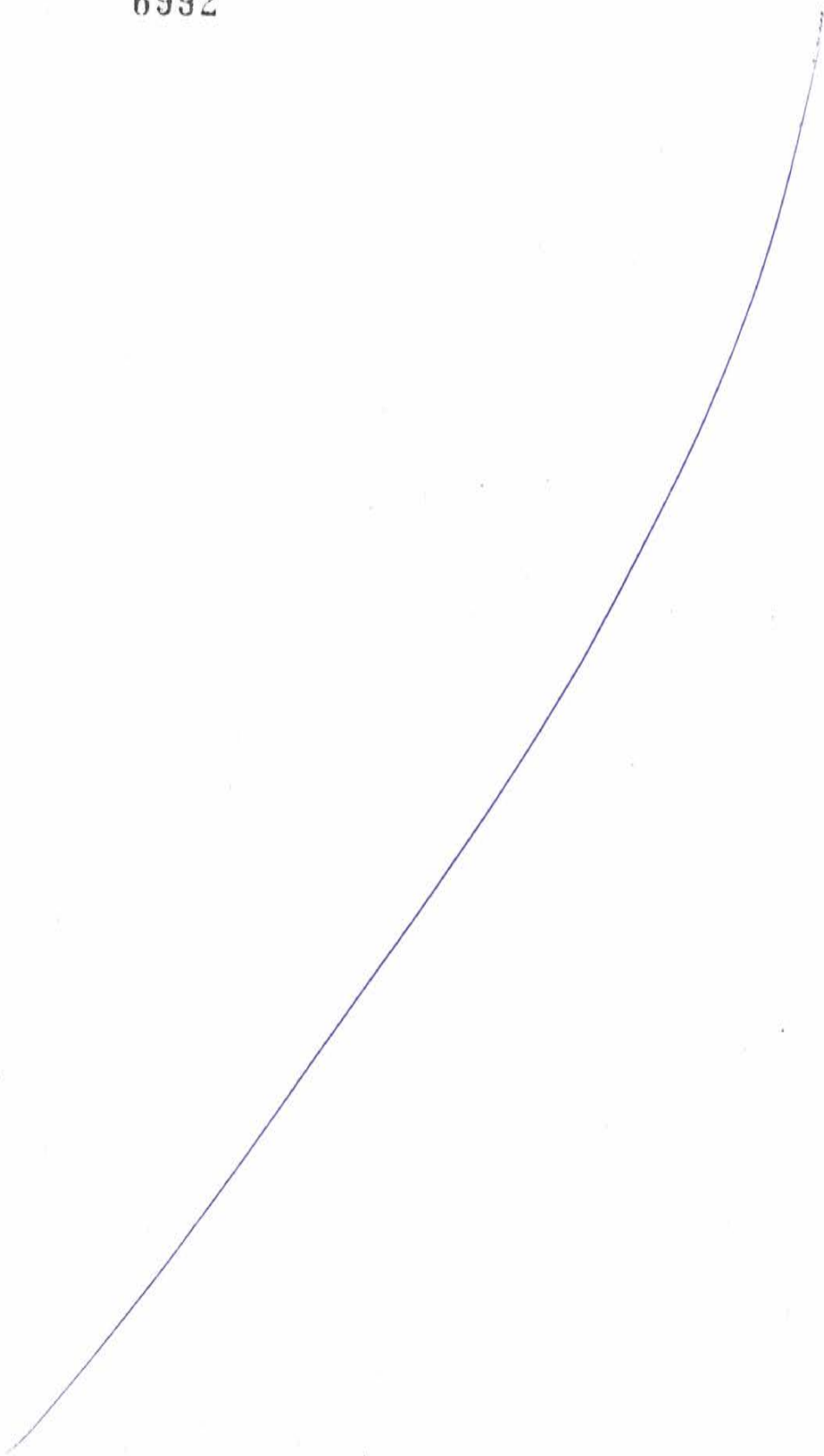
ATTACHMENT 6: Health Activity Procedure

The Activity Procedure will be maintained by the Health and Environment Coordinator and issued monthly to the Project HSE Manager.

No	Description	By Whom	By When Frequency	Deliverables	Status	Remarks
1.	Personnel					
1.1	Health and medical personnel Their qualifications and responsibilities	Construction Manager HSE Manager	Before mobilization at the project	Health Management Procedure HSE Organization		
2.	Training					
2.1	Induction Training	HSE Manager	First day at the project	Training materials Training records (date, content & participants)		All personnel (Employer, vendors and subcontractors)
2.2	Specific health related training	HSE Manager Medical staff	As required	Training materials Training records (date, content & participants)		
2.3	First aid training	Medical staff	First week at the project	Training materials Training records (date, content & participants)		Personnel selected from the workforce, mainly supervisors and foremen, one every 100 people.
3.	Workforce					
3.1	Pre-employment Medical Check	DAEWOO - TPL JV Subcontractors	Before mobilization at the project	Medical certificate		To be filed by the project HSE Manager and the Clinic
3.2	Food handlers and cleaning personnel	Medical staff	Every six months	Medical certificate		
3.3	Heavy equipment and crane operators and electricians	Medical staff	Once a year	Medical certificate		
4.	Planning and Risk Assessment					Assessment and evaluation to ensure compliance & incorporation of lessons learnt
4.1	Project overall health	HSE Manager	Construction	Health Procedure (this		Temporary



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No	Description	By Whom	By When Frequency	Deliverables	Status	Remarks
	hazard assessment		planning Start of construction	document)		Facilities Plan to also cover preventative and mitigation measures.
4.2	Project specific health hazard assessment	HSE Manager Health Coordinator Medical staff	Start of construction	Procedures MSDS		Procedures to cover preventative and mitigation measures.
4.2	Work specific health hazard assessment	HSE Manager Medical staff	As required	Procedures MSDS JSA/Method Statement		Procedures to cover preventative and mitigation measures.
5.	Medical and Sanitary Facilities					
5.1	First Aid Facilities	HSE Manager	Start of construction	Temporary Facilities Plan		Medical equipment and supplies by project Doctor/Nurse
5.2	Ambulance	HSE Manager	Start of construction	N/A		
5.3	Sanitary and Washing Facilities	Construction Manager	Start of construction	Temporary Facilities Plan		
6.	Housekeeping and Waste Disposal					
6.1	Camp maintenance and cleaning	Administration Manager	Daily	Sanitation Guide		A log of the personnel living at the Camp shall be kept.
6.2	Provision for Trash and Debris Receptacles	Construction Manager	Start of construction	Waste management Procedure		
6.3	Collection and removal of rubbish/waste	Administration Manager	Daily	Waste Management Procedure		
6.4	Sewage, Drainage System and Treatment of Sanitary Waste	Administration Manager		Temporary Facilities Plan Waste Management Procedure		
6.5	Insect Control	Administration Manager	Twice a week	Sanitation Guide		
6.6	Housekeeping of Construction Areas and temporary facilities	Superintendents & Supervisors	Daily	Waste Management Procedure		Including Site Temporary Facilities

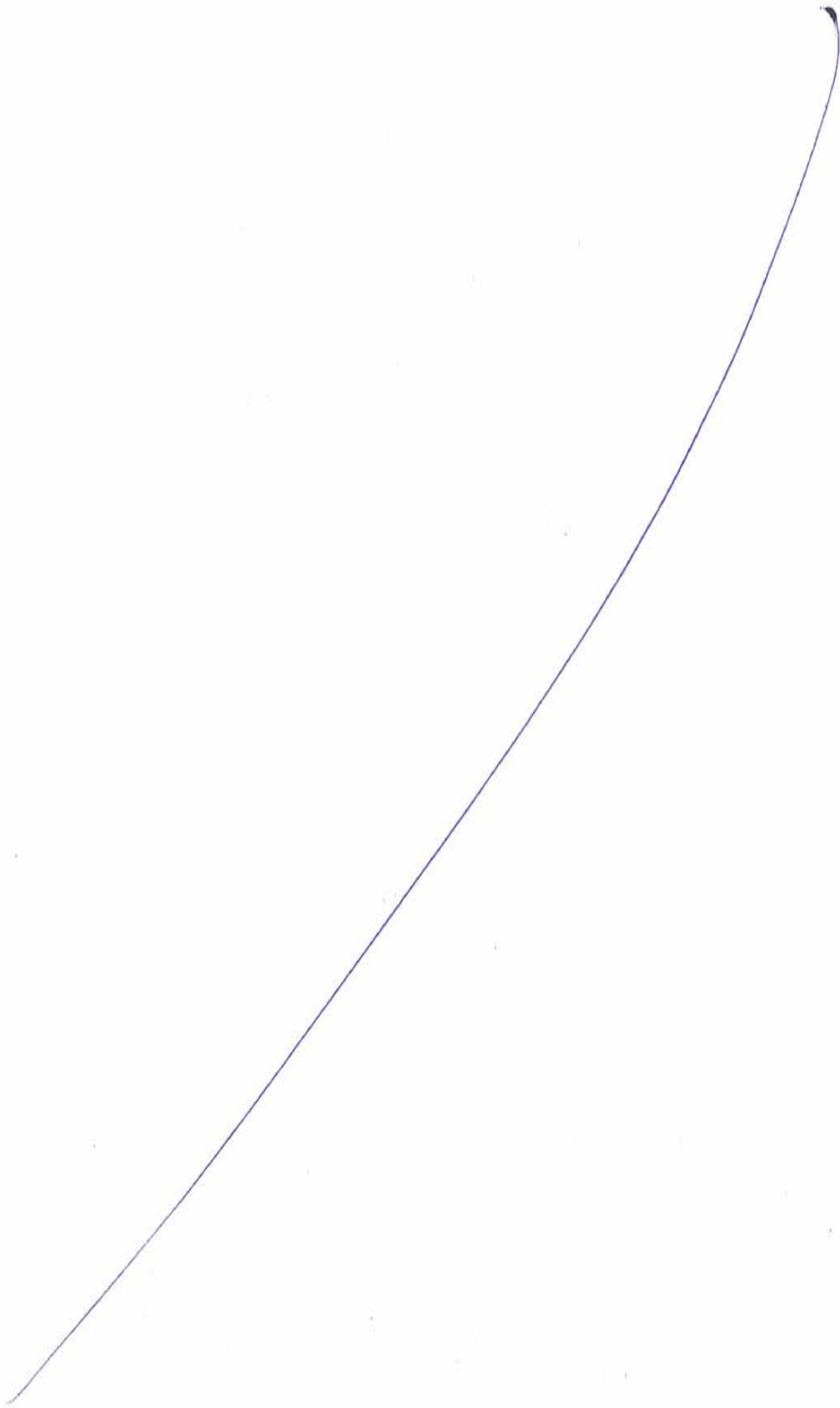


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No	Description	By Whom	By When Frequency	Deliverables	Status	Remarks
7.	Food & Water Quality					
7.1	Drinking Water	Medical staff	Regular intervals	Analysis records Sanitation Guide		It depends on the water supply source
7.2	Catering Services	Administration Manager		Sanitation Guide		
8.	Emergencies					
8.1	First response team	HSE Manager	One month before beginning of construction	Emergency Procedure		In coordination with Employer HSE and Security Plant Organization
8.2	Medical Emergencies	HSE Manager	One month before beginning of construction	Emergency Procedure		In coordination with Employer HSE and Security Plant Organization
9.	Inspections and Reporting					Records to be kept for 2 years after Acceptance
9.1	Inspections of camp & temporary facilities	HSE Manager Medical staff	Weekly	Inspection reports & Action Item List		
9.2	Health audits	HSE Manager Medical Staff		Audit report		As part of HSE Audits
9.3	Incident Reporting	HSE Manager	As required	Investigation report		
9.4	Overall Reporting	HSE Manager	Monthly	Report		part of the Monthly Progress Report

Notes:

(1) "By whom" may indicate the persons

- Responsible for organizing, supervising, coordinating or controlling an activity
- Who will perform/participate in an activity

(2) "By When" may indicate the completion or start of an activity or the date by which deliverables are to be issued.

(3) "Deliverables" may specify either document to be prepared or collected. Unless otherwise specified in "Remarks" column, deliverables other than the Project deliverables (e.g., MOM, reports, certificates and action lists) are to be filed by the party/person responsible for that particular activity.



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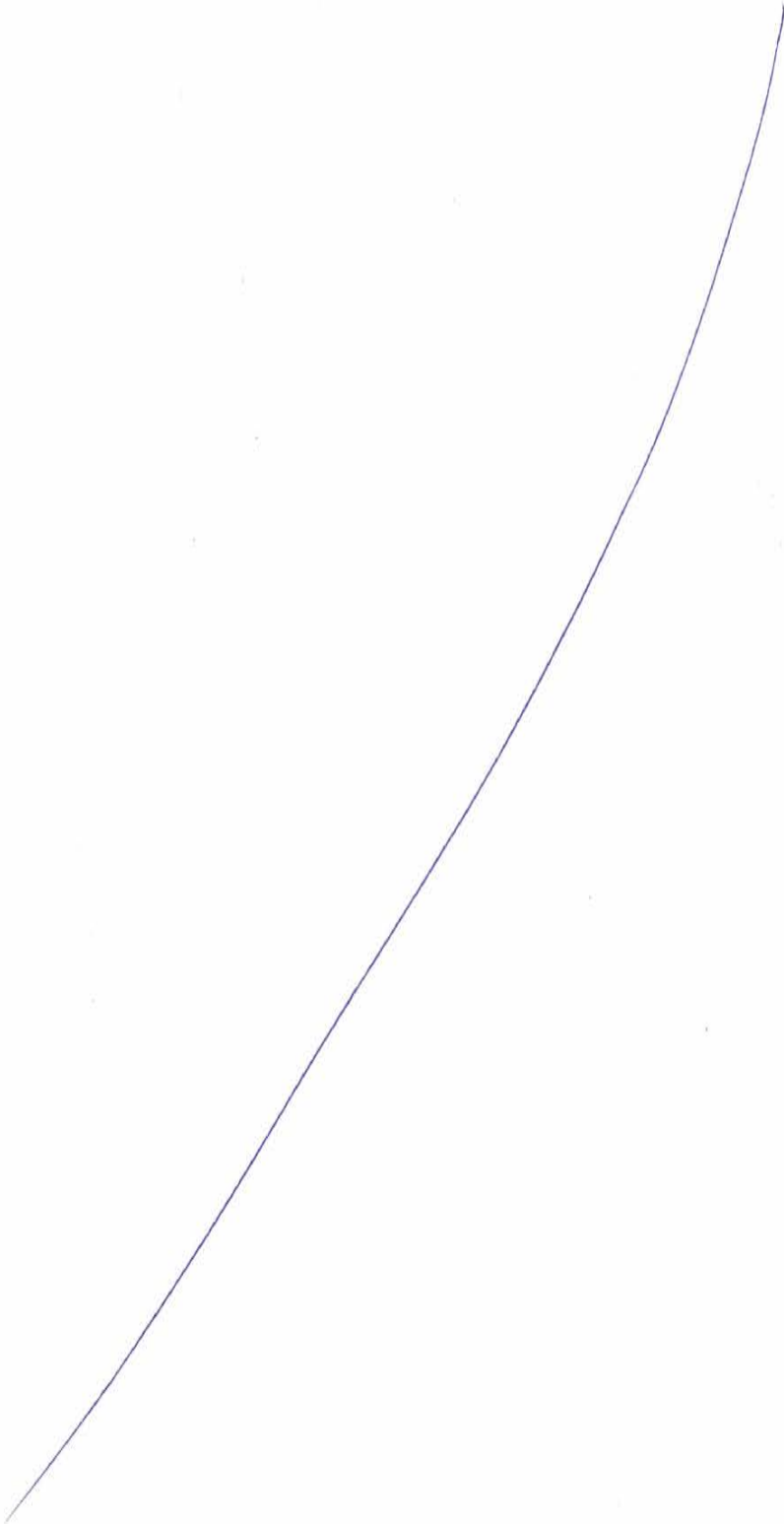
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**Mumbai Trans Harbour Link Project
Package-2**

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(4) In the "Status" column, the following words mean

- Comp: the item has been completed
- Yes : the item is on-going
- Blank : the item has not been initiated yet

ATTACHMENT 7: Camp Inspection Check List

Labour camp Inspection Report		
Date :		MEMBERS PRESENT :
SL No	Observation	Remarks
1	Are the entry roads / walkways / passages to camp kept clear?	
2	Are the walkways & roads are even and free from water logging?	
3	Is the entry inside workmen camp restricted?	
4	Is Illumination level OK in access / egress?	
5	Are dustbin / garbage bins allocated for each & every colony?	
6	Is the garbage being disposed off on regular basis?	
7	Are the drinking water facilities adequate in the Workmen camp?	
8	Is there any emergency communication system established?	
9	Is the Workmen camp constructed with Non-Fire Hazard Material?	
10	Is the workmen camp constructed with materials, which are not readily flammable?	
11	Are Fire Extinguishers & Fire Buckets available and maintained regularly?	
12	Are locations of Fire Extinguishers & Fire Buckets listed out & displayed?	
13	Are First-aid facilities available?	
14	Whether disinfection activities carried out on weekly basis?	
15	Whether Cement Flooring provided?	
16	Condition of the Side walls / Roof Sheet	
17	Is shelter strong enough to with stand wind pressure?	
18	Whether the electrical connections provided are safe.	



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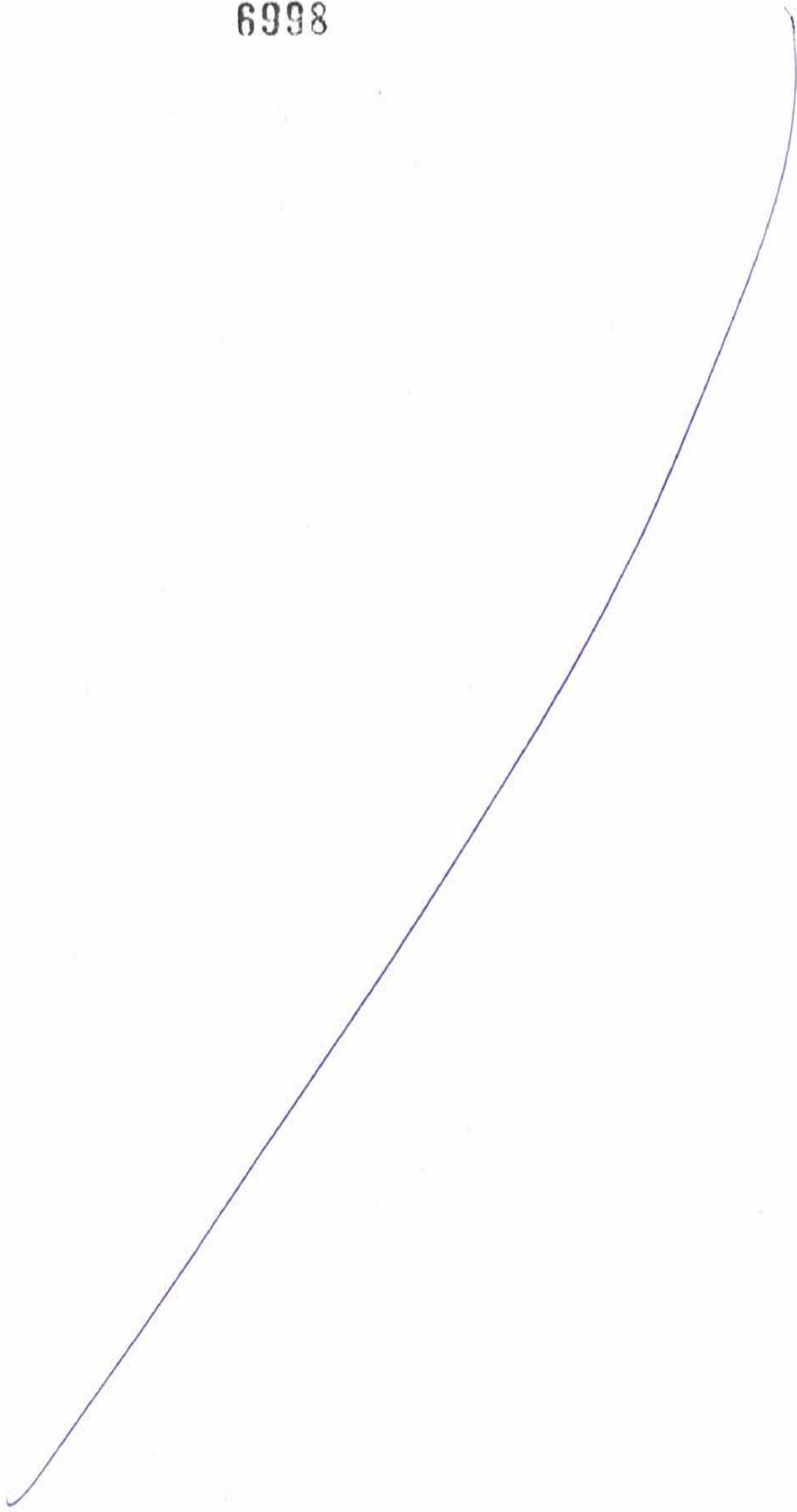
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Health Plan



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**Mumbai Trans Harbour Link Project
Package-2**

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19	Is the ventilation of the rooms adequate?	
20	Is the illumination of the rooms adequate?	
21	Are the doors and windows in good condition?	
22	Is the general hygienic condition of the rooms adequate?	
23	Are kitchens kept clean and tidy?	
24	Is the water supply adequate for cooking?	
25	Is the garbage of kitchen being disposed off every day?	
26	Are the utensils are being cleaned on regular basis?	
27	Are gas cylinders & other flammable materials kept in safe area (away from fire)?	
28	Are suitable regulator, Connecting tube & connections with the cylinder O.K	
29	Are fire extinguishers kept outside kitchen?	
30	Is the Wash area - Water tanks constructed as per the Design Drawing?	
31	Are adequate toilets available?	
32	Are the toilets are being cleaned on regular basis?	
33	Is there adequate water facility available for toilet and bath?	
34	Are the septic tanks and soak pit working properly?	
35	Is area around bathrooms cleaned & kept dry and non-slippery?	
36	Is proper drainage provided?	
37	Is drinking water available?	
38	Is water tank tap not leaking?	
39	Is water tank cleaned regularly?	

Name & Signature

Safety Personnel

HR & Admin Personnel



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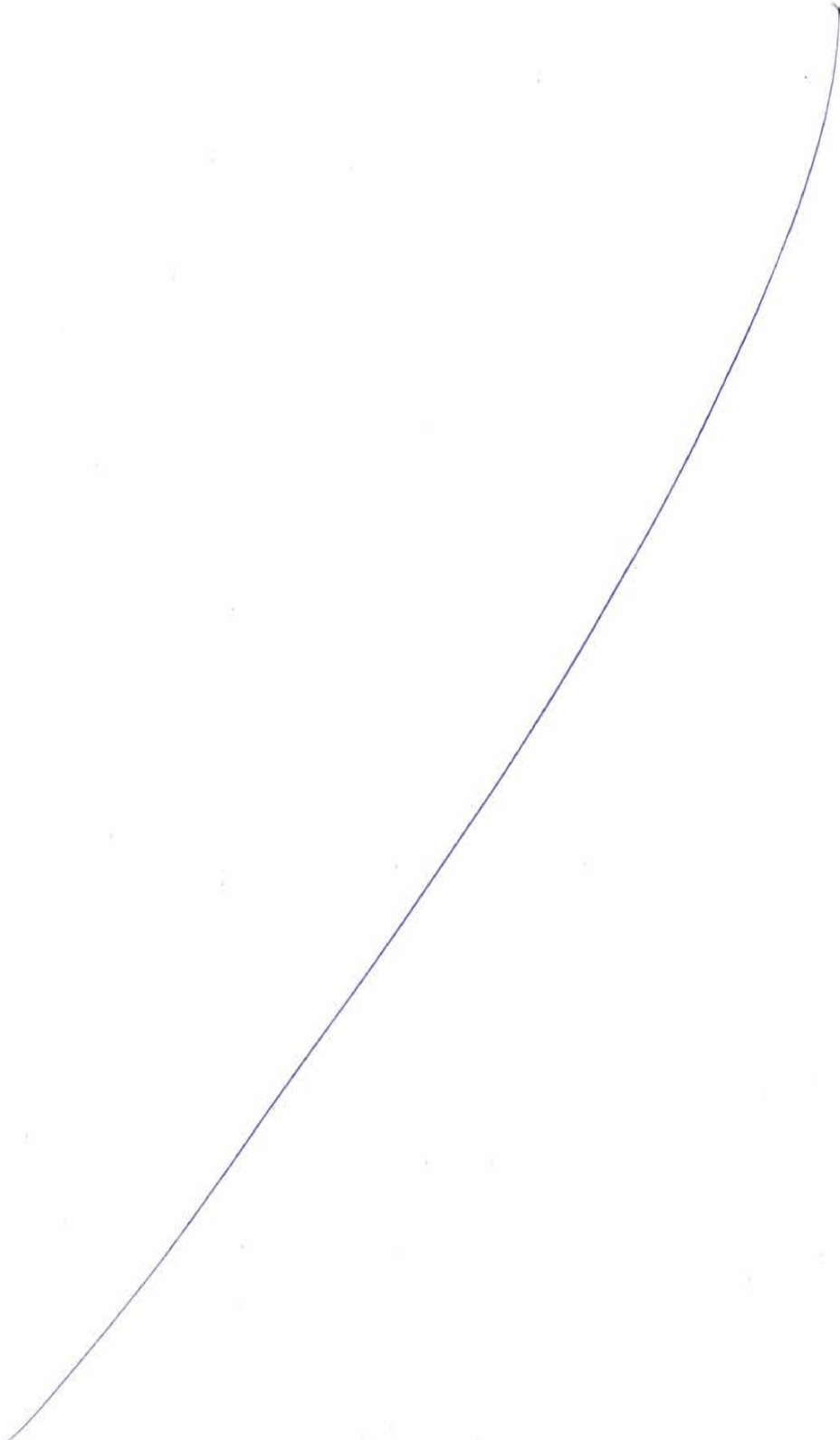
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TECHNICAL PROPOSAL: QUALITY ASSURANCE PLAN

DAEWOO – TPL (JV)



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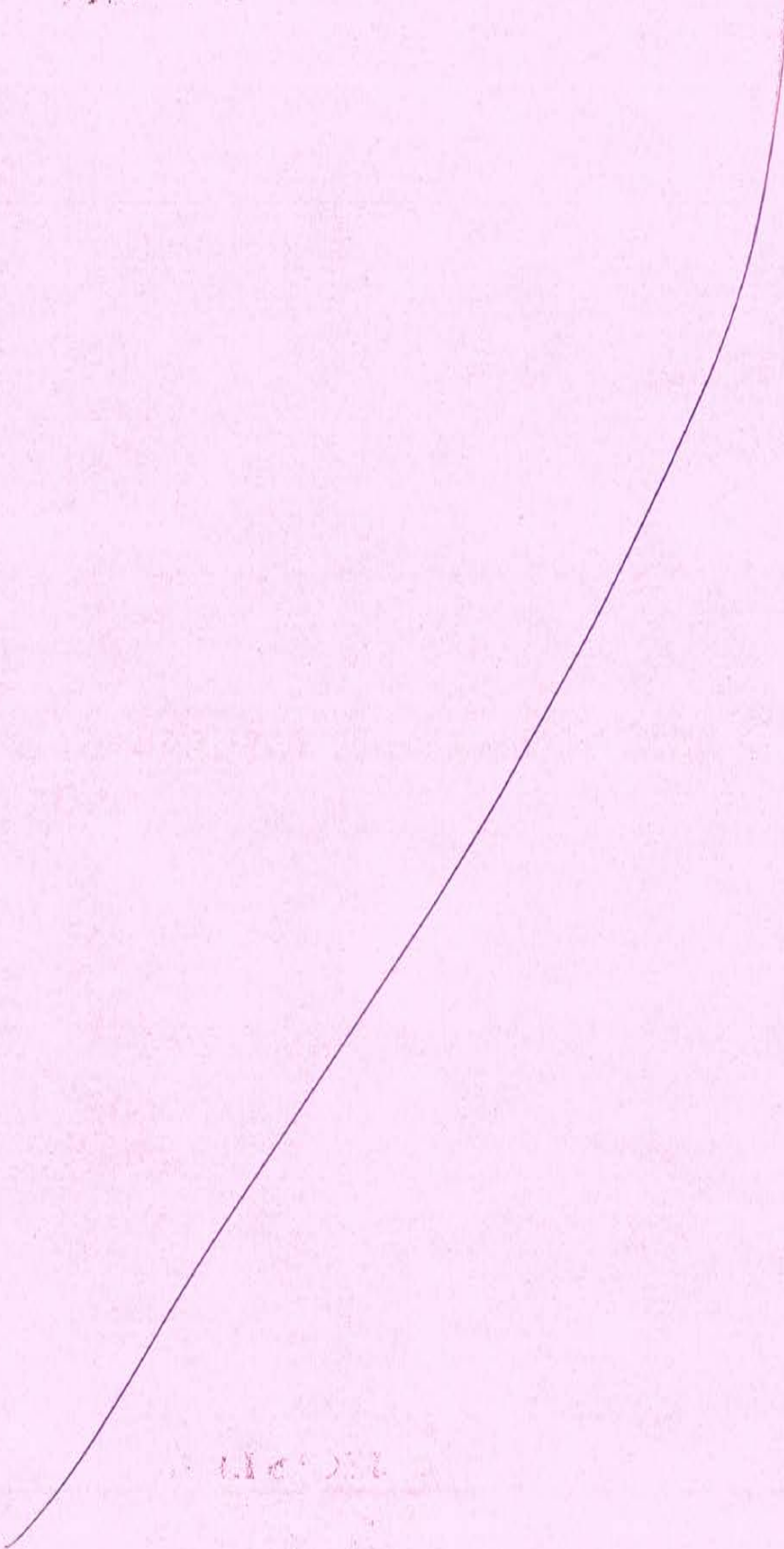
**Project: Mumbai Trans Harbour Link Project (Package-2)
(Construction of a 7.807 km long bridge section (CH 10+380 –
CH18+187) across the Mumbai Bay including Shivaji Nagar
Interchange)**

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Mumbai Trans Harbour Link Project

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OUTLINE QUALITY PLAN

Mumbai Trans Harbour Link Project (Package-2)(Construction of a 7.807 km long bridge section(CH 10+380 – CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange)

Document No.: DAEWOO E&C -TPL JV /QMD/UI/MTHL PKG 2/PQP/R0

Mumbai Metropolitan Region Development Authority



JULY 3, 2017 प्रदेश विकास प्राधिकरण

DAEWOO E&C-TATA PROJECTS LIMITED JV



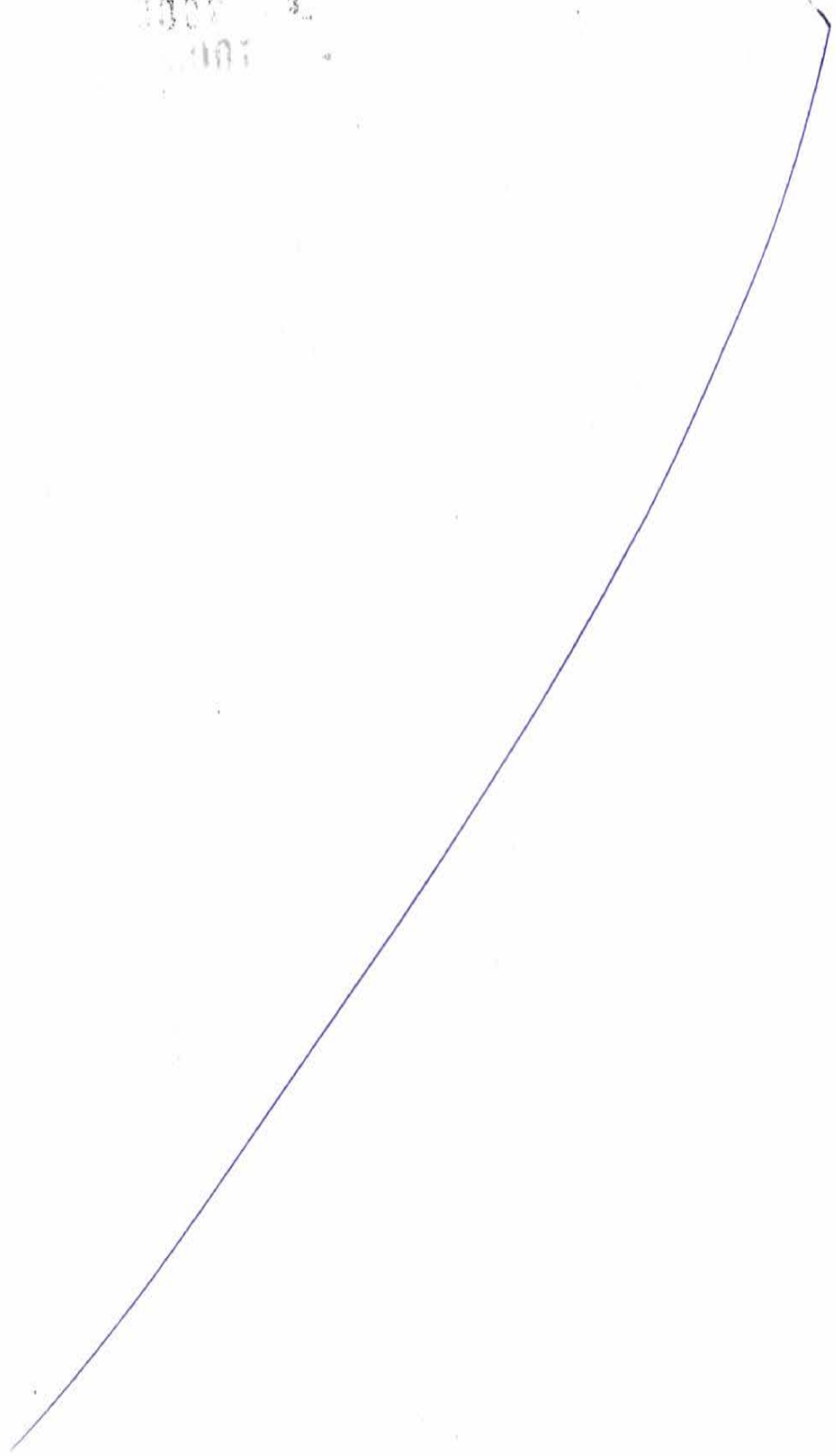
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Mumbai Trans Harbour Link Project (Package-2)(Construction of a 7.807 km long bridge section(CH 10+380 – CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange)
 for

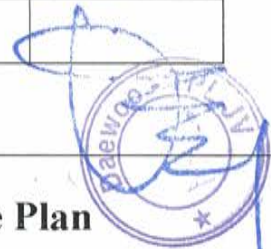
M/s. Mumbai Metropolitan Region Development Authority.

Date	Rev.No	Description		Prepared by	Reviewed by	Approved by	Approved by	Approved by
			Sign					
03.07.2017	R0	First submission	Date	03.07.2017	03.07.2017	03.07.2017		
			Designation	SR MGR (QA)	Head QMD (UI)	BU Head (MT&W - UI)		
			Name	MKB	RSP	SR		

Record of Revisions



Date	Revision No.	Details of Revision	Page Affected



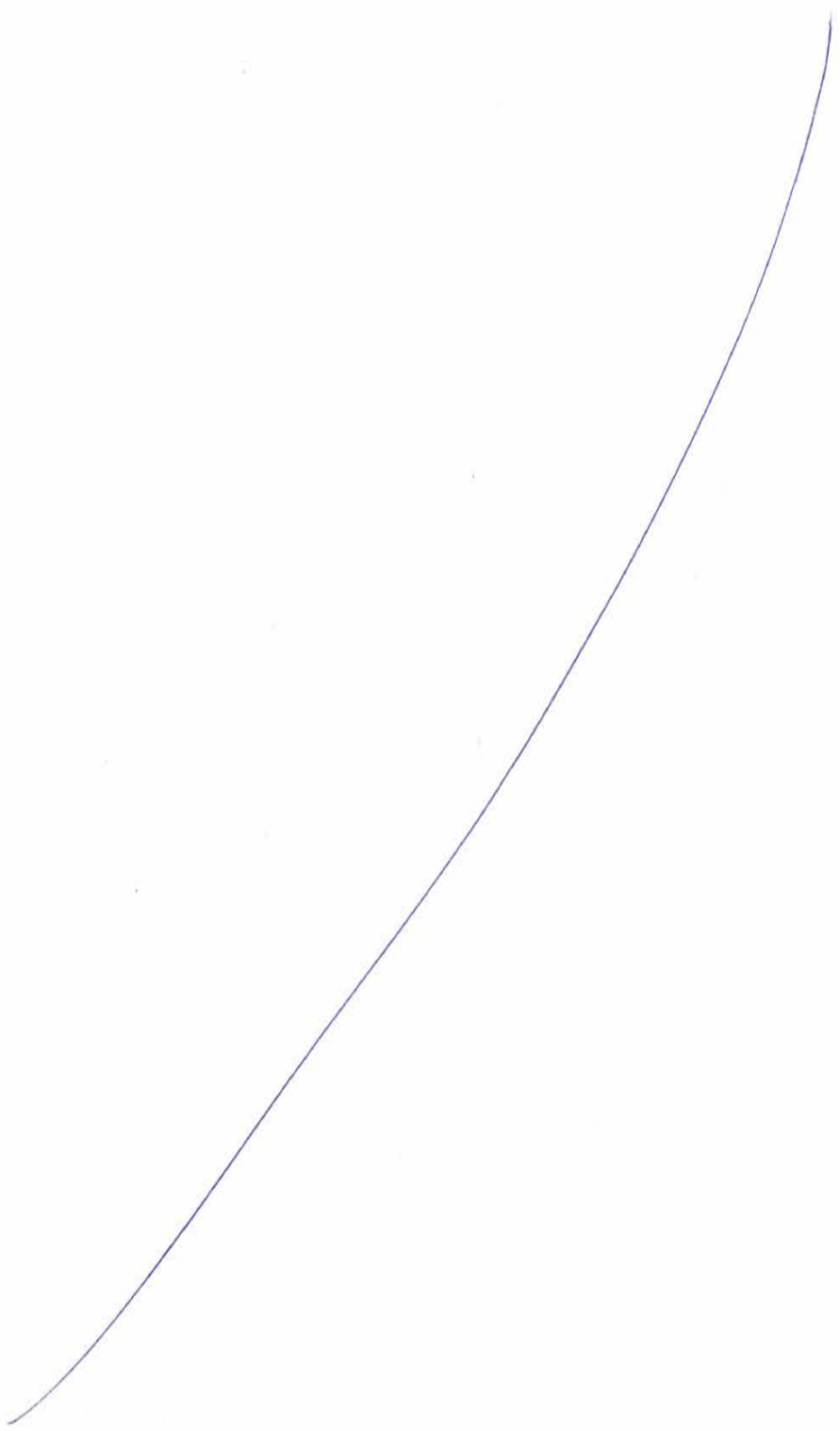
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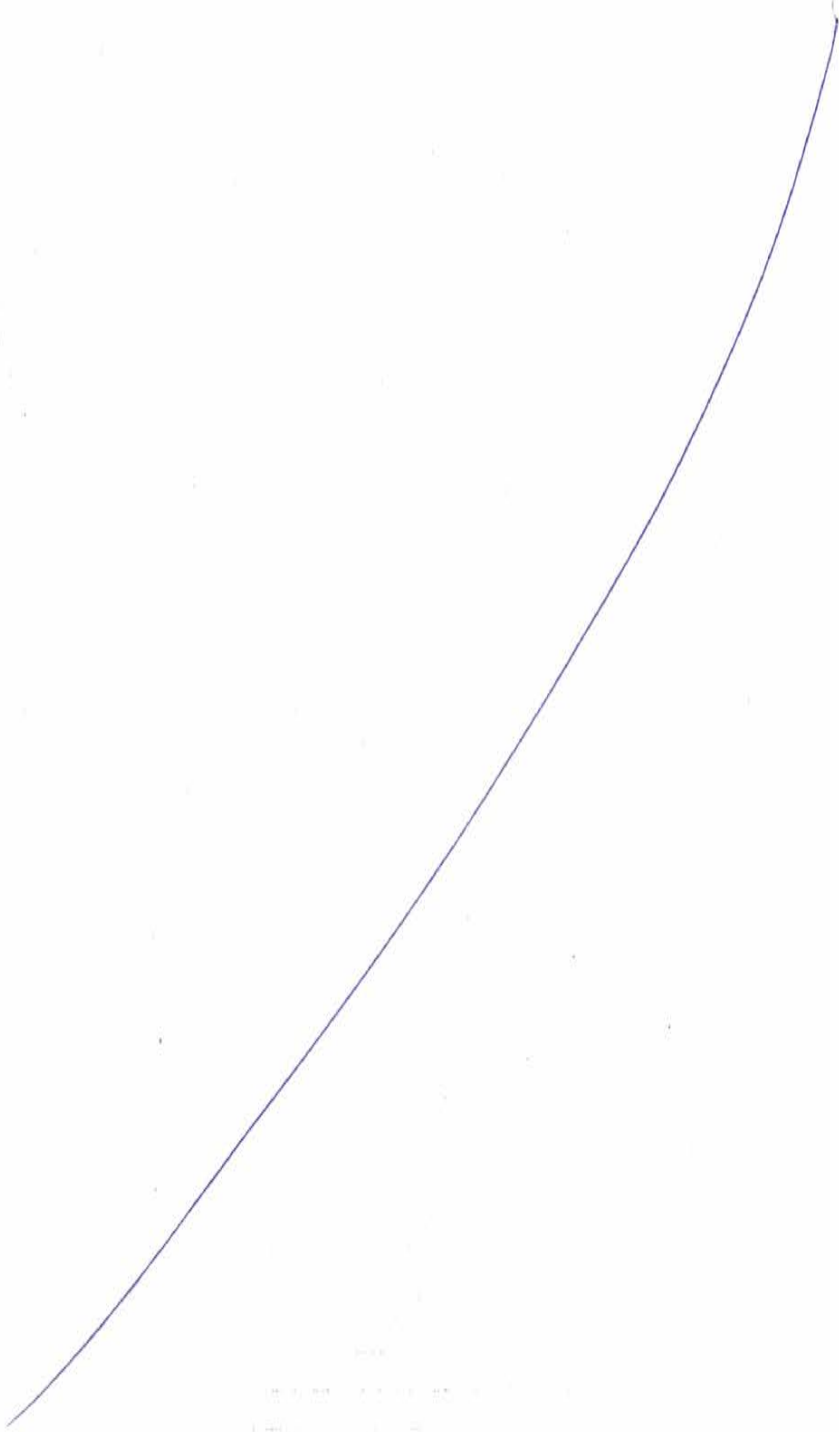


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4	Project Manager	Controlled
5	QMD Manager	Controlled
6	Procurement - Head	Un-Controlled
7	Planning Manager	Un-Controlled
8	SHE Manager	Un-Controlled
9	Head – HR & Administration	Un-Controlled
10	Design - Head	Un-Controlled
11	MMRDA	Controlled



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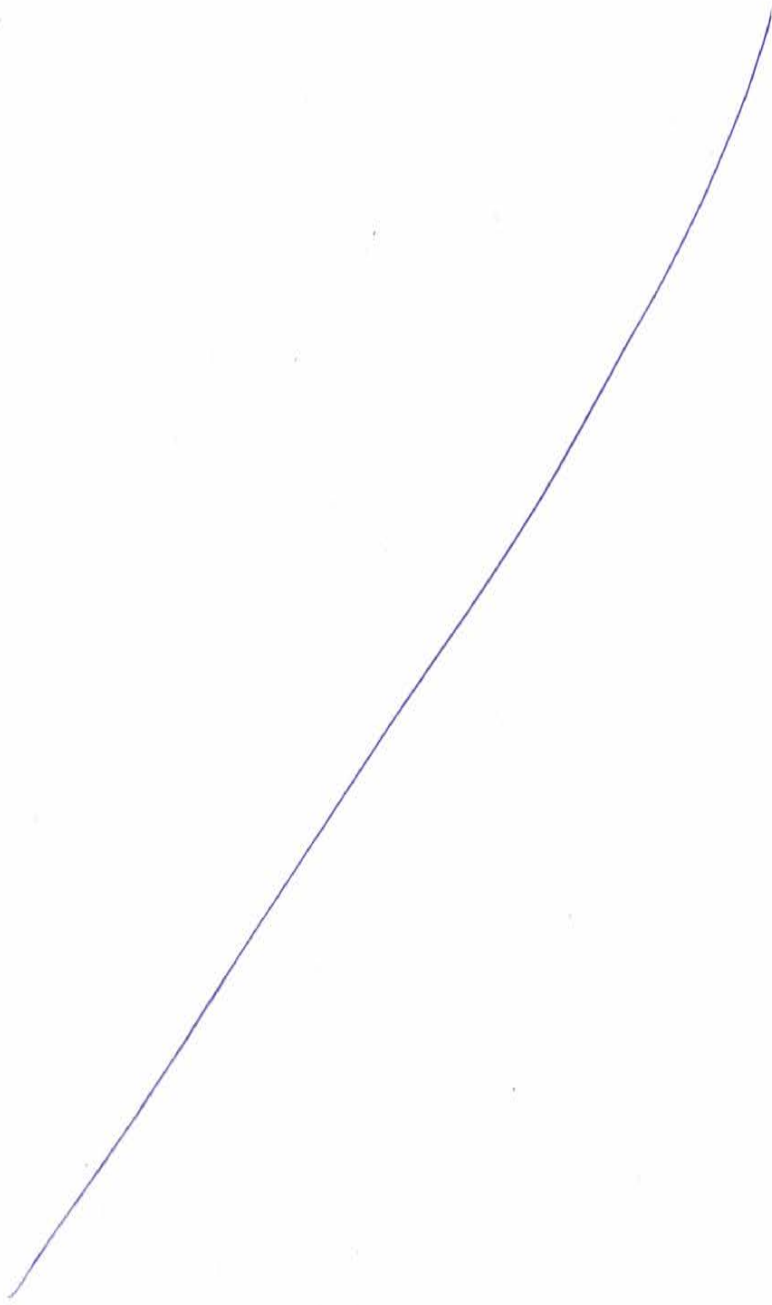
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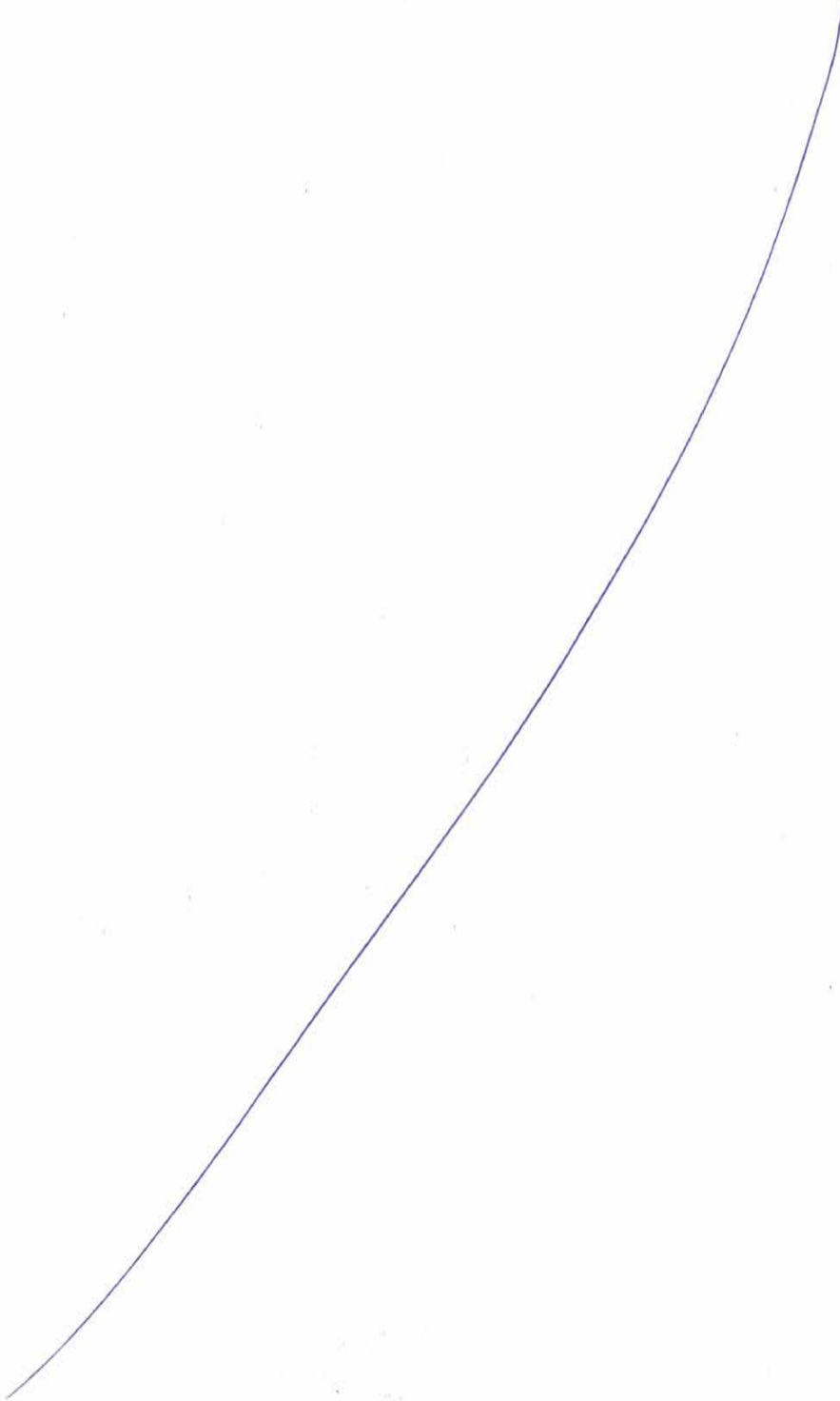
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1.0 SCOPE

“Customer”: M/s. Mumbai Metropolitan Region Development Authority

Contractor: DAEWOO E&C-TPL JV JV

Project Scope: Mumbai Trans Harbour Link Project (Package-2)(Construction of a 7.807 km long bridge section(CH 10+380 – CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange)

1.1 OBJECTIVE

The purpose of this document is to describe the system employed by DAEWOO E&C-TPL JV. General Management of the Quality, for planning, executing, controlling, monitoring and completing the works, in accordance with the Quality Policy of our Organization, as required by EN ISO 9001:2008 and EN ISO 14001:2004 Regulations.

1.2 INTRODUCTION OF THE ORGANIZATION

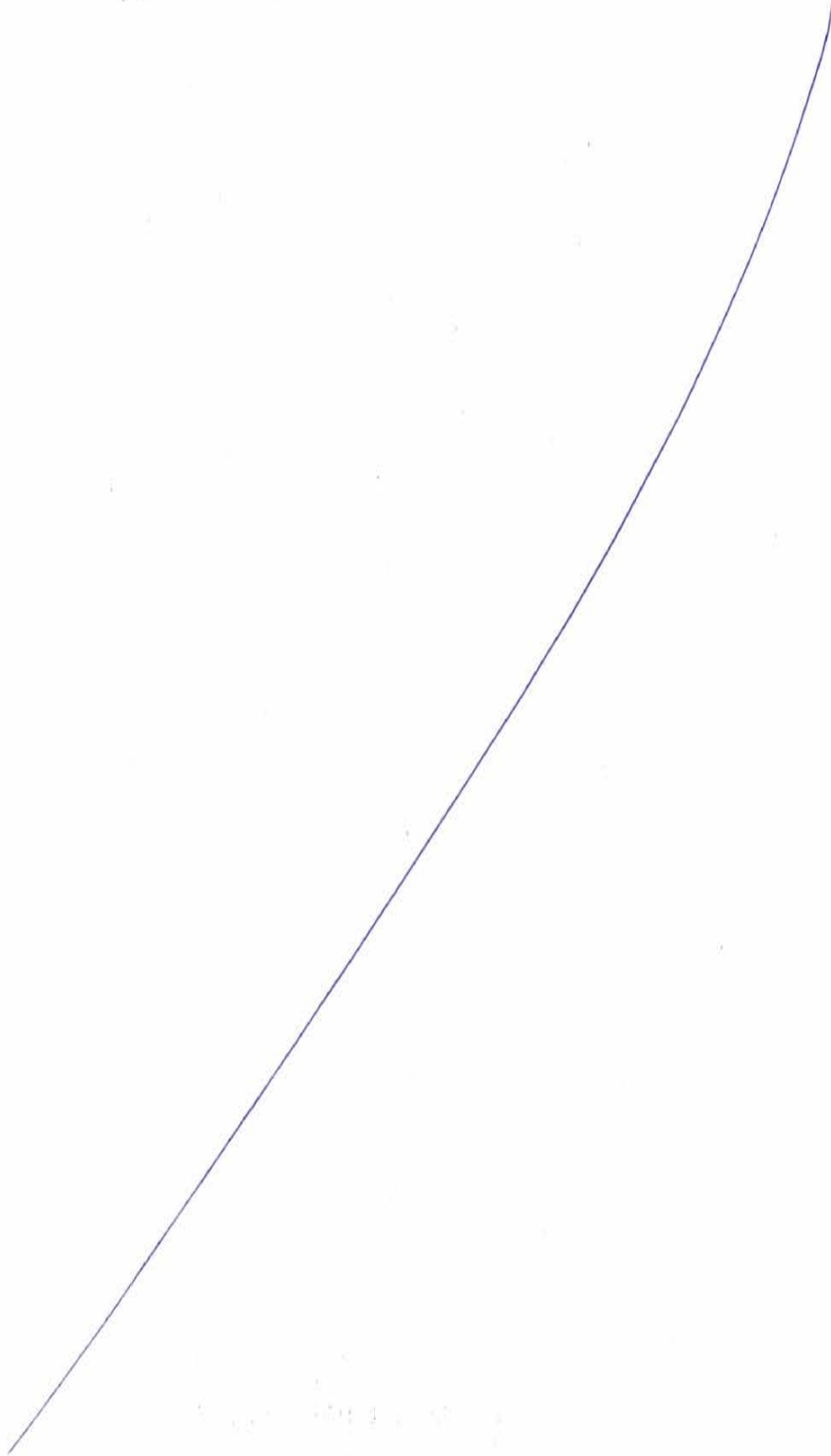
TPL :

TATA Projects Limited was promoted in the year 1979 as closely held company by the Key Companies of TATA Group. The Company is certified to ISO: 9001, ISO: 14001, OHSAS-18001. TPL has following Strategic Business Units and Business Units.

- SBU - Industrial Infrastructure
 - BU - Power generation
 - BU – Metal and Minerals
 - BU - Oil, Gas and Hydrocarbons
 - BU - Transmission and Distribution
 - BU - Water and Waste Water
 - BU - Transportation
 - BU – Construction
- SBU - Urban Infrastructure
 - BU – Metros, Tunnels & Waterways.
 - BU – Roads, Bridges & Ports
 - BU – Building / Airports.



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- BU – Smart Cities
- SBU - Quality Services
 - BU – Testing, Inspections and Certification (TIC)
 - BU-Repair and Maintenance Operations (RMO)
 - BU – Training Services.
- SBU - Utility Service

DAEWOO Engineering & Construction:

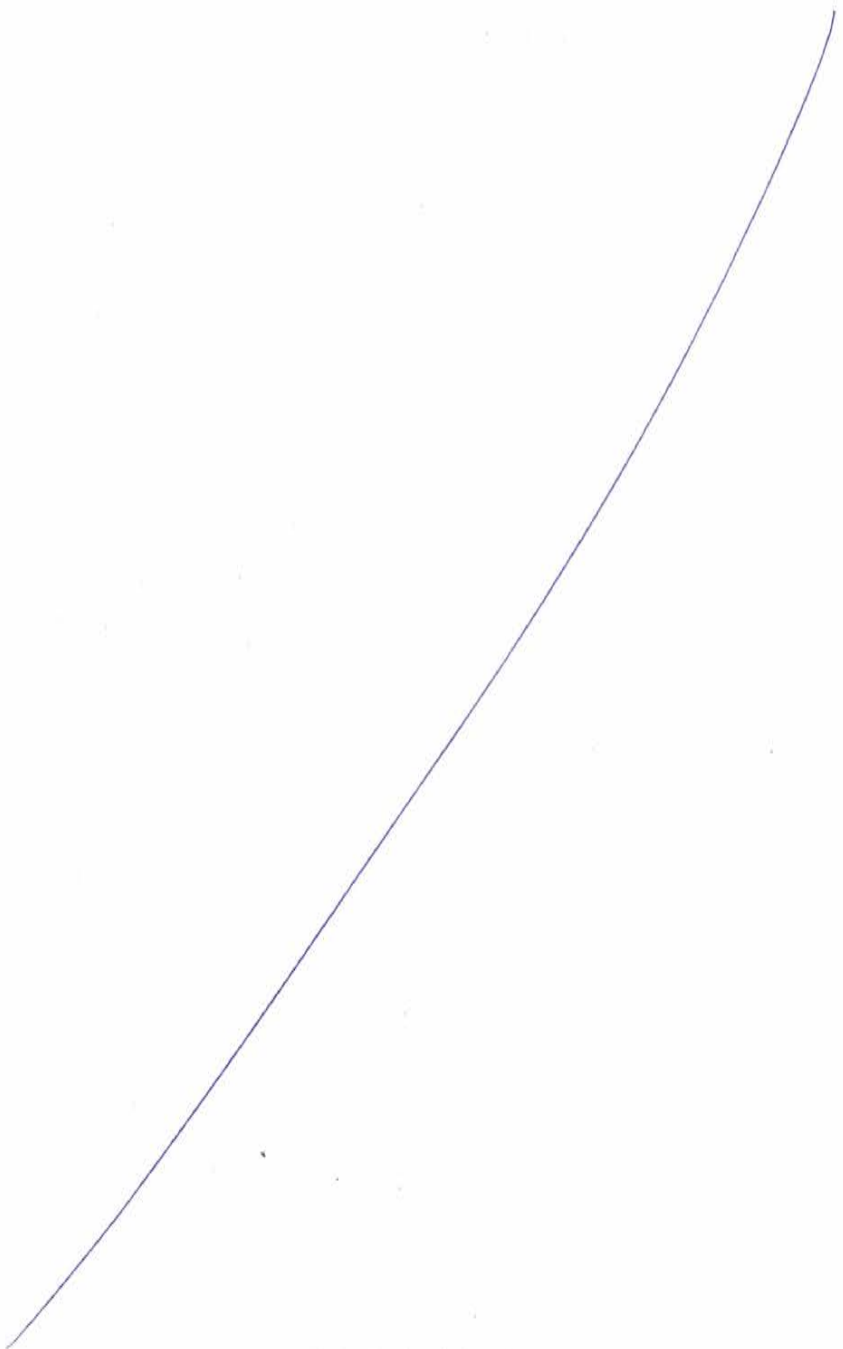
Daewoo Engineering & Construction Co., Ltd. operates as a construction company in South Korea and internationally. It engages in the construction of civil projects, including highways, roads and bridges, railways and subways, harbours and reclamation facilities, environmental projects, and leisure facilities; building works, such as office buildings, hotels and condominiums, commercial complexes, educational and medical facilities, and exhibition and sports centres; and plants comprising petro chemistry, power plant, nuclear power, and industrial facility projects. The company also constructs apartments, urban residential and commercial complexes, townhouses and villas, and studio apartments and urban lifestyle homes, as well as provides urban redevelopment, reconstruction, and remodelling services. DAEWOO Engineering & Construction Co., Ltd. was founded in 1973 and is headquartered in Seoul, South Korea

Daewoo Engineering & Construction branches into major categories of construction.

- **Oil and gas:** NLNG Train Six Bonny Island, Algeria Oman Fertilizer Project, Arzew GNL 3Z Project
- **Power:** Sur Independent Power Plant, Jorf Lasfar 5&6 Coal-fired Power Plant, Benghazi North Combined Cycle Power Plant, Ulsan Power Plant Extension Project, Hadong Thermal Power Plant No. 1, 2, 3, 4, 5, 6
- **Nuclear:** Wolsong Nuclear Power plant Unit 3 & 4
- **Industrial:** Gwangyang Steel Plant, Phase 4, Bio-Manufacturing Facility Project, 500 T/D Kraft Paper Plant

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Mumbai Trans Harbour Link Project

Package-2



- **Environment:** Jungdong Municipal Waste Incineration Plant, Daejangdong Municipal Waste Incineration Plant, Sanbuk Municipal Waste Incineration Plant
- **Transportation:** Palau Compact Road Project, Palau Compact Road, Pusan~Keoje Fixed Link Private Participation Project
- **Harbor/Dam:** Extension Works for Djen Djen Port Protection, Nakilat Ship Repair Yard, Duqm Ship Repair Yard
- **Building:** Malaysia KLCC Tower, Jeju Convention Center, National Central Museum
- **Housing:** Hanoi New Town Development / Vietnam, Boughzoul New Town Development PJ / Algeria

2.0 NORMATIVE REFERENCES

2.1 REFERENCE AND APPLICABLE DOCUMENTS

The following documents are used as source of reference for preparation of this Project Quality Plan:

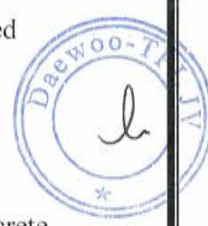
- A. ISO 9001:2008 – Quality Management Systems – Requirements.
- B. Quality Manual
- C. MMRDA Mumbai Trans Harbour Link Project (Package-2) (General Specifications) – Tender / Contract Technical Specifications.

3.0 TERMS, DEFINITIONS AND ABBREVIATIONS

In the context of this document, the abbreviations or phrases shall have the meanings noted against.

3.1 REFERENCE STANDARDS

All relevant IS Standards pertaining to all Road and Bridge Construction materials, concrete, Fabrication of steel structures, Formwork, Reinforcement work and other miscellaneous works, as listed in "M/s- MMRDA Mumbai Trans Harbour Link Project (Package-2)" Technical Specifications.

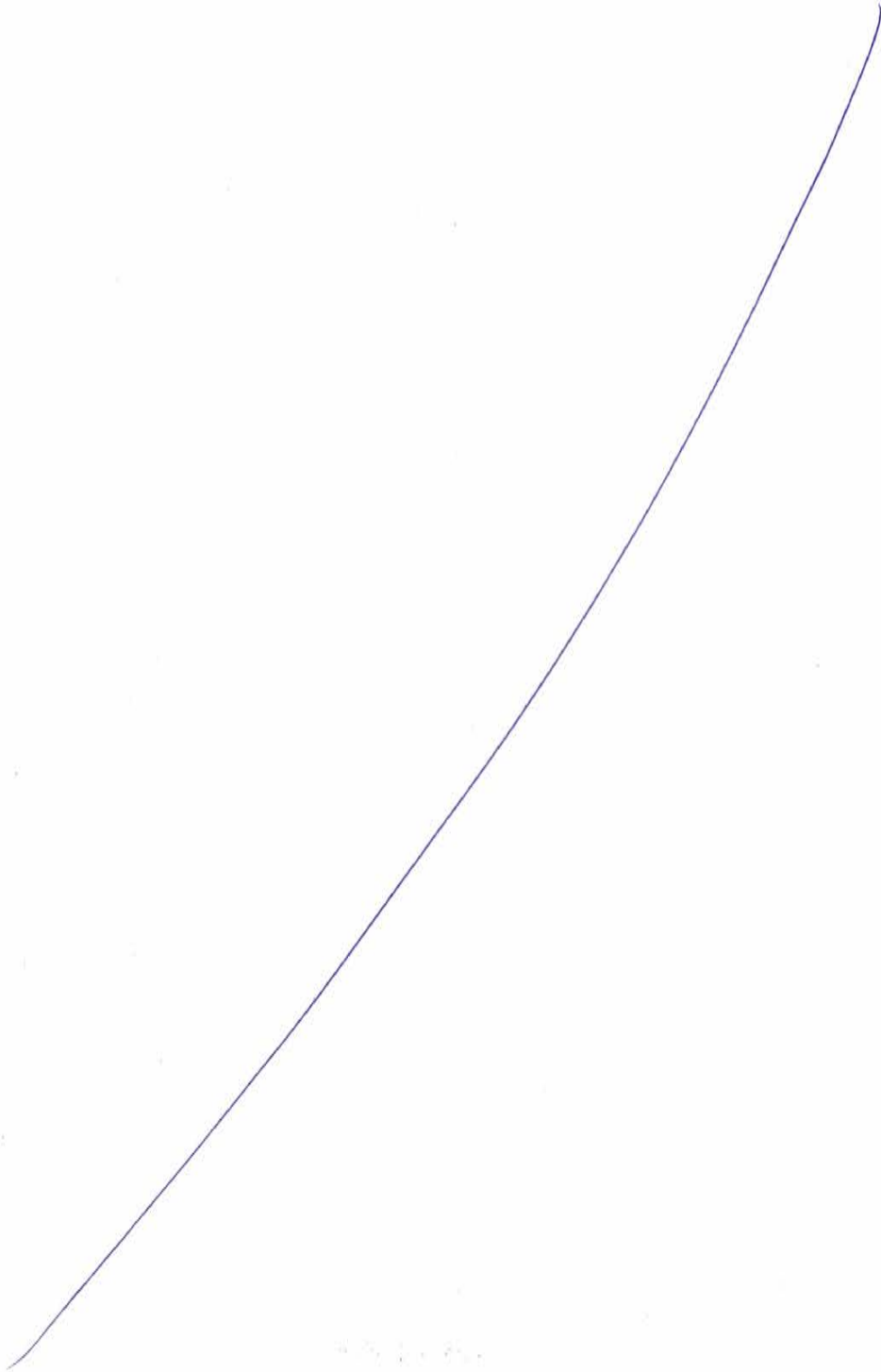


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3.1.1 OTHER REFERENCES

- “M/s- MMRDA Mumbai Trans Harbour Link Project (Package-2)” Contract Technical Specification
- Quality System Procedures required by ISO 9001: 2008 (Annexure-IV)
- Activity Wise Method Statements (List as per Annexure- V)
- Activity Wise Inspection and Test Plans (List as per Annexure – VI)

3.1.2 PRIORITY WISE REFERENCES:

In case of any discrepancy or disagreement between different specifications to be followed for any item of work, the following preferences shall be adopted in the order of precedence as they appear below, as per contract document:

- Contract Specifications.
- IS, IRC, MORTH & ASTM.

3.2 TERMS AND DEFINITIONS

In the context of this document, the following abbreviations or phrases shall have the meanings noted against.

Customer (Employer): M/s. Mumbai Metropolitan Region Development Authority

Contractor: DAEWOO E&C TPL JV

Project: Mumbai Trans Harbour Link Project (Package-2)(Construction of a 7.807 km long bridge section(CH 10+380 – CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange)

Audit – A systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.

Calibration – Comparison and adjustment to a standard of knowledge, accuracy and identification thereof with adequately recorded results.

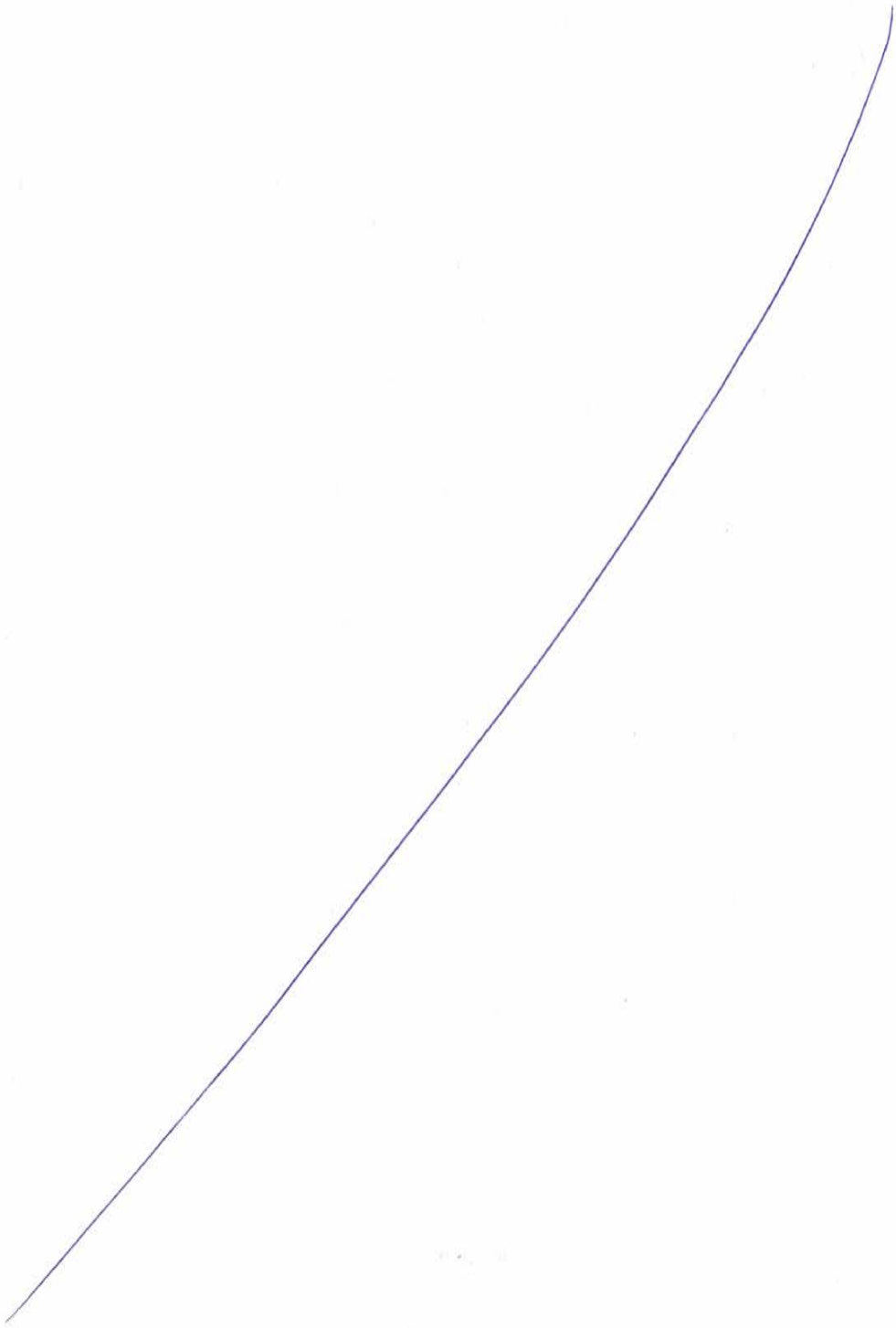


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Package-2



Check – A stage in the production / construction cycle in which Customer or an Authorized Inspection Agency or DAEWOO E&C-TPL JV representative performs a check or test to determine the acceptability of the item for further processing.

Concession – A formal approval by Customer or his authorized representative, to deviate from the specification or design, which does not affect the final function of the item.

Contractor Representative – Project Manager of DAEWOO E&C-TPL JV

Controlled Copy - Latest copy issued to users by Originator of the document after obtaining approval from Customer / Authorized Inspection Agency, as applicable.

Corrective Action – Action taken to prevent further recurrences of similar non-conformity.

Hold Point – A stage in the production / construction cycle when inspection and / or test are performed to determine the acceptability of an item for further processing. Prior notification shall be given to MMRDA and further activities shall not progress without (MMRDA) approval.

Head Office (HO) –DAEWOO E&C-TPL JV Headquarters Mumbai where the Quality Management operations for Project Supplies Inspection and Field Quality are coordinated.

Infrastructure – System of facilities, equipment and services necessary for the operation of an organization.

Inspection – Activities such as Measuring, Examining, Testing, Gauging one or more characteristics of a material, procedure, product or service and comparing this with the specified requirements.

ITP – Inspection and Test Plan, indicating the activities in sequence, checks to be carried out, frequency, Reference documents, acceptance criteria and stages of Inspection for Sub-Contractor, DAEWOO E&C-TPL JV and (MMRDA).

Material Test Certificate – A document of test results either from source of materials or from in-house or independent agencies.

Non-Conformity - Non-compliance with a requirement.



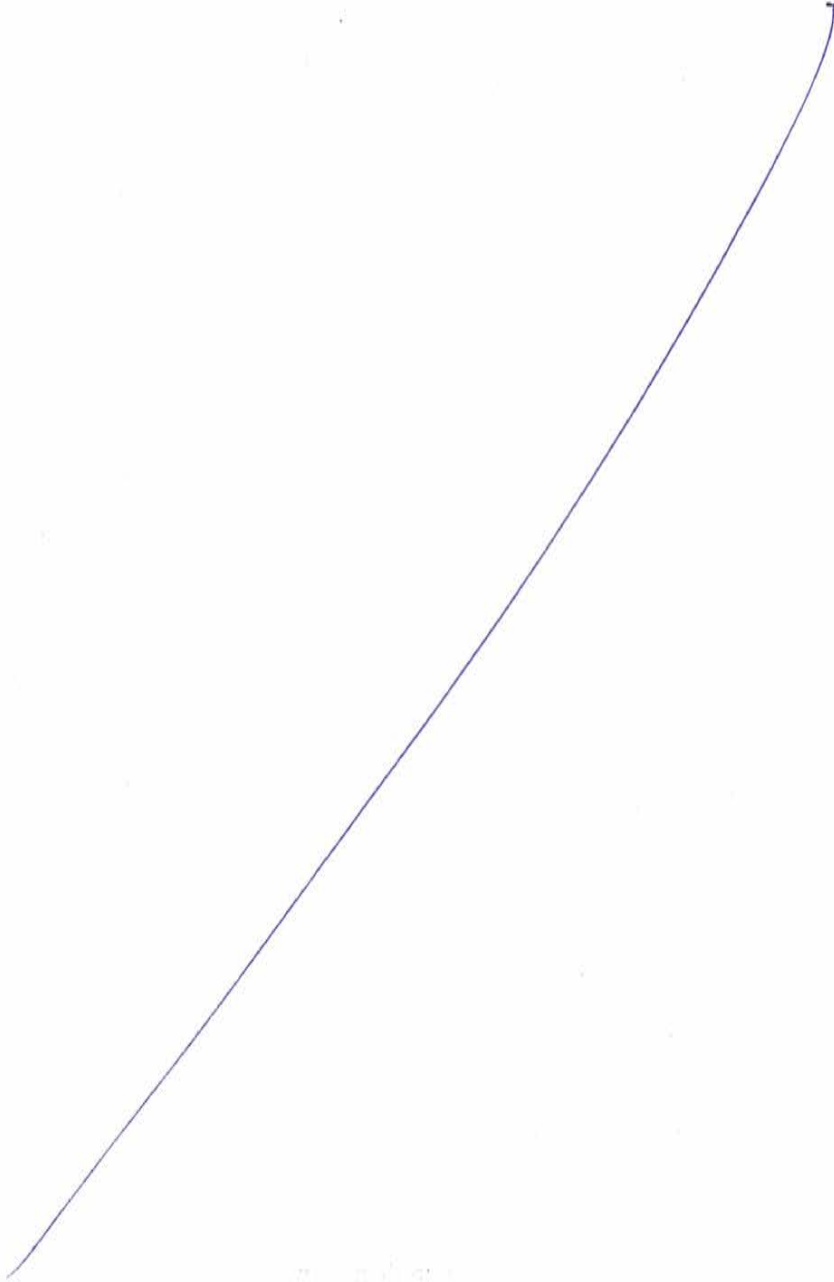
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Non-Destructive Examination –The integrity or conformity of an item can be assessed without resorting to destructive analytical procedures.

Process – A set of activities related or interacting, which transform input elements into results.

Quality – Degree to which a set of inherent characteristics fulfils requirements.

Quality Assurance – Part of Quality Management focused on providing confidence that Quality requirements will be fulfilled.

Quality Control – Part of Quality Management focused on fulfilling Quality requirements.

Quality Plan – A document specifying which procedures and associated resources shall be applied by whom and when to a specific project, product, process or contract.

Quality Audit – A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives

Master Copy - Original / copy signed and approved by all the concerned.

MQP / QAP – Quality Plan for manufacturing of the Material / Equipment from Vendor or Manufacturer.

Procedure – Specified way to carry out an activity or a process.

Regional Office –DAEWOO E&C-TPL JV SBU – Urban Infra with BU – Metros Tunnels & Waterways at Mumbai, where operations of the Project are coordinated.

Release - Authorization to continue with the following stage of Processes.

Repair – The process of restoring a non-conforming condition such that the item conforms to the original specified requirements, where such a repair or restoration is acceptable.

Review – A stage in a production / construction cycle in which MMRDA or DAEWOO E&C-TPL JV representative may verify records and or procedures and determine the acceptability of the same.

Supplier – Organization or person that provides a product / service.

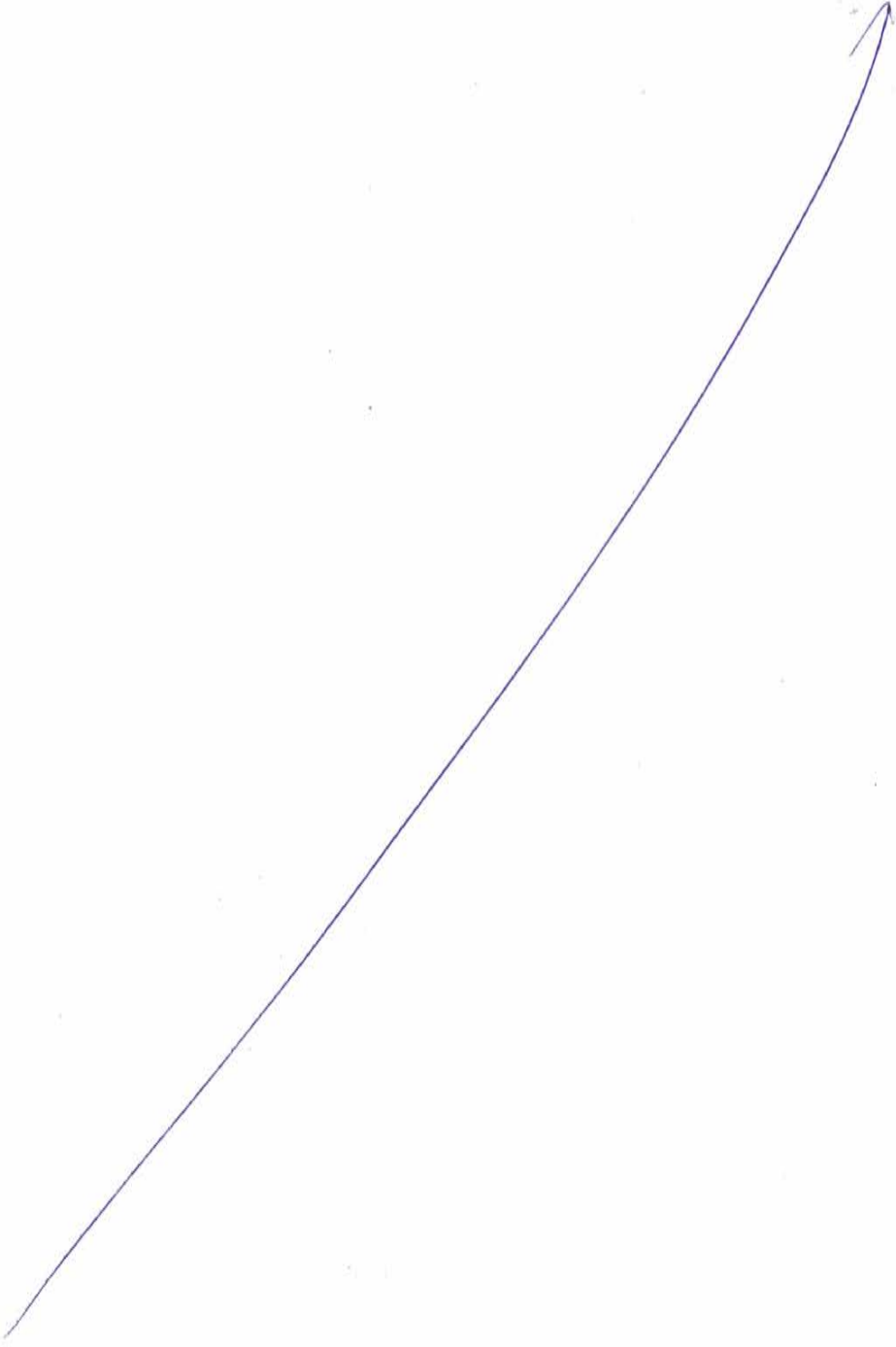


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Vendor / Supplier – Any person, firm or Company appointed by DAEWOO E&C-TPL JV to provide service in the execution of the project.

Witness Point - A stage in the production / construction cycle when inspection and /or test are performed to determine the acceptability of an item for further processing. Prior notification shall be given to MMRDA. If MMRDA is not present at the specified time, DAEWOO E&C-TPL JV is free to proceed for the next stage of operation. All the related Quality Documents shall be submitted to MMRDA for review.

Un Controlled Copy - One-time copy issued for reference or any other purpose.

3.3 ABBREVIATIONS

- BU : Business Unit
- CE : Construction Engineers
- CHRO : Chief Human Resources Officer
- CQSH : Corporate Quality and Safety Head
- SHE : Environmental, Health and Safety
- EIC : Engineer In-charge
- H.O : Head Office, Secunderabad
- ITP : Inspection and Test Plan
- IMTE : Inspection, Measuring and Testing Equipment
- MIV : Material Issue Voucher
- MQP : Manufacturing Quality Plan
- Mfr TC : Manufacturer Test Certificate
- MS : Method Statement
- NCR : Non-Conformity Report



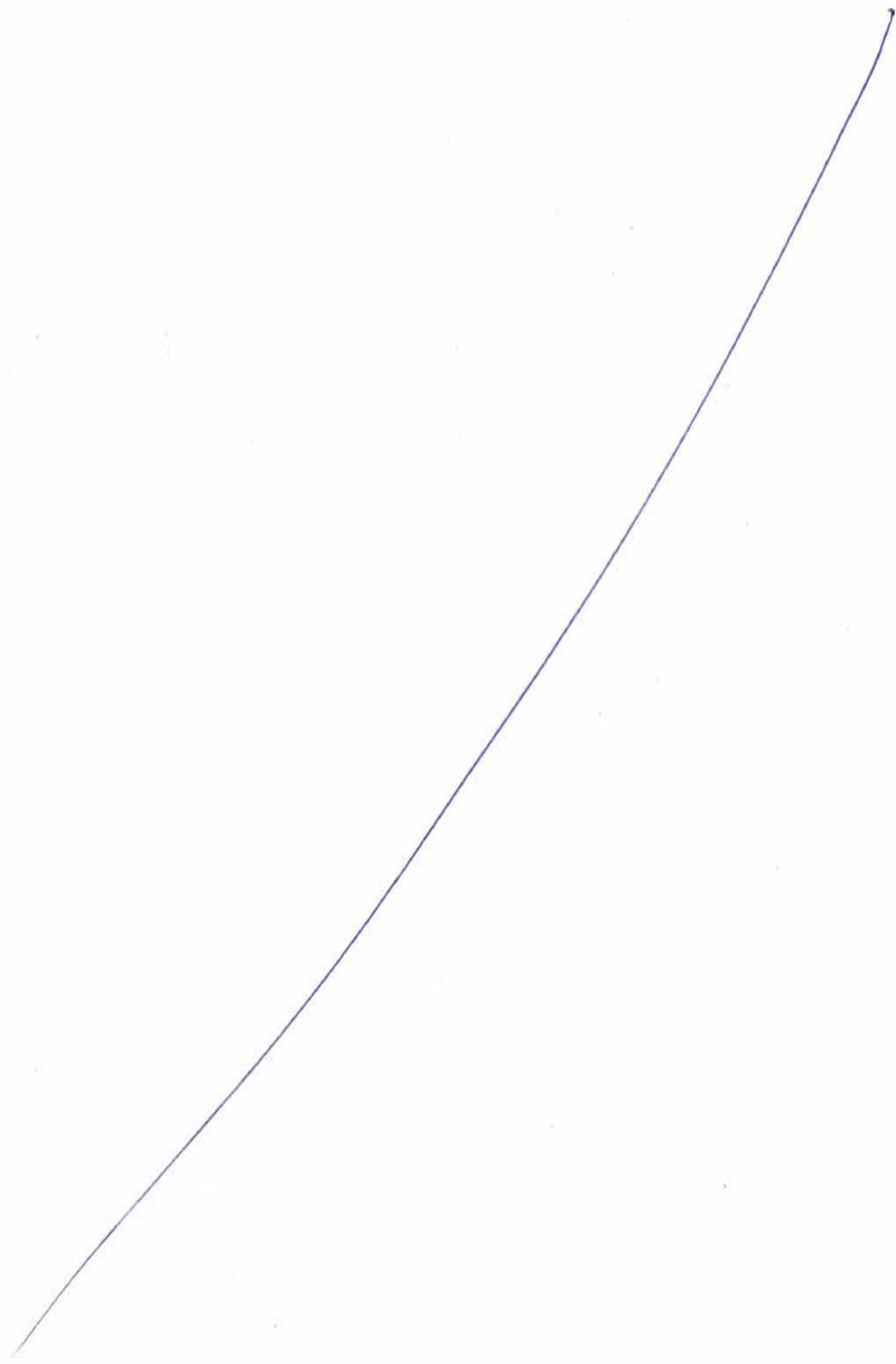
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QMD	:	Quality Management Department
DAEWOO -TPL JV	:	DAEWOO -Tata Projects Limited JV
SBU	:	Strategic Business Unit

4.0 QUALITY MANAGEMENT SYSTEM

4.1 PURPOSE OF PROJECT QUALITY PLAN

To indicate narrative details of how DAEWOO E&C-TPL JV interprets the individual elements of ISO 9001-2008 for application to this Project including the controls and verifications to be kept in place to assure Quality during each stage of Design, Procurement, Construction and Commissioning. The Project Quality Plan determines the Quality Policy for this Project.

To detail in a matrix format how JV's Quality System addresses all elements of ISO 9001, references of all responsible parties with in DAEWOO E&C-TPL JV for the implementation / control of each area, the applicable Procedures used to Control / assure each area and the verifying documents produced for each area.

The Process Interface Matrix and Clauses Applicability Matrix are given in Annexure – I and Annexure – II.

4.2 PROJECT QUALITY POLICY

DAEWOO E&C -TPL JV will establish excellence in quality in order to achieve customer satisfaction in 'Mumbai Trans Harbour Link Project (Package-2)(Construction of a 7.807 km long bridge section(CH 10+380 – CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange)', while engineering, constructing, commissioning and handing over of the project components so as to ensure the successful operation and performance of this project.



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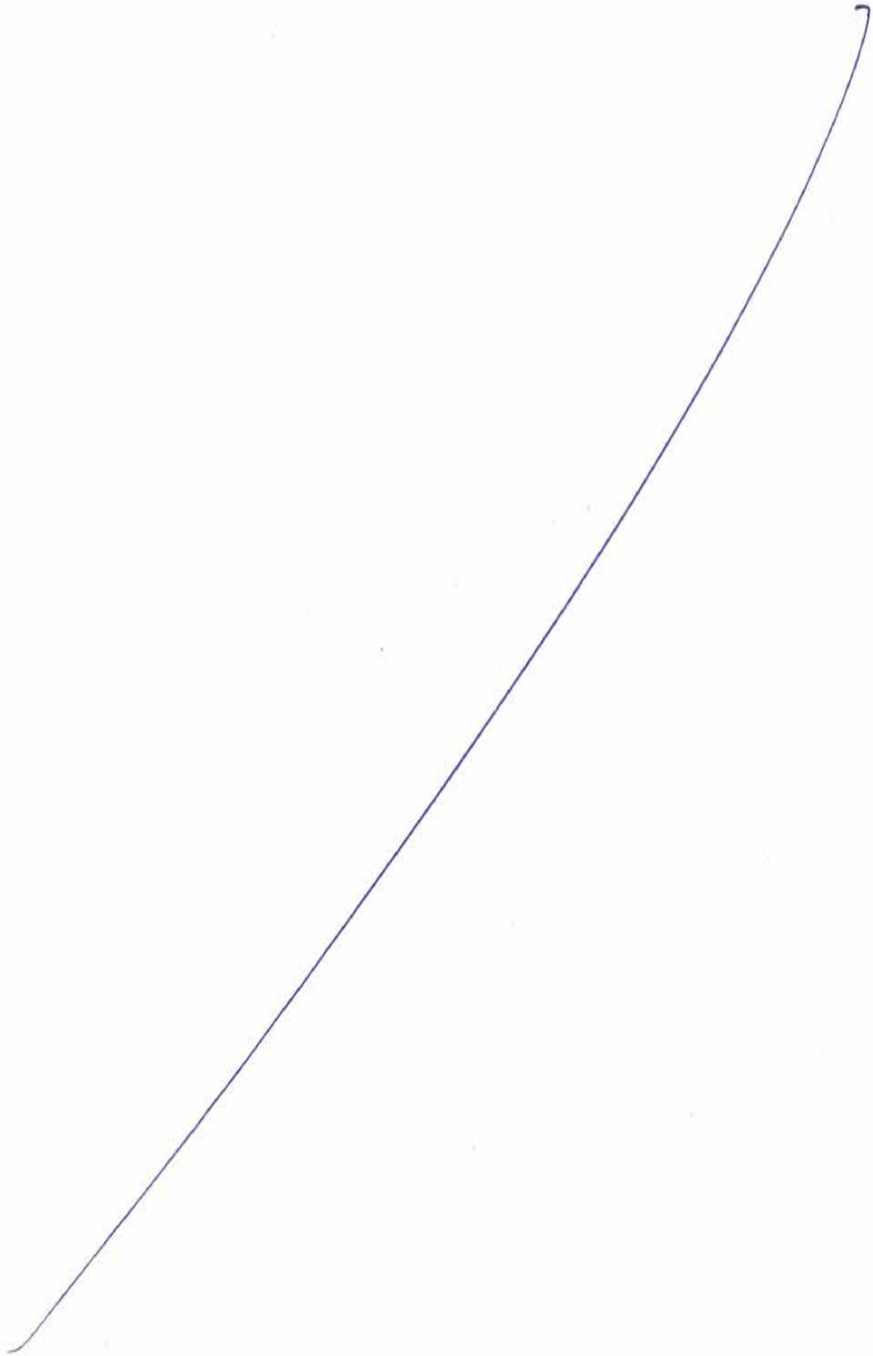
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Mumbai Trans Harbour Link Project
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4.3 PROJECT QUALITY OBJECTIVES

- a) Focus on / Enhance customer satisfaction by providing quality services.
(From current level min.85% to expected level 95%)
- b) Actively contribute to our employees and sub-contractors development through support, encouragement and transfer of knowledge and skills.
- c) To ensure completion of Project stages within stipulated time.
(Adherence to L2 Schedule)
- d) Continuous improvement in "Cost to Serve" through incorporation of "Best Practices".
(1 number of new technologies per year)
- e) To ensure 100% compliance with the applicable requirements



Authorized Signatory of DAEWOO E&C-TPL JV



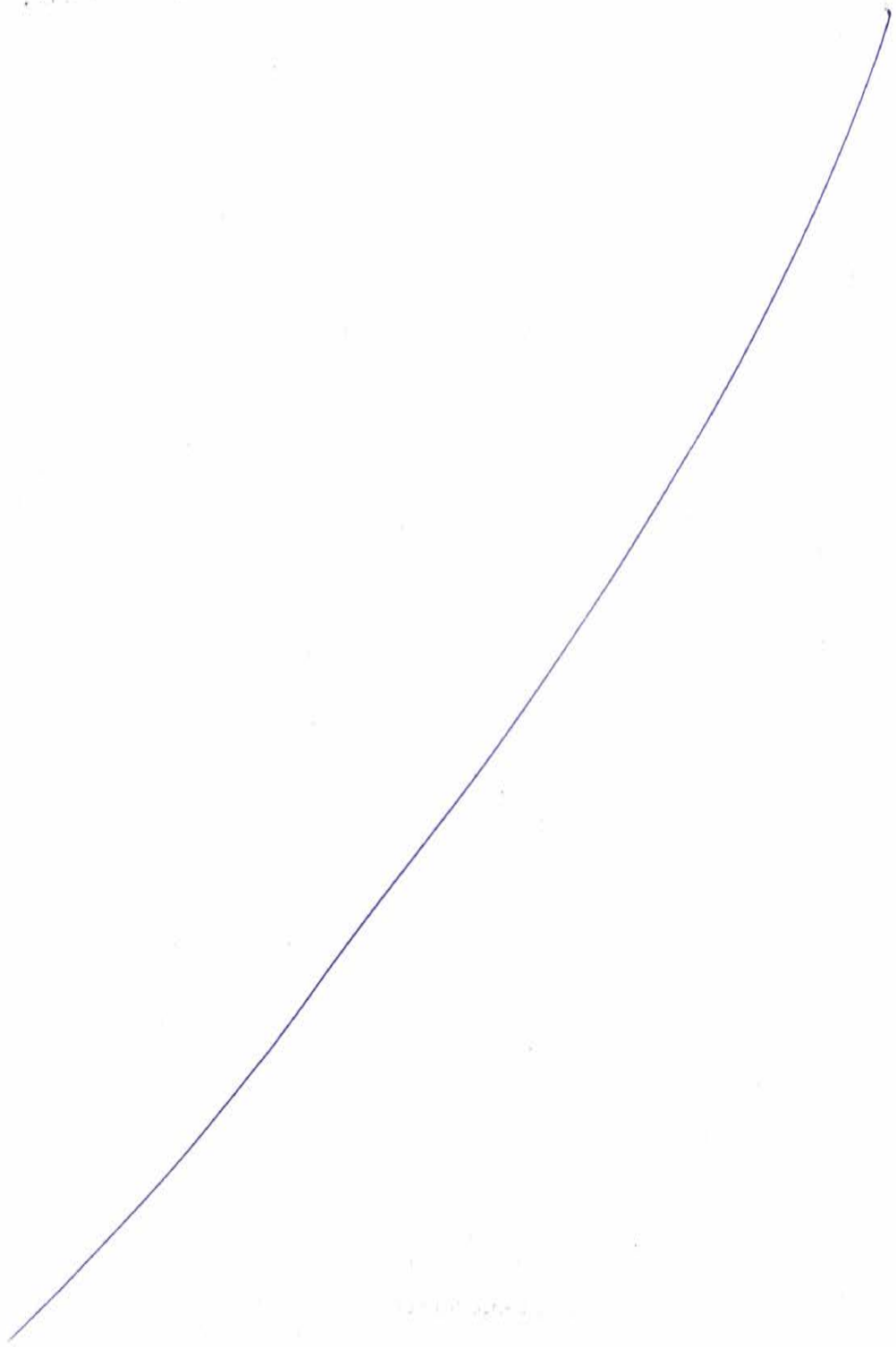
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4.4 PROJECT KEY PERFORMANCE INDICATORS

- a) To complete the detail Engineering and arrange drawings as per schedule to site for execution.
- b) To organize supply of materials and equipment to site as per schedule.
- c) To complete erection of structures and equipment as per the schedules.
- d) To complete pre-commissioning of equipment as per schedules.

4.5 QUALITY STRATEGIES

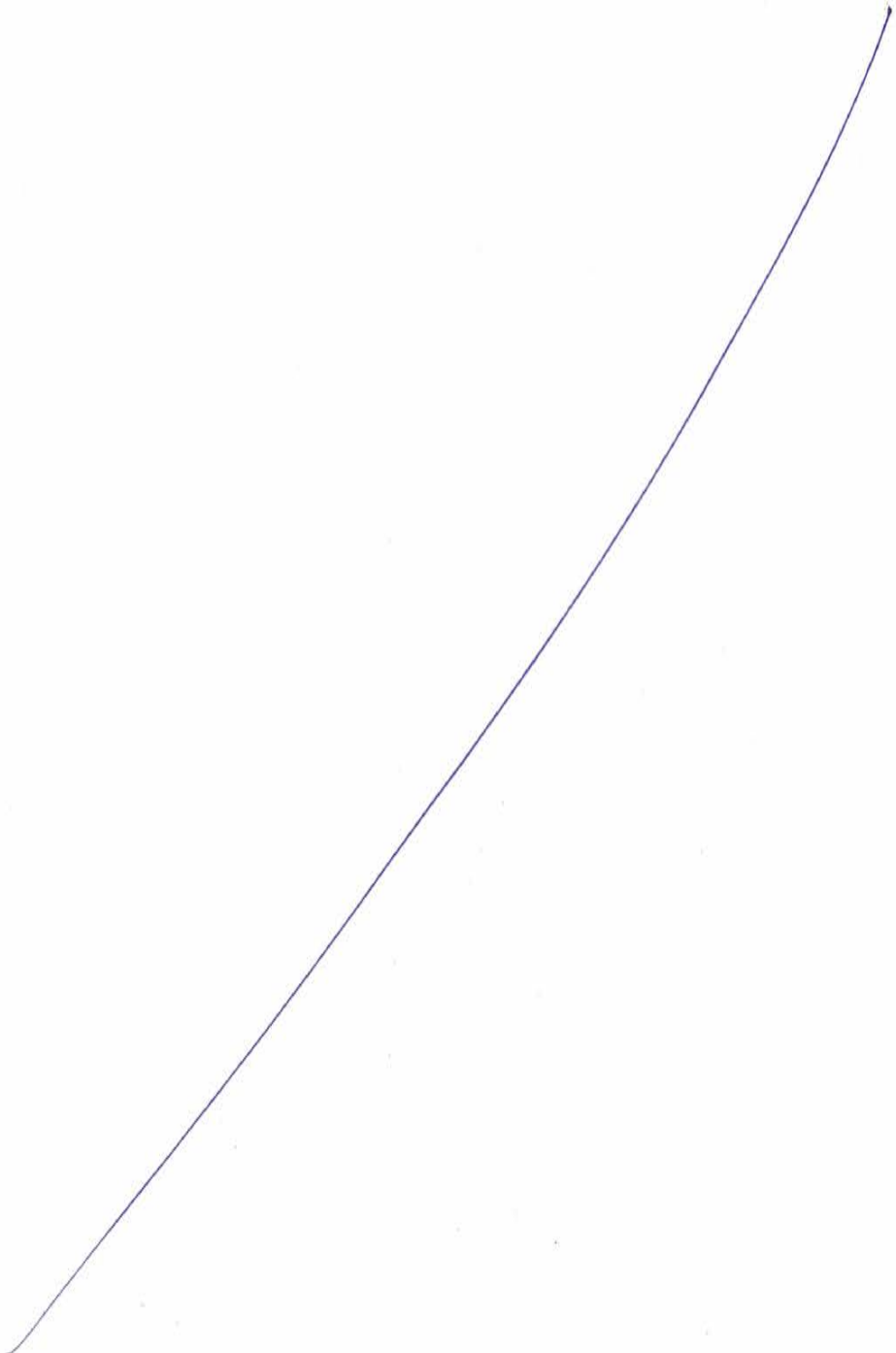
- a) Continual improvement of Quality Processes and Procedures by adopting appropriate Corrective and Preventive Actions taken at the following stages:
 - Root Cause Analysis of Non-Conformities noticed in Supplies and Construction activities.
 - Root Cause Analysis of Re-Works,
 - Root Cause Analysis of Customer Complaints,
 - Periodic Quality Audits,
- b) Benchmarking and take actions to minimize the Re-works and Repairs.

4.6 QUALITY MANAGEMENT STRUCTURE

- Comprises coordinated activities to direct and control the DAEWOO E&C-TPL JV with regard to Quality. DAEWOO E&C-TPL JV Quality Management Department is independent of Project's Team and directly reports to Managing Director through Corporate Quality & Safety Head (CQSH)
- Quality Assurance for developing required Quality Documentation as per the project specifications and providing to all the concerned for carrying out QC activities in supplies and Construction activities.
- Quality Control of Supplies for ensuring compliance of Order & Quality requirements with reference to the project specifications.
- Quality Control of Construction activities at Site for ensuring compliance of Quality requirements with reference to the project specifications.

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- Assessment of Vendors by Evaluation of their capabilities before placement of orders, placement of purchase order on approved vendors and monitoring performance of vendors for improving the Quality of products / Services.
- Continuous updating skills of Quality personnel by providing suitable training and qualifications as required.

4.7 DOCUMENTATION REQUIREMENTS

Quality Management System documentation consists of the following levels:

- Quality Manual including Quality Policy and Objectives.
- Quality System Procedures required by ISO 9001: 2008
- Work Instructions
- Forms & Records

Quality Management System documentation applicable to this contract are:

- Project Quality plan
- Project Specific Method Statements and Procedures
- Inspection and Test Plans
- Forms & Records to meet Project Quality requirements, specifications, procedures and National & International standards.

4.8 Level - I Documents: PROJECT QUALITY PLAN

Project Quality Plan encompasses the complete requirements of project QMS and the same are based on the requirements of ISO 9001:2008. The objective of the Project Quality Plan is to implement a system of control that all the phases of project are done in accordance with the applicable contract requirements, codes, specifications, drawings and statutory requirements.

4.9 Level - II Documents: Quality System Procedures and Project Specific Procedures:

These are DAEWOO E&C-TPL JV Standard procedures applicable to this project and shall be followed for all relevant activities. List of Quality System Procedures are provided in Annexure -IV

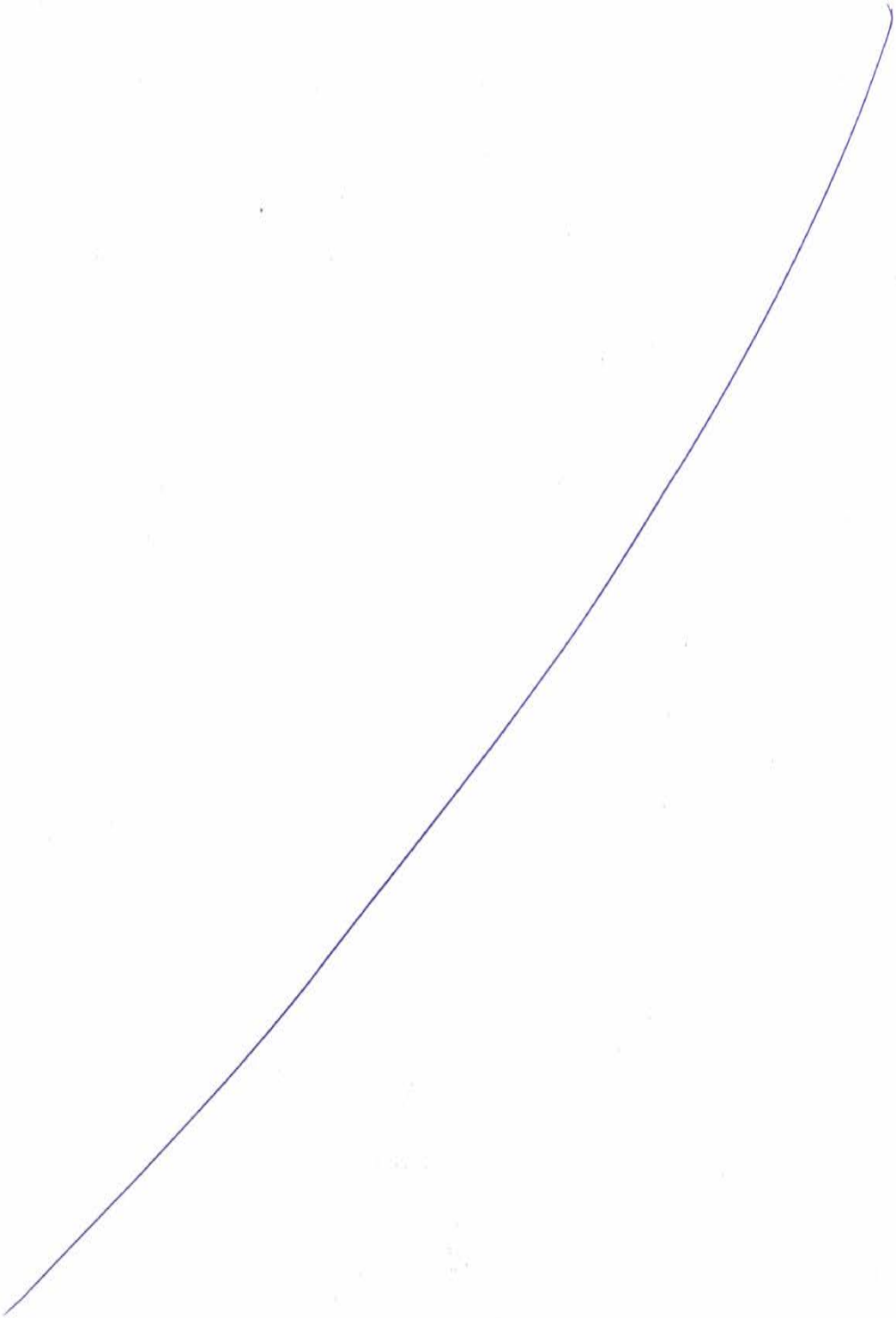


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Project Specific Procedures shall be prepared for various activities based on Mumbai Metropolitan Region Development Authority (MMRDA) specifications, applicable codes / standards, reviewed & approved by Head-QMD, and submitted to Mumbai Metropolitan Region Development Authority (MMRDA) for approval. These procedures shall be implemented during execution of the project. They give clear guidance to all the concerned and helps in clear co-ordination between various activities. Typical List of Project Specific procedures are provided in Annexure –

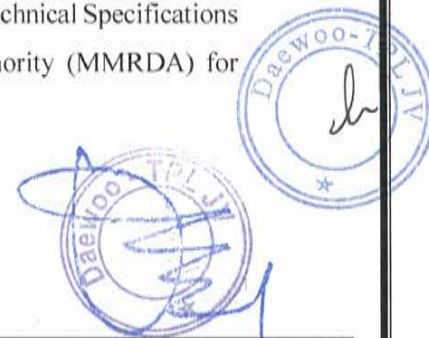
4.10 Level – III Documents: Manufacturing Quality Plans (MQP), Inspection and Test Plans and Work Instructions

Manufacturing Quality Plans (MQP) are provided by vendors based on purchase orders, relevant standards, data sheets etc. The same are reviewed by Inspection Coordinator and Approved by Head –QMD, before submission to Mumbai Metropolitan Region Development Authority (MMRDA) for Approval.

Inspection and Test Plans shall be developed to cover various activities of scope of work. The Inspection and Test Plans shall specify the activity description, controlling specification, quantum of check, acceptance criteria, responsible person and inspection stages for DAEWOO E&C-TPL JV and Mumbai Metropolitan Region Development Authority (MMRDA). All Inspection and Test Plans shall be submitted to Mumbai Metropolitan Region Development Authority (MMRDA) for review and approval before commencement of the construction activity.

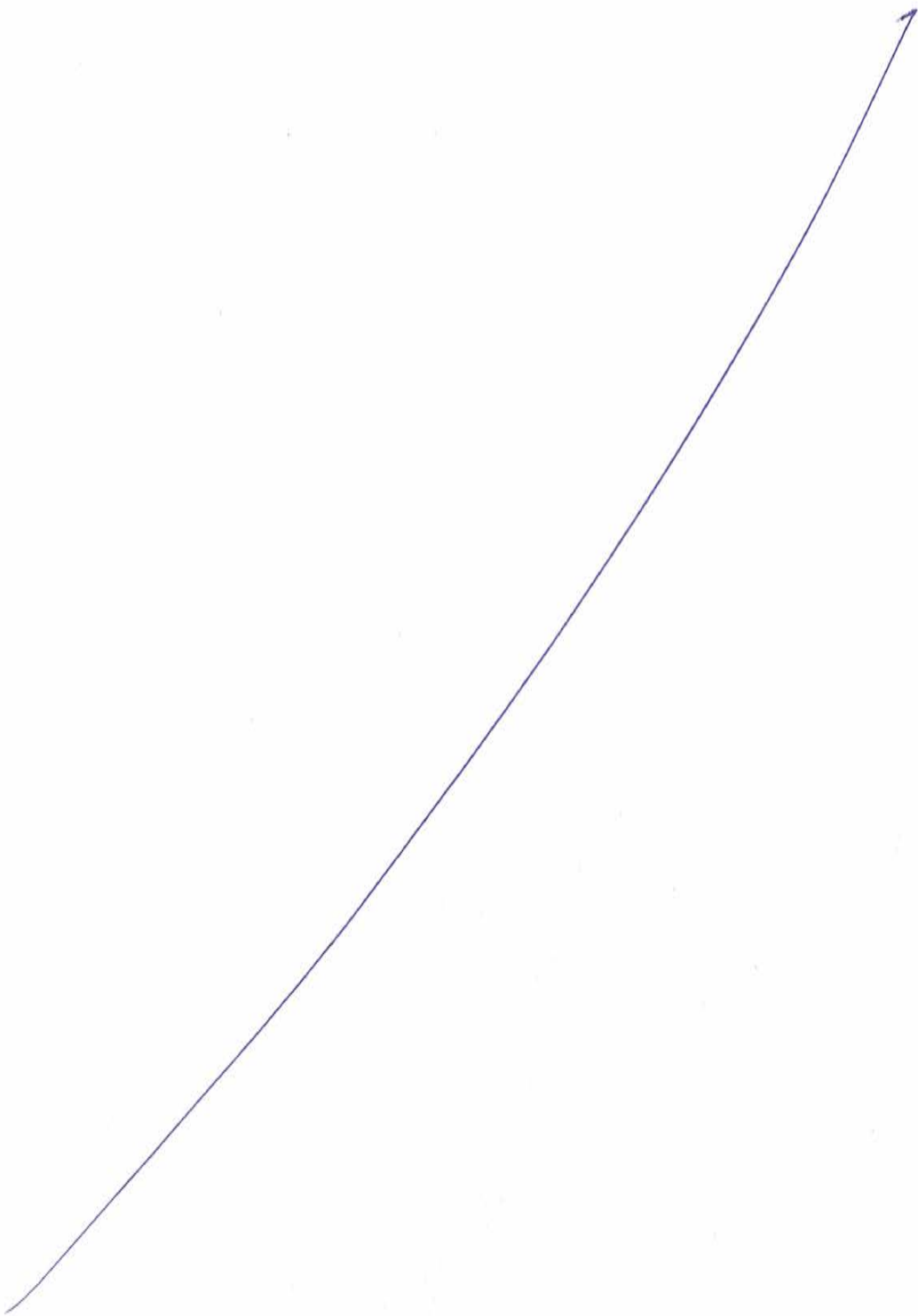
4.11 Level - IV Documents: Formats / Check Lists

The required Quality Formats / Checklists shall be prepared for various activities specific to the project, based on DAEWOO E&C-TPL JV Standard Formats, Applicable Standards & Mumbai Metropolitan Region Development Authority (MMRDA) Technical Specifications and submitted to Mumbai Metropolitan Region Development Authority (MMRDA) for Approval.



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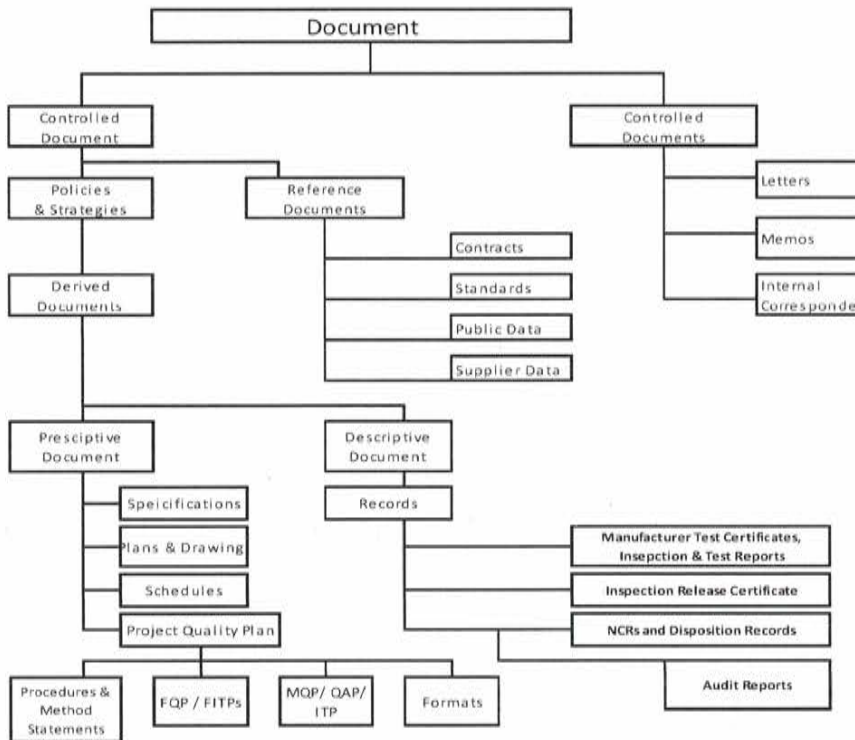


4.12 CONTROL OF DOCUMENTS

Applicable Procedure: Procedure for Control of Documents – DCP-4.2.3 (Annexure-IV).

4.12.1 GENERAL

Documents to be controlled shall include Contract documents, Project Quality Plan, All Procedures, Manufacturing Quality Plans, Method Statements / Procedures and Check Lists, Drawings, HSE Plan and Mumbai Metropolitan Region Development Authority (MMRDA) Contract Technical Specifications. The relevant documents of external origin will be identified and their distribution will be controlled. The above Process Map illustrates the documents to be controlled for



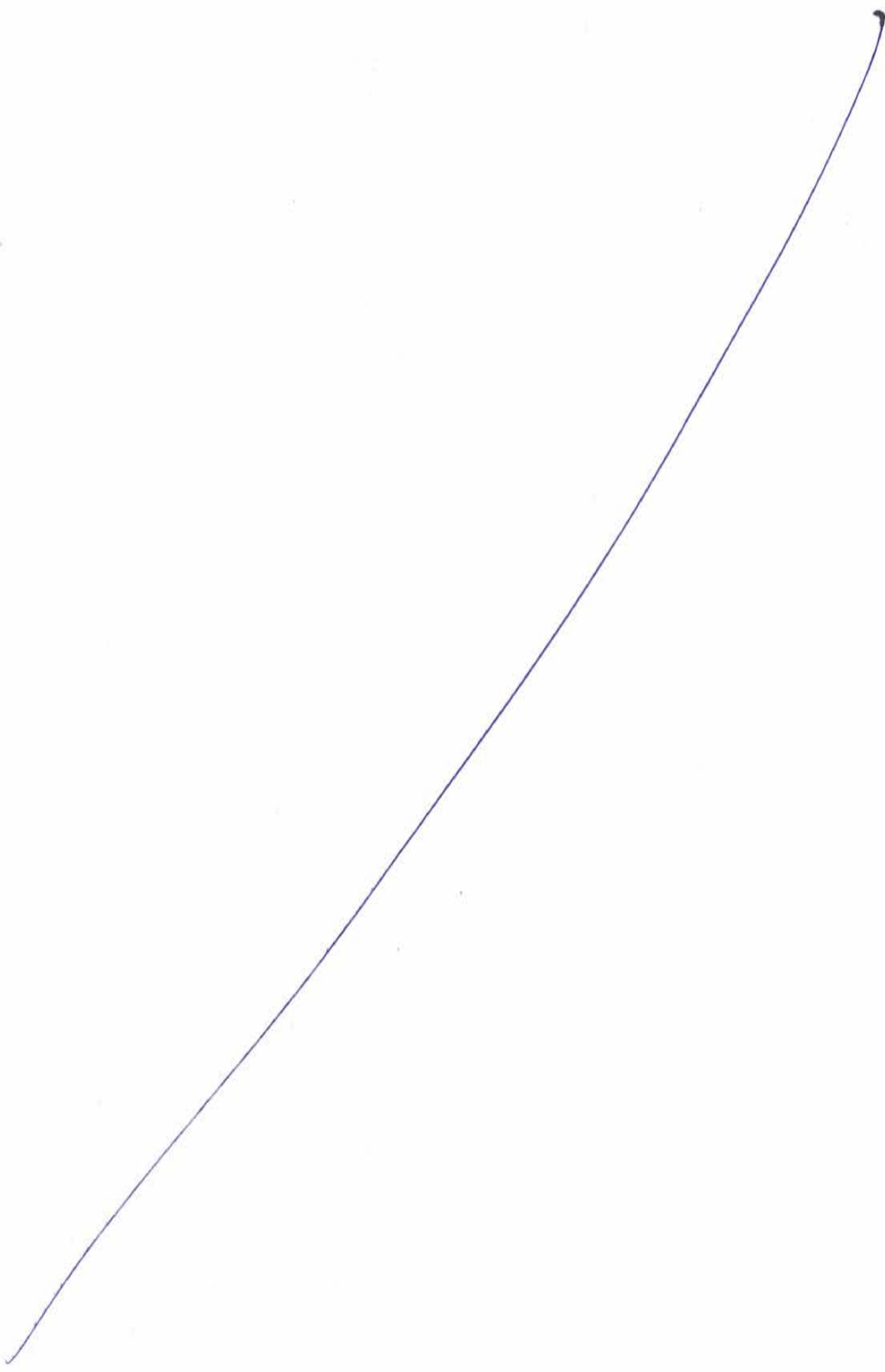
this Project.

4.12.2 CONTROL OF INTERNAL DOCUMENTS

- a) The Quality Management system documents such as Quality Manual and Standard Procedures are issued by Head – QA of Quality Services to users through electronic system.



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- b) The concerned documents as given below will be submitted to Mumbai Metropolitan Region Development Authority (MMRDA) through Document Controller for approval:
- Project Quality Plan
 - Project SHE Plan / Job Safety Analysis for various activities.
 - Project Specific ITPs, Procedures / Method Statements and Check lists
 - Drawings / Data sheets
 - Vendor QAPs / ITPs
 - Project Schedules and Status Reports.

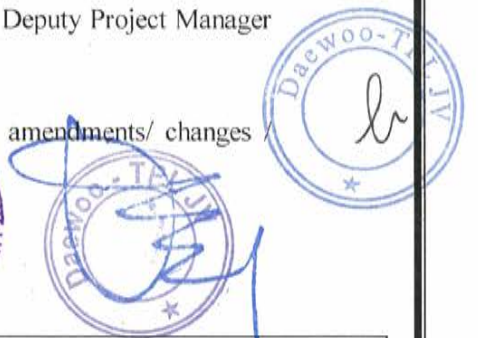
After Mumbai Metropolitan Region Development Authority (MMRDA) approval, the documents will be sent to the concerned users by the respective Heads of Departments, for compliance.

As required, the Documents will be revised and sent to the concerned users after approval from Mumbai Metropolitan Region Development Authority (MMRDA), by the respective Heads of Departments, for compliance.

- c) The users are responsible for removing / destroying obsolete versions of documents on receipt of revised versions. If these are retained for any reason, they shall be marked "SUPERSEDED – FOR INFORMATION ONLY".

4.12.3 DOCUMENTS RECEIVED FROM CUSTOMER

- Project Manager shall maintain 'Master List' of documents received from Mumbai Metropolitan Region Development Authority (MMRDA) through Documents Controller. The above list shall be updated continuously by Project Manager as and when changes / revisions to any documents are received.
- Project Manager shall transmit the relevant documents received from Mumbai Metropolitan Region Development Authority (MMRDA) to Deputy Project Manager and others, as applicable.
- Project Manager shall be responsible for communicating all amendments/ changes / revisions in documents to all the users.



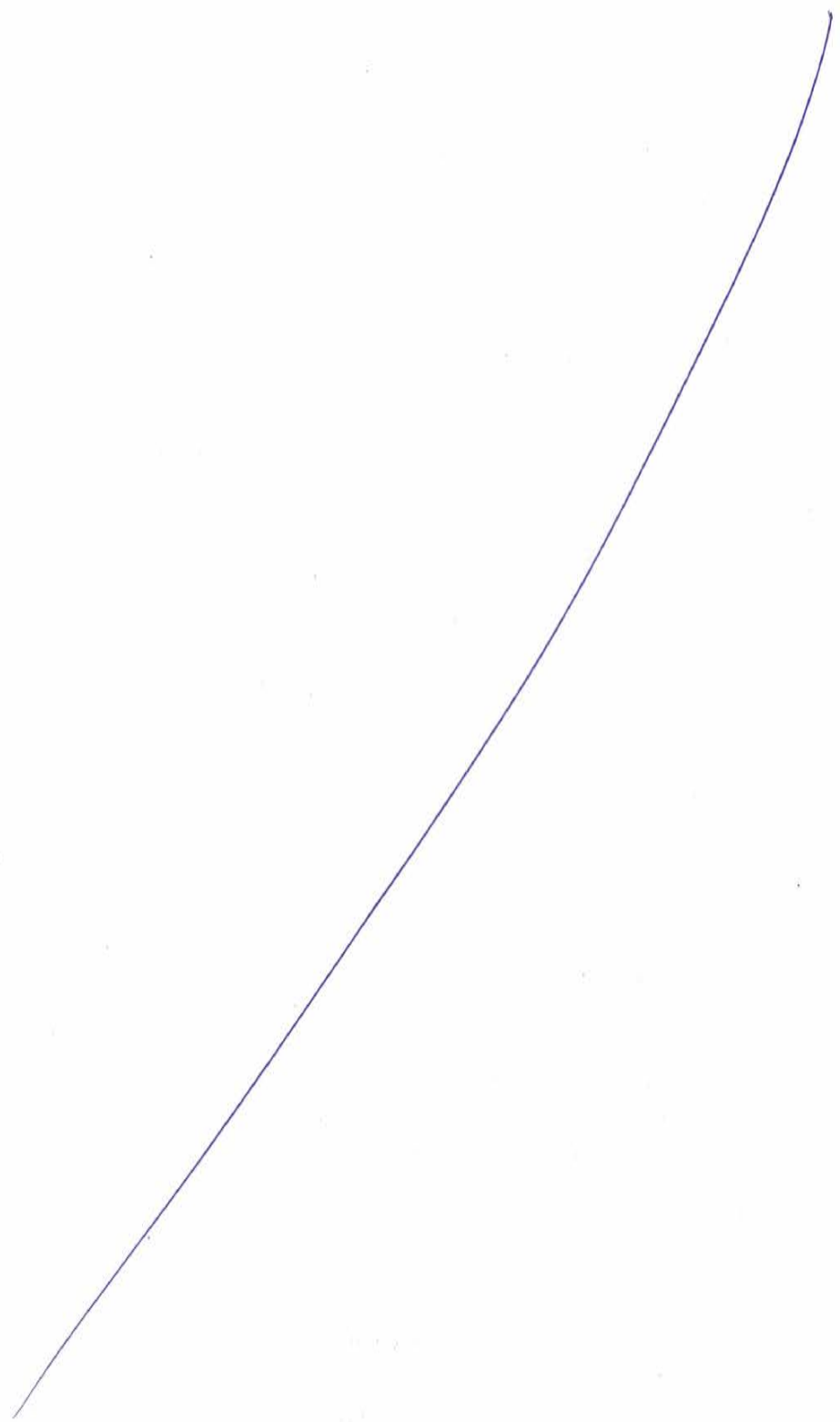
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- d) The users shall maintain documents as per the latest Master list and ensure that obsolete copies are either destroyed or marked as 'SUPERSEDED – FOR INFORMATION ONLY', in case they are retained for legal / knowledge preservation purposes.

4.12.4 DOCUMENTS FROM DAEWOO E&C-TPL JVSUPPLIERS / VENDORS

Drawings / data sheets / specification received from suppliers / vendors for review and approval by Engineering Coordinator shall be approved and appropriate distribution controls and records are maintained for the documents.

4.12.5 NATIONAL & INTERNATIONAL CODES / STANDARDS

- a) The required National and International standards shall be made available to the specific users by electronic media by Librarian.
- b) If there is need for any new code / standard, the same shall be indented by the user with approval from Head – Transportation & Hydro / QMD-Head to enable procurement by Librarian.
- c) Librarian shall procure the indented codes of standards and issue them after updating the list of National / International codes / standards.

4.13 CONTROL OF RECORDS

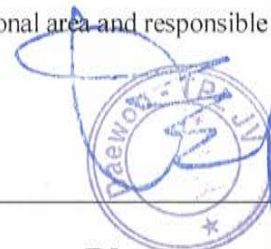
Applicable Procedure: Procedure for Control of Records – CRP-4.2.4 (Annexure-IV).

Head –Transportation & Hydro/ QMD-Head shall nominate an executive in their respective function to maintain related Project Quality Records.

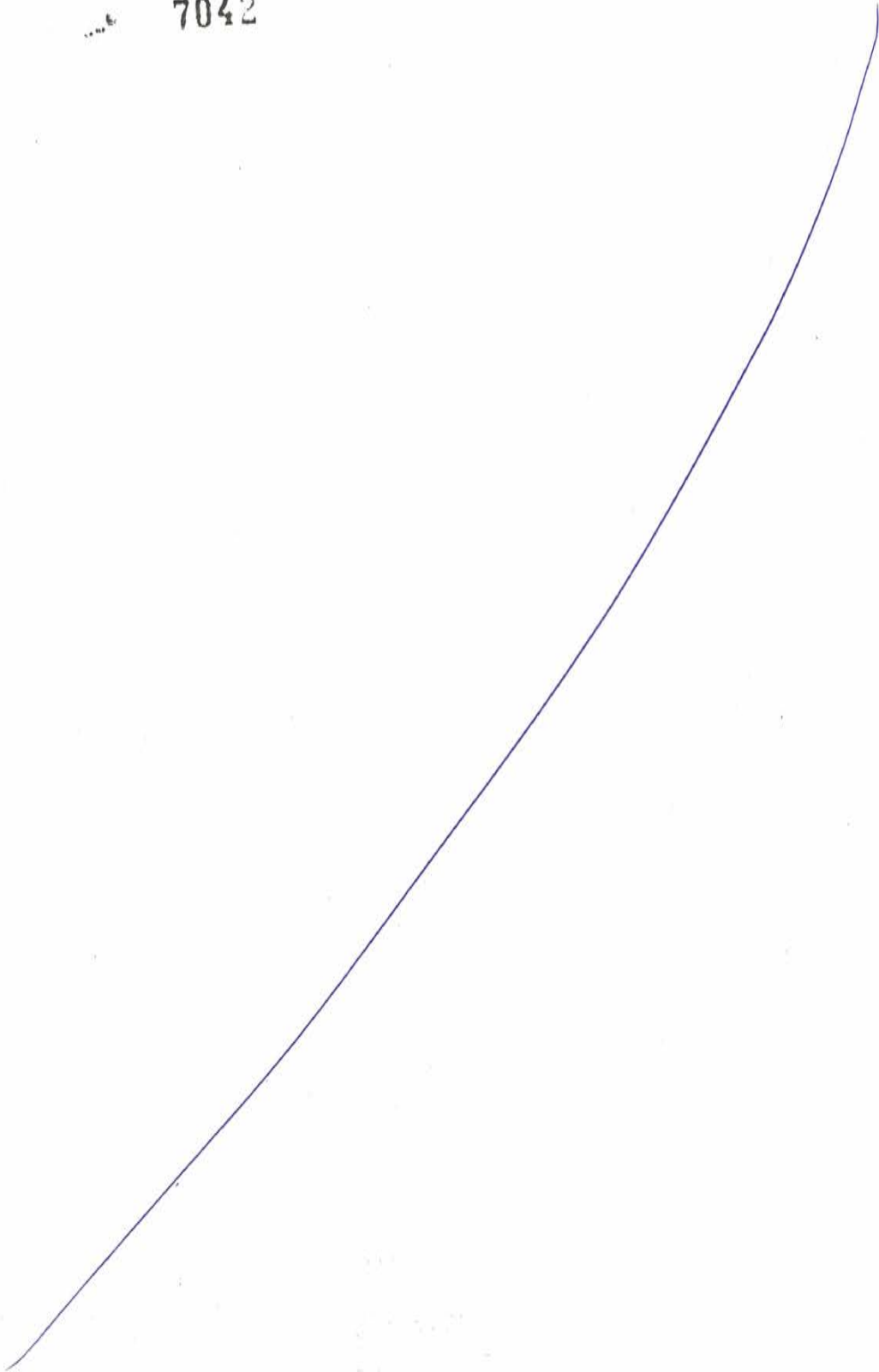
The nominated executive shall properly identify, collect, index and maintain the related Project Quality Records to enable easy retrieval.

The Project Quality Records shall be made available for review / evaluation by the Mumbai Metropolitan Region Development Authority (MMRDA) / Authorized agency for an agreed period as per the contract.

Typical list of Project Quality Records to be maintained in each functional area and responsible executive is given below:



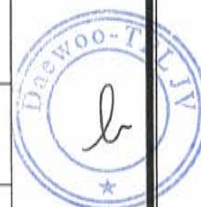
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Sl. No	Type of Quality Record	Executive Responsible	Retention Period (Years)
1	Contract, Contract review records, Contract variation and approval records	Project Manager	5
2	Project schedules, Status reports, Review meeting records	Project Manager	5
3	Drawings, Data Sheets, Review records with Engineering sub-contractor, NCRs and resolution records, Customer additional requirements related to engineering, Final As-built drawings.	Design Head	5
4	Vendor evaluation and Performance records, approved vendor lists, Purchase Orders and work orders along with their vendor evaluation, PCR approvals.	Procurement Head	5
5	Project Quality Plan, QAP / MQP / ITP / Procedures / Method Statements, Project Quality Audit Reports	Head - QMD / QMD Manager	5
6	Inspection and Test Reports, Customer Inspection Release Certificates vendor vies	Head - QMD / QMD Manager	5
7	Project Schedules, Status reports, Progress review records, Customer complaints and dispositions	Project Manager	5
8	Drawings, RA Bills	Planning Manager	5
9	Follow-up records on Project Quality Plan implementation, Project Quality Management Review Meeting records, NCRs and Dispositions	Field Quality Engineer	5
10	Records of Qualified Processes, Equipment, Personnel, as applicable	Field Quality Engineer	5
11	Stage and Final Inspection & Test Records	Field Quality Engineer	5


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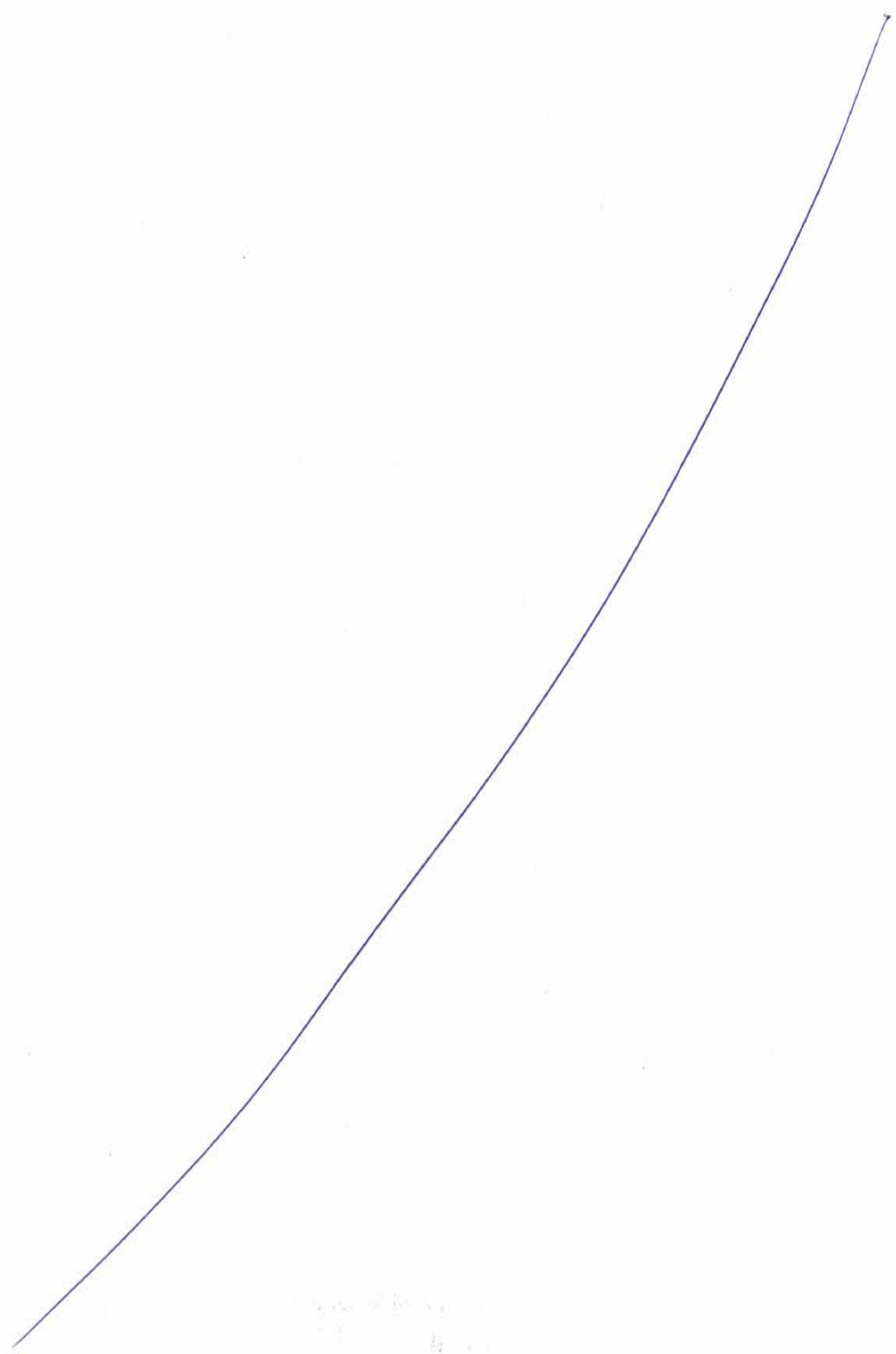
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Sl. No	Type of Quality Record	Executive Responsible	Retention Period (Years)
12	Records of calibration of inspection, measuring and test equipment	Field Quality Engineer	5
13	Record of deviations from drawings with Engineering Coordinator / Project Manager (for making As-Built drawings later)	Planning Manager	5
14	Records of lost, damaged, unsuitable products Supplied by Customer	PM / Stores Officer	3
15	Analysis of non-conformities and Customer Complaints	Head - QMD / QMD Manager	5
16	Results of Corrective and Preventive actions	Head - QMD / QMD Manager & Project Manager	5
17	Project Safety Plan and Records (for details Refer Project Safety Plan)	SHE Manager	5

MANAGEMENT RESPONSIBILITY

5.1 MANAGEMENT COMMITMENT

Top management is committed for implementation of Quality Management System and its continual improvement through

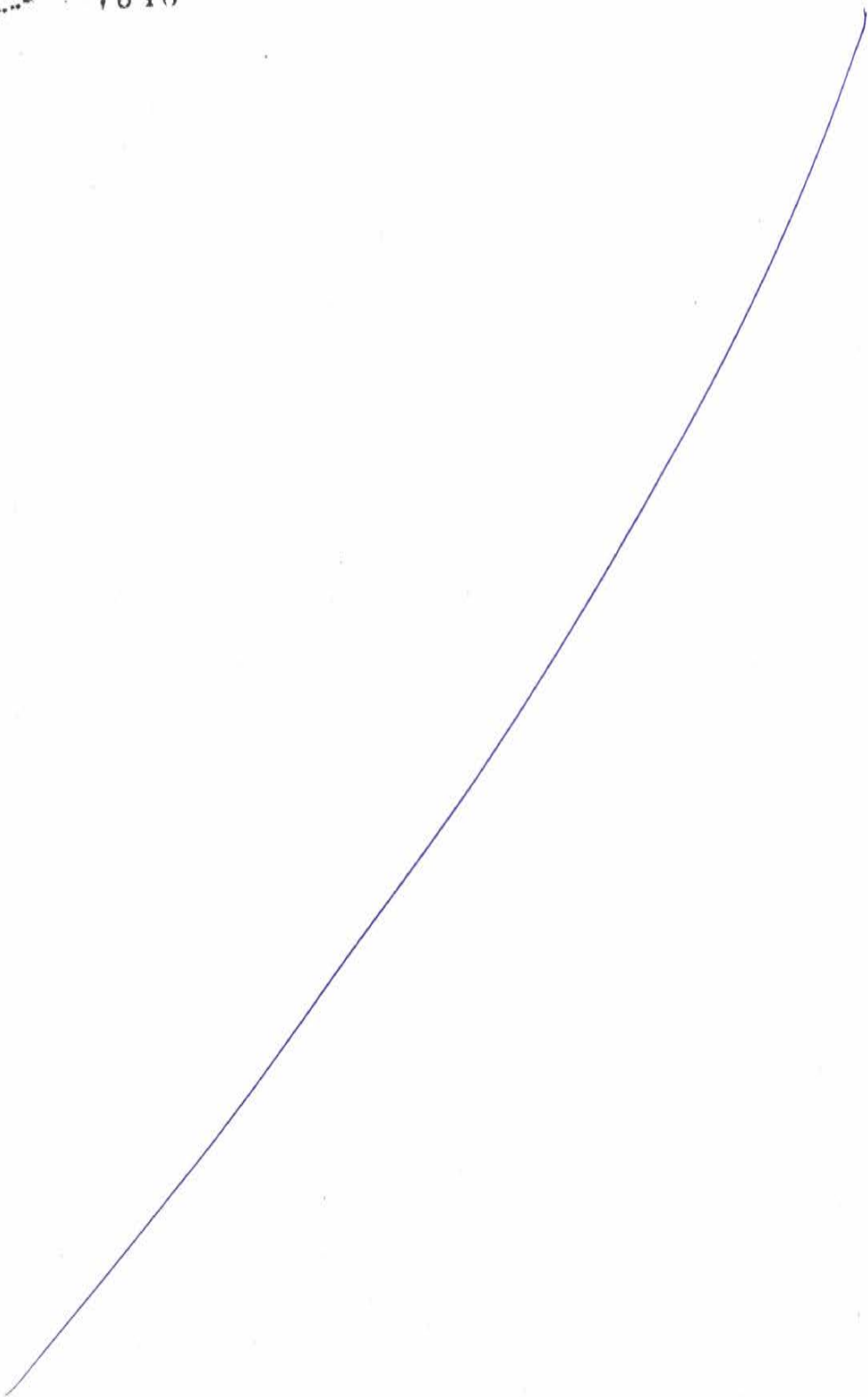
- Establishing 'Quality Policy' and 'Quality Objectives' and communicating throughout the organisation.
- Communicating to the employees regarding the importance of Customer requirements and statutory and regulatory requirements.

5.2 RESPONSIBILITY AND AUTHORITY

The responsibilities and authorities of various functional heads and personnel are given below. Organogram for the Project is given in Annexure-111.



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Applicable Procedure: Procedure for Quality Management – QMD – 8.2.4 (Annexure-IV)

5.2.1 Responsibilities and Authorities at Regional Office (Mumbai):

5.2.1.1 Head- Learning & Development:

- Coordination with Head - BU, Heads - Enabling Services, Head - QMD and Head – SHE in identifying training needs.
- Arranging training and development programs to personnel.

5.2.1.2 Head – Quality Management Department (QMD):

Head – QMD shall be responsible for Project supplies Inspection and Field Quality functions and reports to Managing Director through COO & CQSH. His responsibilities include:

- Over all administration and technical responsibilities of Quality Management Department.
- Resource planning and deployment in Quality Management Department.
- Approval of Manufacturing Quality Plans (MQP), Project Quality Plans (PQP), Inspection & Test Plan, related Method Statements and Inspection & Test Procedures.
- Approval of Non-Conformity Reports related to supplies and Project sites.
- Overall Co-ordination with BU, Enabling Service Departments, Project sites and vendors as necessary.
- Evaluation of Quality of supplies, Quality performance at Project sites and reporting to senior management.
- Organizing periodic Quality Audits of the Projects as per the Audit Schedule in coordination with Project Manager, Deputy Project Manager and Mumbai Metropolitan Region Development Authority (MMRDA).
- Vendor / Sub-Contractor's Evaluation and Performance monitoring.

5.2.2 Responsibilities and Authorities at Regional Office (Mumbai):

5.2.2.1 Chief Operating Officer (COO) SBU - Urban Infra

COO SBU - Urban Infra is overall responsible for the Business Unit. He is responsible for business development, ensuring submission of project tenders / bids, contract reviews, Pre-bid Engineering, Design and Engineering, Project Management and Execution till the projects are handed over to Customer, as applicable.



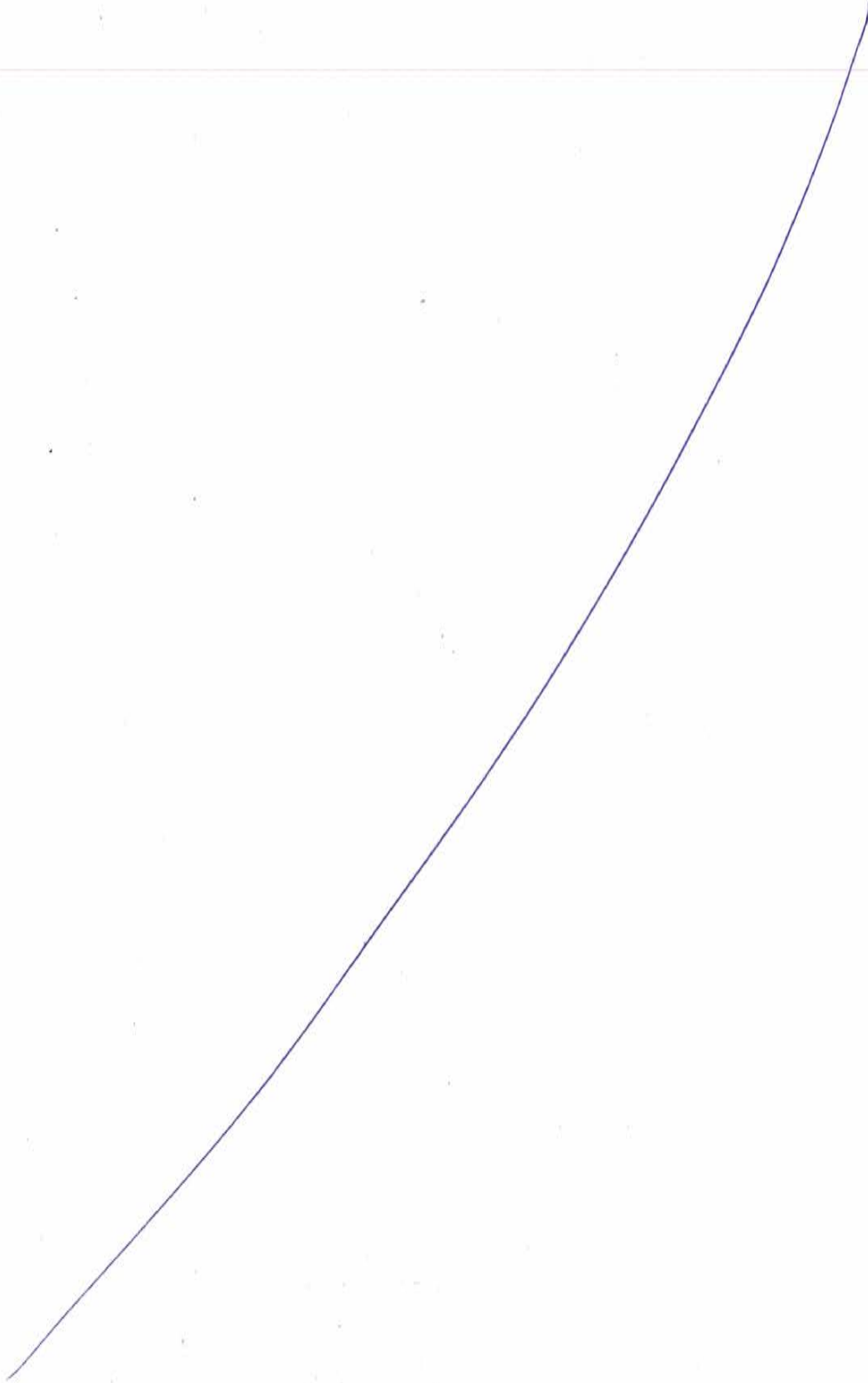
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COO SBU - Urban Infra conducts periodical review of the projects regarding progress with reference to committed schedules and costs of supplies and site works with reference to budgeted cost and take appropriate corrective actions.

5.2.2.2 Head – Metros, Tunnels & Waterways

Head – Metros, Tunnels & Waterways is overall responsible for the Project right from receipt of contract till completion and handing over to Customer and reports to COO SBU - Urban Infra. His responsibilities include:

- To oversee the project completely.
- Monitor every function of the project i.e. Control Budget, Scheduling, Indenting, Supplies award of works, Site progress, Billing, Collection, Payment to vendors, Contractual matters, taxation matters, etc.
- Participate in the Review Meetings with Customer, as required.

5.2.3 Responsibilities and Authorities at Site:

5.2.3.1 Project Manager

Project Manager is responsible for Project Management at RO, overall coordination with Mumbai Metropolitan Region Development Authority (MMRDA), and concerned DAEWOO E&C-TPL JV Internal Departments pertaining to his project and reports to Head – Metros, Tunnels & Waterways.

His responsibilities include:

- Approve project execution work plan and budget
- Communicate salient features of the project, roles, expectations, KRAs to the project team.
- Ensure on time in full project delivery as per the project plan
- Ensure compliance to statutory requirements with the assistance of Contracts Head.



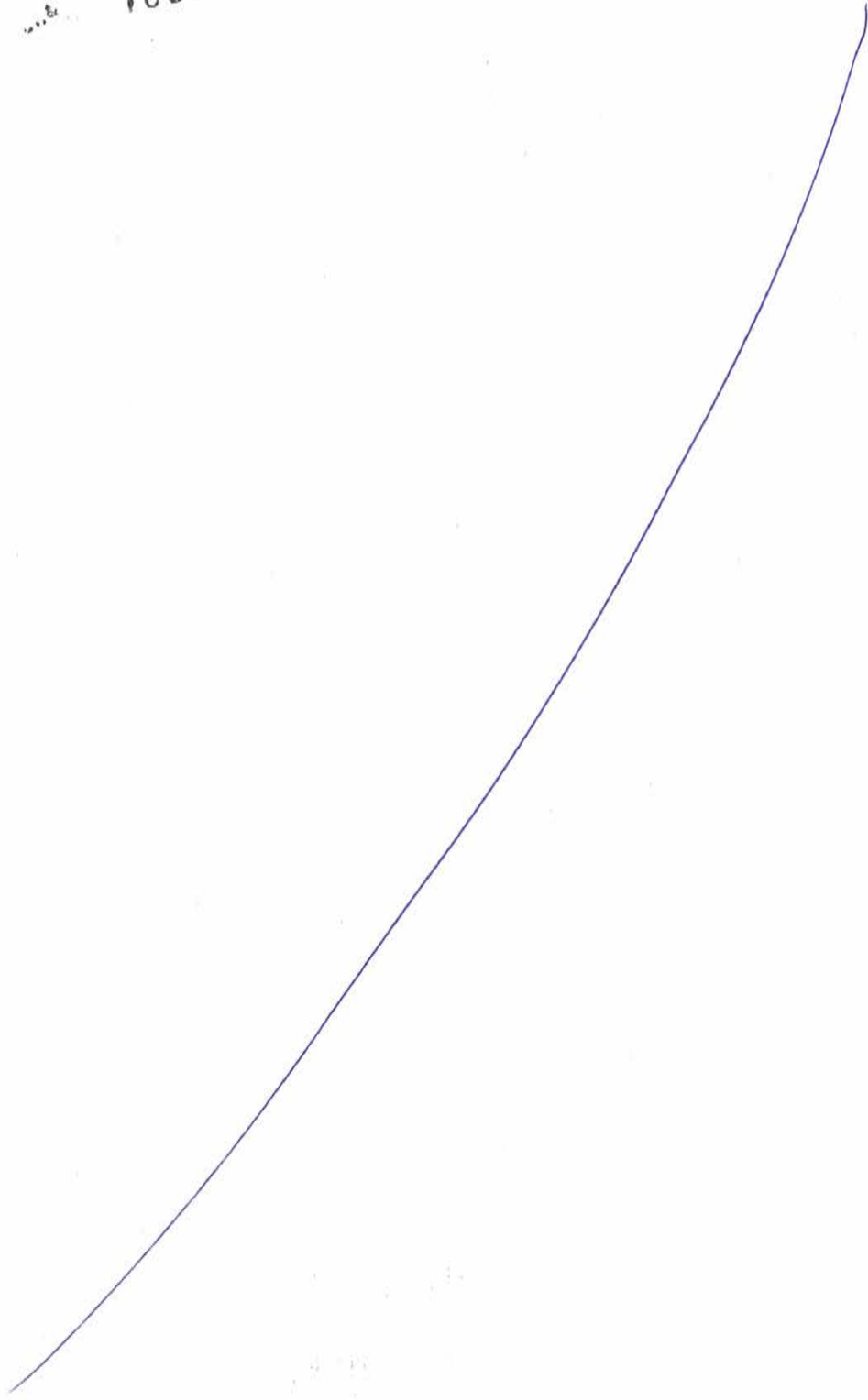
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- Build & maintain effective working relationships with external entities- client, other contractors, Govt. agencies, local community etc.
- Monitor resource productivity, physical and financial progress in consultation with Project Controls.
- Ensure adherence to contract specifications, HSE and quality standards.
- Prioritize and resolve conflicting issues on the project in consultation with Management committee of JV-Board.
- Plan and ensure adherence to mobilization/ demobilization of resources with Project Controls.
- Ensure that all functions at the project site are appropriately staffed, trained and managed.
- Define and monitor performance targets for the project team.
- Ensuring that periodical material re verification is carried out as per the extant procedures.

5.2.3.2 Document Controller:

Document Controller is responsible for total Control of Documents related to Project in coordination with Customer and reports to Project Manager.

- After receipt of documents from the concerned Head of the SSDs, allocation of documents number and submission to Customer for approval.
- Maintaining the Master List of Documents.
- After receiving approval of the documents form Customer / Authorized Inspection Agency, information to the concerned Head of the Enabling Services / QMD / SHE.

5.2.3.3 Planning Manager:

Planning Manager shall be responsible for planning activities at site and reports to Project Manager. His responsibilities include: -

- Planning of material, machinery / equipment and construction activities.

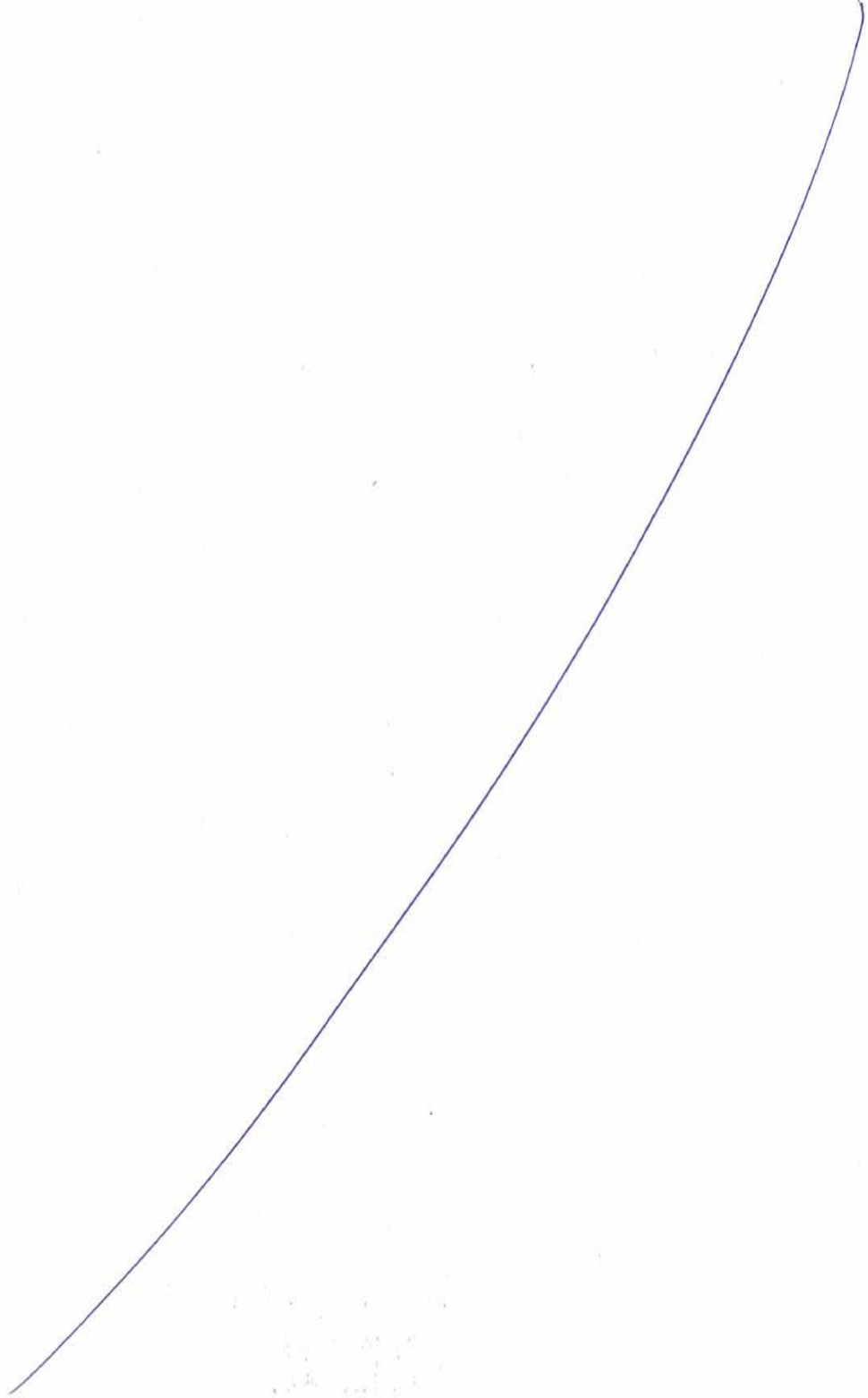


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- Follow-up with Design Head for timely receipt of drawings. Distribution of the drawings to the concerned sub-contractors. Making available the drawings along with master list of drawings to the Construction Engineers and Field Quality Engineer / Inspector.
- As and when revised drawings are received, verification with respect to progress and identification of additional requirements due to revision. Information to Project Manager, in case job is completed prior to receipt of revision drawings and additional items required due the revision.
- Identification of discrepancies with related to mismatches between Civil / Mechanical drawings.
- Preparation of schedules and periodic status reports.
- Processing of RA Bills in coordination with the concerned.
- Verification and Clearing of Sub-contractors bills in coordination with the concerned.
- Issuance of Local purchase orders with the approval of Project Manager.

5.2.3.4 Design Head:

Design Head shall be responsible for Engineering activities and reports administratively to Project Manager and functionally to respective Engineering Head at RO.

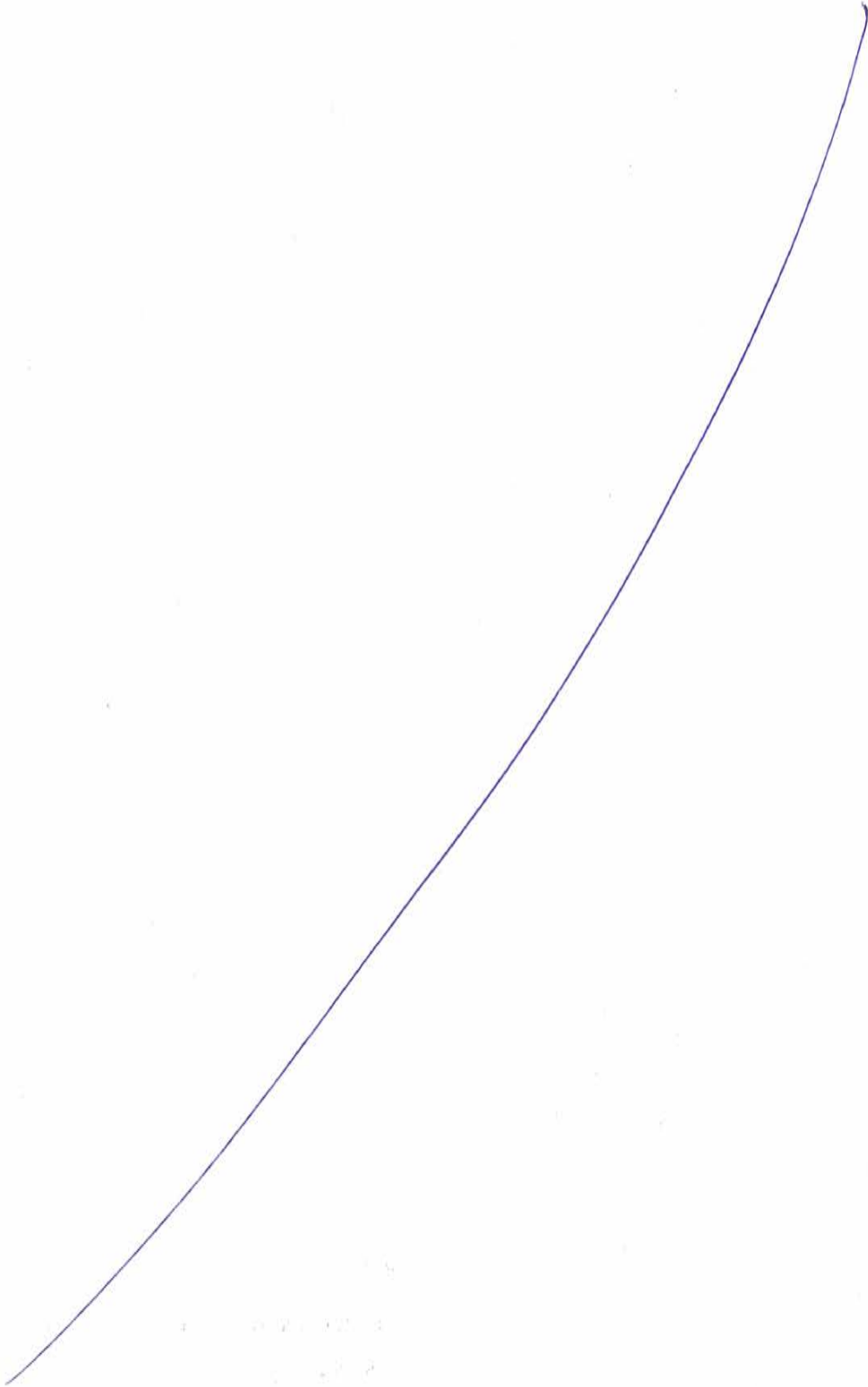
His responsibilities include: -

- Implementation of Project Quality Plan with respect to engineering activities.
- Co-ordination with Engineering Consultant / Sub-Contractor for Engineering drawings, Data sheets and Design calculations, as applicable.
- Review of Engineering drawings, Data sheets and Design calculations as received from Engineering Consultant / Sub-Contractor before submitting to Mumbai Metropolitan Region Development Authority (MMRDA).
- Coordination with Engineering Consultant / Sub-Contractor for resolution of Non-Conformities.

5.2.3.5 Procurement Head:

Procurement Head shall be responsible for overall procurement of materials, packages and placement of work orders on sub-contractors for the project and reports administratively to Project Manager and functionally to respective SCM Head at RO.

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His responsibilities include:

- Implementation of Project Quality Plan with respect to SCM activities.
- Evaluation of vendors and Sub-contractors in coordination with QMD and Finance.
- Procurement of products, systems and services as per the project requirement.
- Coordination with Project Manager for material planning.
- Monitoring Vendors and sub-contractor's performance.
- Feed back to non-performing vendors and sub-contractors for improving their performance.
- De-listing the non performing vendors and sub-contractors.

5.2.3.6 Head - HR & Administration:

Head - HR & Administration shall be responsible for overall human resource development and deployment function and reports administratively to Project Manager and functionally to respective HR Head at RO.

His responsibilities include: -

- Manpower planning in consultation with Head – Metros, Tunnels & Waterways, Head - QMD and Head – SHE.
- Recruitment of manpower and arranging induction training.
- Performance management system and coordination for performance evaluation of employees, compensation, recognition and rewards.
- Employee welfare.

5.2.3.7 QMD Manager:

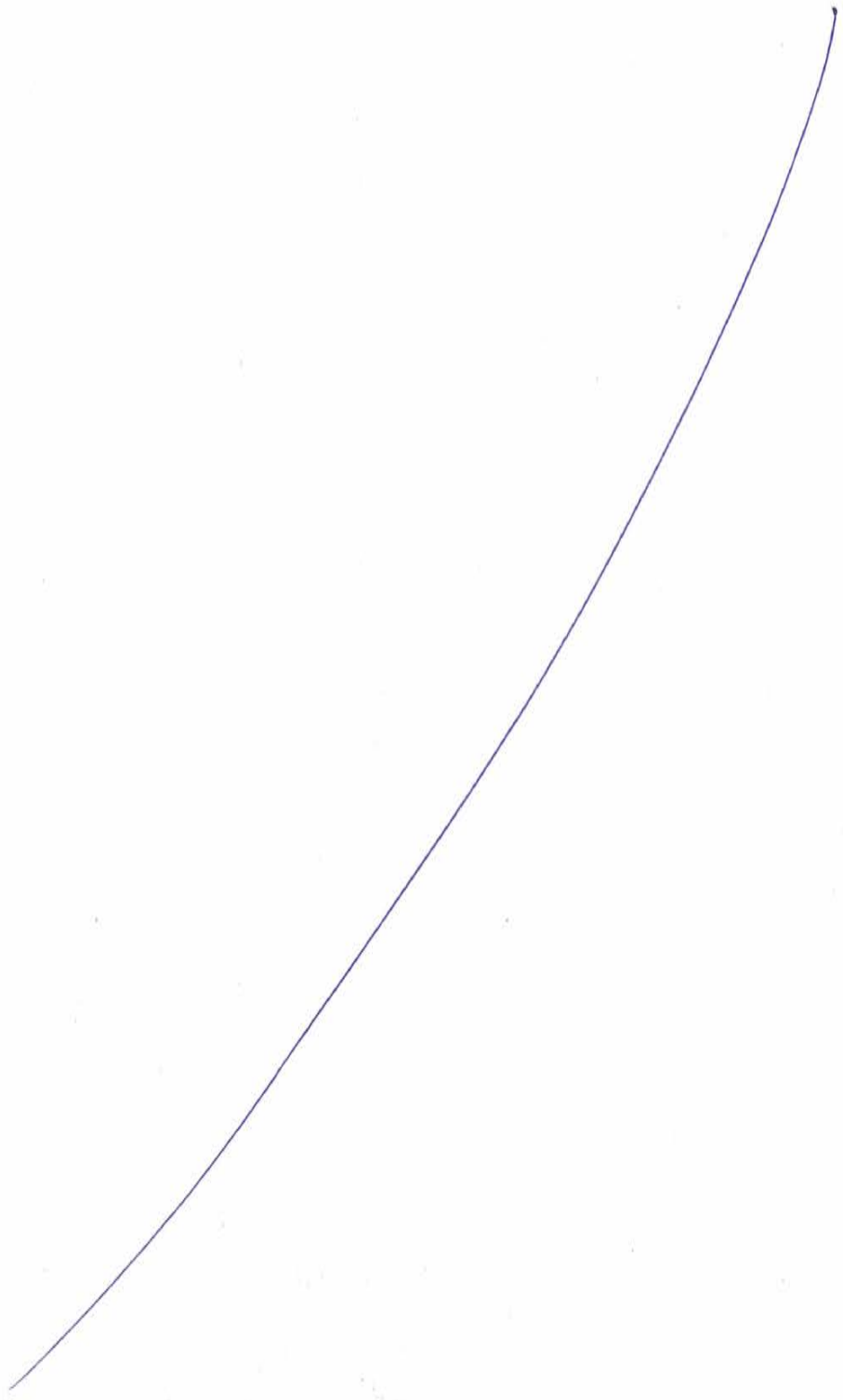
QMD Manager is responsible for overall Quality activities at site and reports functionally to Head QMD and administratively to Project Manager.

QMD Manager in co-ordination with Project Manager has the responsibility and authority to identify, initiate, recommend, control, and verify activities affecting quality. Also acts as a Management Representative at site for effective implementation of Project Quality Plan.

- Ensure the availability of approved Drawings, Quality records for supply items, ITPs, Method Statements / Procedures and Formats, as required.

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- Ensures establishing of Procedures for Special processes, such as Concreting (Design Mix), Piling, Pre-casting, Welding (WPS & PQR), etc.,
- Assist Project Manager in effective implementation of approved ITP, Method Statements and QC procedures.
- Co-ordination with Mumbai Metropolitan Region Development Authority (MMRDA) for timely inspection and clearances.
- Co-ordination for timely disposal of non-conformity reports
- Participate in Project Quality Audits as per the Schedule given by Head QMD.
- Organize and conduct Project Quality Management Review Meeting for every six months at site.

5.2.3.8 Deputy Project Manager – Viaduct / Stations:

Deputy Project Manager shall be responsible for Project Management at site and reports to Project Manager.

His responsibilities include: -

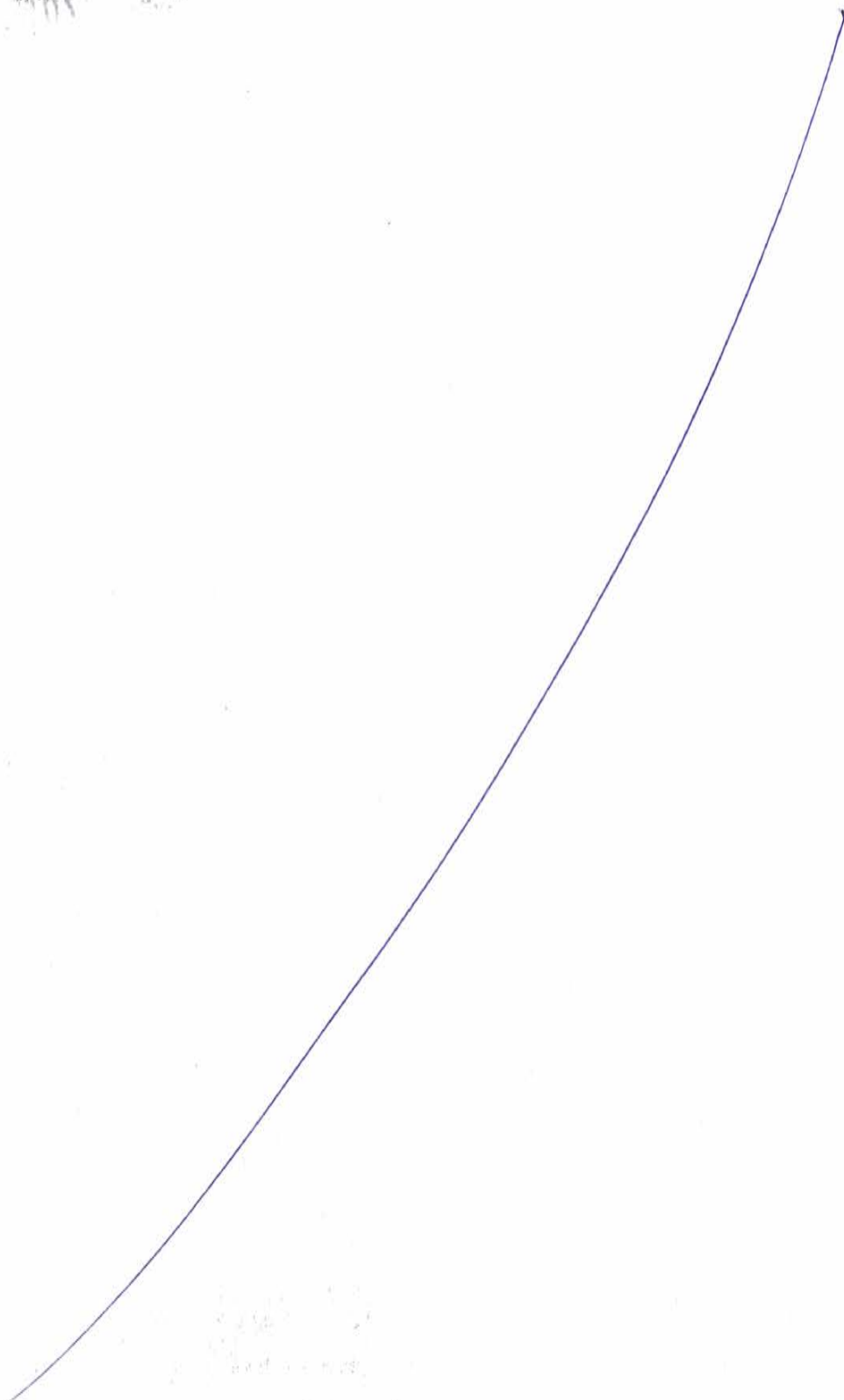
- Implementation of Project Quality Plan at site.
- Coordination with Mumbai Metropolitan Region Development Authority (MMRDA) and Project Manager for construction, installation and commissioning activities at site.
- Ensuring conformance to specified requirements.
- Progress monitoring and control of site activities
- Maintenance of documents received from RO, HO and Mumbai Metropolitan Region Development Authority (MMRDA), as applicable.
- Validation of special processes such as Design Mix for Concreting Works, Welding Process etc.
- Control of Customer supplied products (as applicable) at site.
- Control of storage, preservation and handling of material and equipment at site.
- Compliance to statutory and regulatory requirements.
- Maintenance of applicable Quality Records.

5.2.3.9 Field Quality Engineer / Inspector:

Field Quality Engineer/ Inspector functionally reports to QMD Manager, and

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Administratively to Project Manager. His responsibilities include:

- Receipt inspection of materials, equipment and other project items received at site.
- Organizing qualification tests as per ITPs / Method Statements.
- Stage and final inspection / tests as per ITPs / Method Statements at project site
- Coordination with Mumbai Metropolitan Region Development Authority (MMRDA) for stage / final inspection where required and obtaining clearances.
- Ensuring identification of products and traceability as required and indicating inspection and test status of jobs inspected.
- Identification of non-conformities and coordination for resolving Non-Conformities (NCs).
- Review calibration certificates of Inspection, Measuring and Monitoring Devices (IMME) and equipment (as required) to ensure valid calibration of IMME under use and maintenance of calibration status.
- Maintaining applicable Quality records.

5.2.3.10 Section / Area In-Charge

Section / Area In-charge shall report to Deputy Project Manager and shall be responsible for supervision of related Construction activities in the Section / Area.

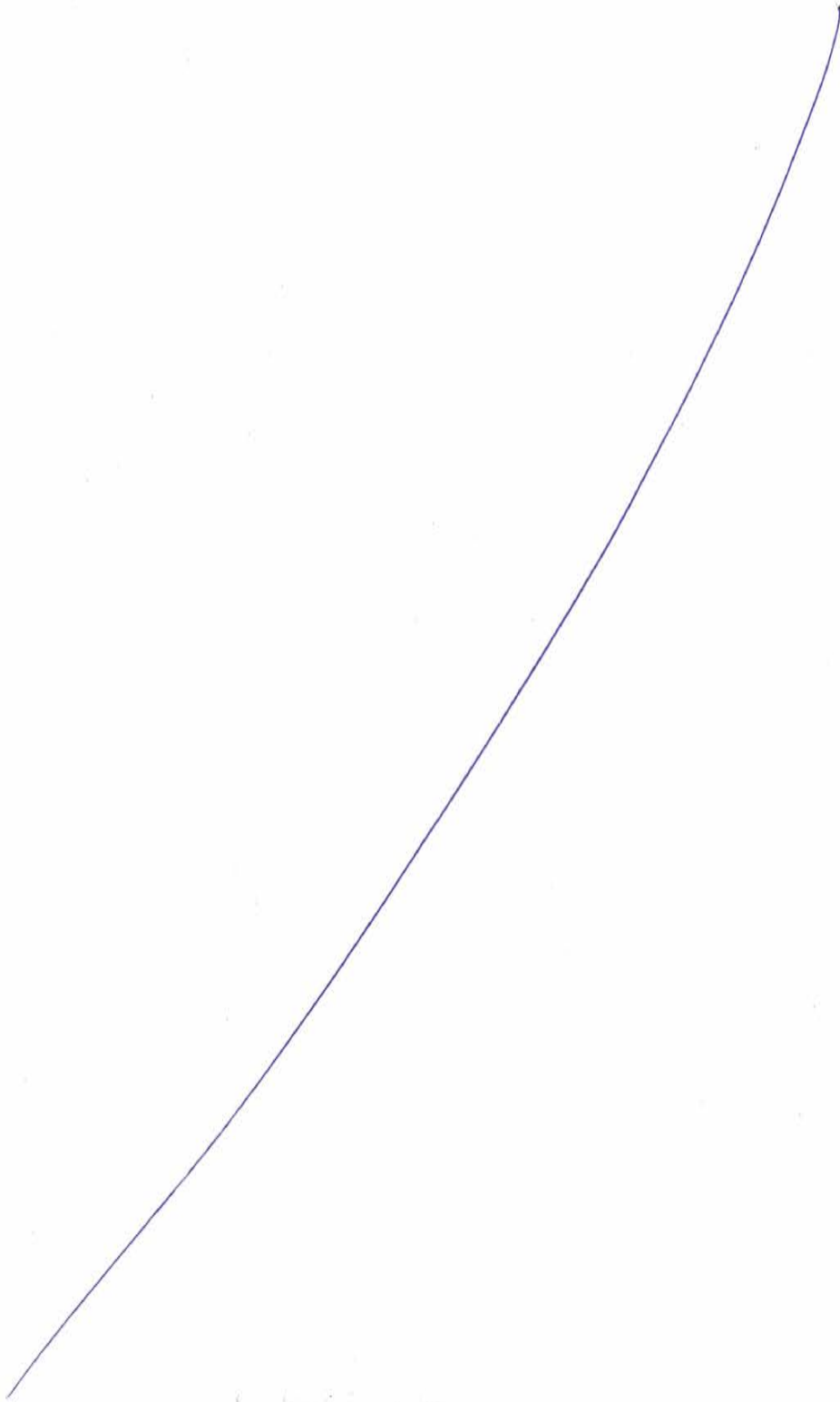
- Withdrawal of materials and equipment from construction stores.
- Instructing, assigning and supervising of works allotted to various sub-contractors.
- Ensuring fabrication and erection activities under controlled conditions in line with applicable Method Statements / Inspection and Test Plans / Procedures and instructions.
- Coordination with Field Quality Engineer / Inspector for inspection and testing as per related ITP and Method Statements.
- Organizing necessary arrangements for Inspection, Special Processes such as Concreting, Piling, Pre-Casting, Testing, as required.
- Ensuring proper identification of components / Structures / Assemblies.

5.2.3.11 Surveyor:

Surveyor shall report to Section In-charge and shall be responsible for Day to Day Planning and carrying out Survey activities at site along with preparation of Survey records based on

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the approved drawings and standards duly approved by Mumbai Metropolitan Region Development Authority(MMRDA).

5.2.3.12 Sr. Engineer / Engineer / Pre-stressing Engineer:

Sr. Engineer / Engineer shall report to Section In-charge & Pre-stressing Engineer reports to Dy. Project Manager and shall be responsible for day to day planning of site, construction / Casting activities and preparation of Construction / Casting records based on the approved drawings and standards duly approved by Mumbai Metropolitan Region Development Authority(MMRDA).

5.2.3.13 Stores Officer (SO):

Applicable Procedure: Procedure for Stores Officer – STP – 7.5.5 (Annexure-IV)

SO is responsible for receipts, storage and issuance of materials and equipment received from vendors, sub-contractors and Mumbai Metropolitan Region Development Authority (MMRDA), and reports to Deputy Project Manager. His responsibilities include:

- Receipt of materials and equipment and obtaining Inspection clearance from the concerned Field Quality Engineer / Inspector on Material Receiving Reports.
- Storage and protection of accepted materials and equipment.
- Issuance of materials and equipment as per Material Issues Vouchers raised by Sub-Contractors / Section In-charge / Sr. Engineer.
- Updating of stock Registers / records.
- Segregation of rejected material / items.
- Proper handling of Customer supplied materials and equipment.

5.2.3.14 SHE Manager:

SHE Manager shall report administratively to Project Manager and functionally to Head – SHE at HO. Refer Approved SHE Plan.

6.0 RESOURCE MANAGEMENT

6.1 PROVISION OF RESOURCES

Head Metros, Tunnels & Waterways / Head – Operations, Head – CMD and Head – SHE shall identify required resources like personnel, equipment, finance, facilities, services etc.,



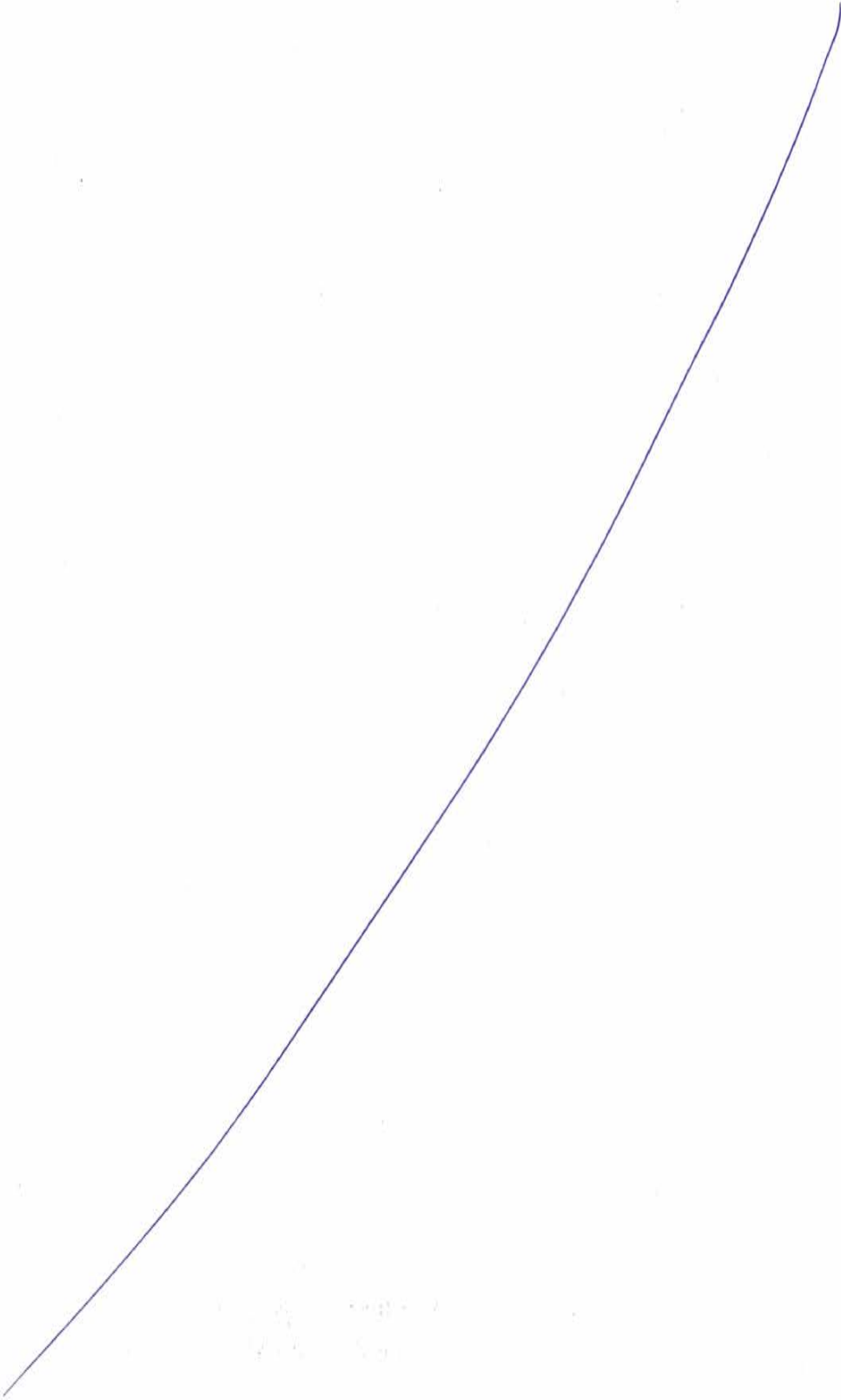
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and arrange the resources are made in coordination with HR, Fleet Management, and Finance, Administration etc for implementation of Project Quality Management System and for continual improvement.

6.2 HUMAN RESOURCES

6.2.1 General

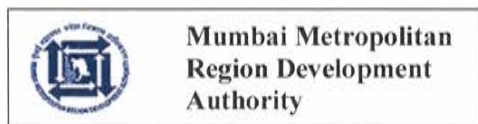
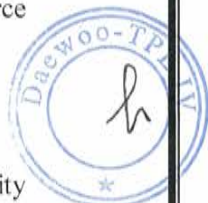
DAEWOO E&C-TPL JV Management provides competent personnel required for execution of the project. The competencies required for personnel performing work affecting conformity to product requirements directly or indirectly (affecting Quality) shall be assessed based on appropriate education, training, skills and experience.

6.2.2 Competence, Awareness and Training

- (a) Head – Metros, Tunnels & Waterways, Head – QMD and Head – SHE assesses the necessary competencies needed for personnel performing the work affecting conformity to product requirements directly or indirectly (Quality) in association with Head-HR. While assessing the existing competence of people in annual performance appraisal, the gaps and training needs shall be identified. Based on this, Head - Learning & Development arranges necessary training for the personnel or Head – HR for other actions like recruiting competent personnel for filling the gaps or outsourcing.
- (b) Head - Learning & Development evaluates the effectiveness of training / actions taken through feedback obtained from concerned Head – Transportation & Hydro, concerned Heads - Enabling Services, Head – QMD and Head – SHE and employees.
- (c) Head – Transportation & Hydro, concerned Heads - Enabling Services, Head – QMD and Head – SHE ensure that the employees are aware of the relevance and importance of their activities for achieving Project Quality Objectives.
- (d) The training records shall be maintained as per procedure for Human Resource Management.

6.3 INFRASTRUCTURE

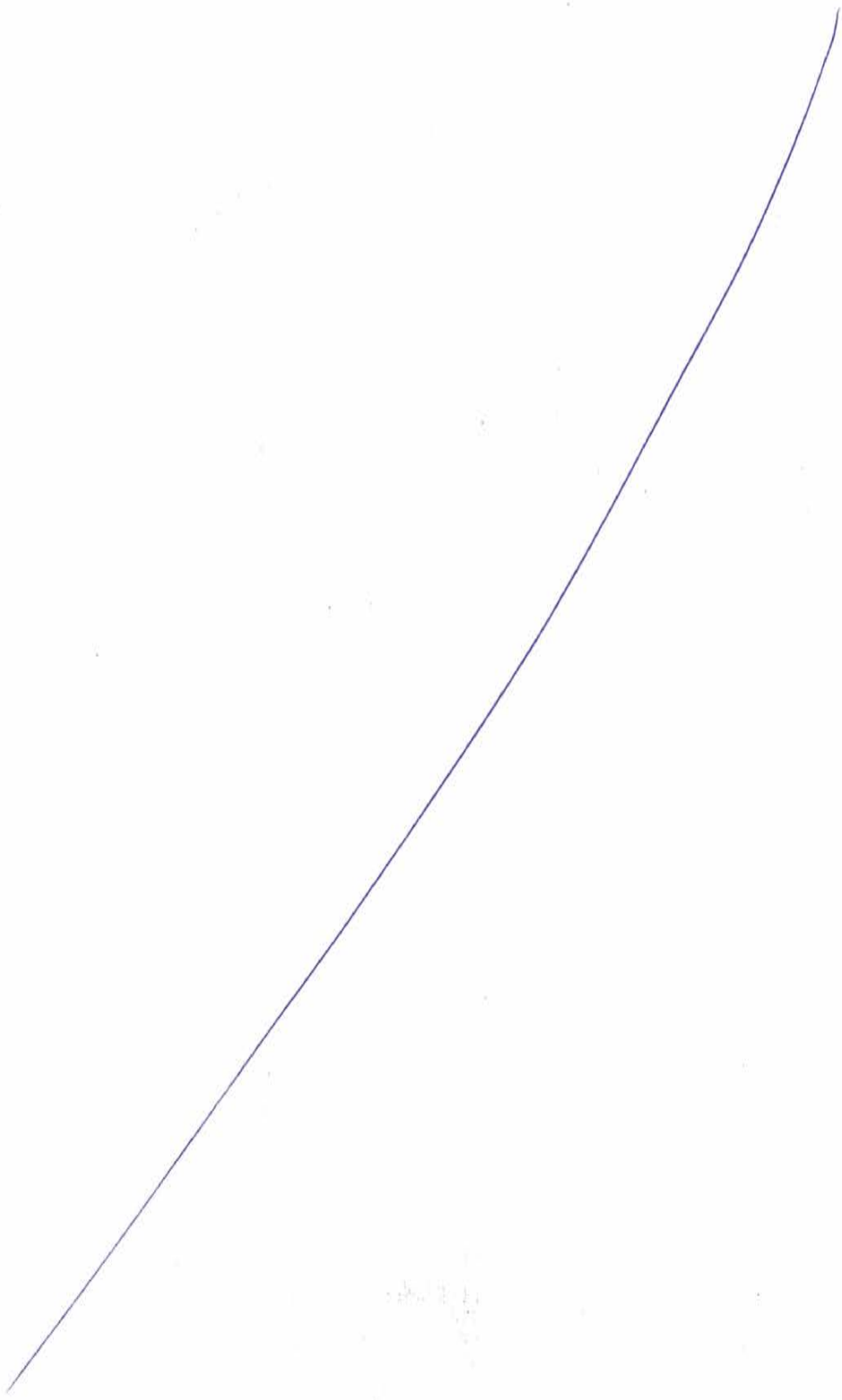
DAEWOO E&C -TPL JV provides the required infrastructure needed to achieve the Quality as per the requirements. In-Charge HR in co-ordination with Project Manager will arrange the following at site.



DOCUMENT TITLE

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- Office building
- Store building
- Software requirements
- Process equipment
- Water & Electrical facilities
- Communication facilities
- Medical facilities in emergency
- Transport facilities
- Information Systems

6.4 WORK ENVIRONMENT

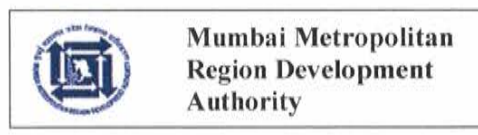
For motivating and to realize full potential of employees and to ensure product conformity requirements, a positive work environment is maintained. In-Charge HR in co-ordination with Project Manager will arrange the following at site.

- House keeping
- Environment protection Sheds requirements (if any)
- Lighting arrangements
- Safety devices
- Storage Facilities
- Statutory & contract requirements.

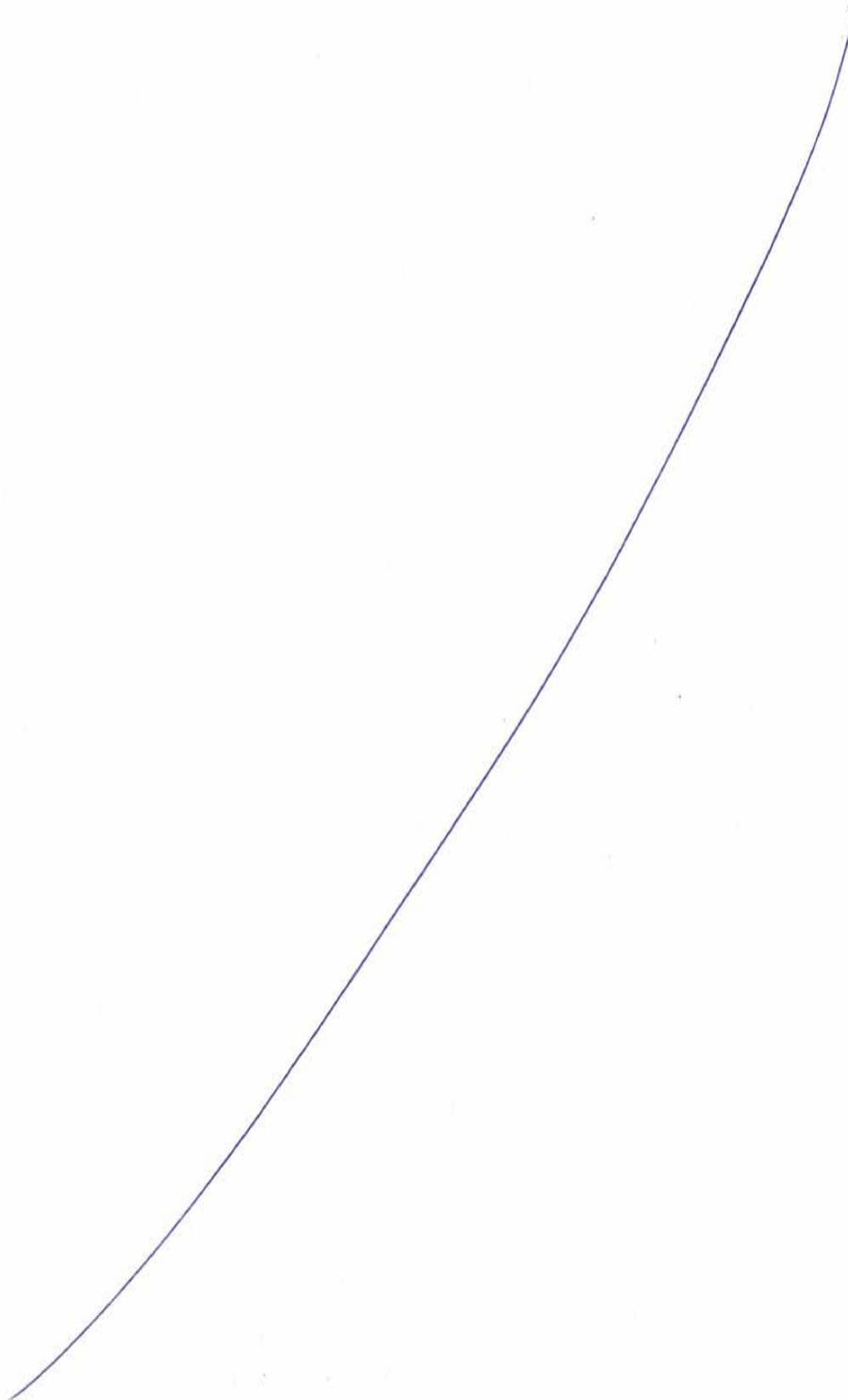
7. PROJECT REALISATION

7.1 PLANNING OF PROJECT REALISATION

(a) Project Manager shall prepare an organization chart for the project including site organization and communicates to all concerned after obtaining the approval of Customer. Site organization chart shall include Planning, HR, Safety, Quality, Site Stores and construction groups (Annexure-III)



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- (b) Project Manager shall prepare Project Control Budget (Supplies & Site budget) for the project indicating the break up cost for each Sub System / Package / Work element and obtains approval from Head –Transportation & Hydro.
- (c) Project Manager and Head – SCM shall meet major suppliers / contractors and defines the boundary limits with various contractors before starting of project.

7.2 CUSTOMER RELATED PROCESS

7.2.1 Determination of requirements related to the Project

- (a) Requirements specified by Customer including the requirements for delivery and post-delivery activities shall be as per the tender specifications and agreed deviations, if any.
- (b) Statutory and regulatory requirements related to the Project and any additional requirements shall also be taken into consideration during detail engineering stage.

7.2.2 Review of requirements related to the Project:

On receipt of contract from Customer, the same shall be reviewed for the following:

- (a) Whether the requirements are adequately defined.
- (b) Whether the clarity and completeness exists in documents / specifications / drawings.
- (c) Whether discrepancies between bid and contract, if any are resolved.
- (d) Whether capability exists with the company to execute the project.
- (e) Any special requirements of Customer.

7.2.3 Customer Communication

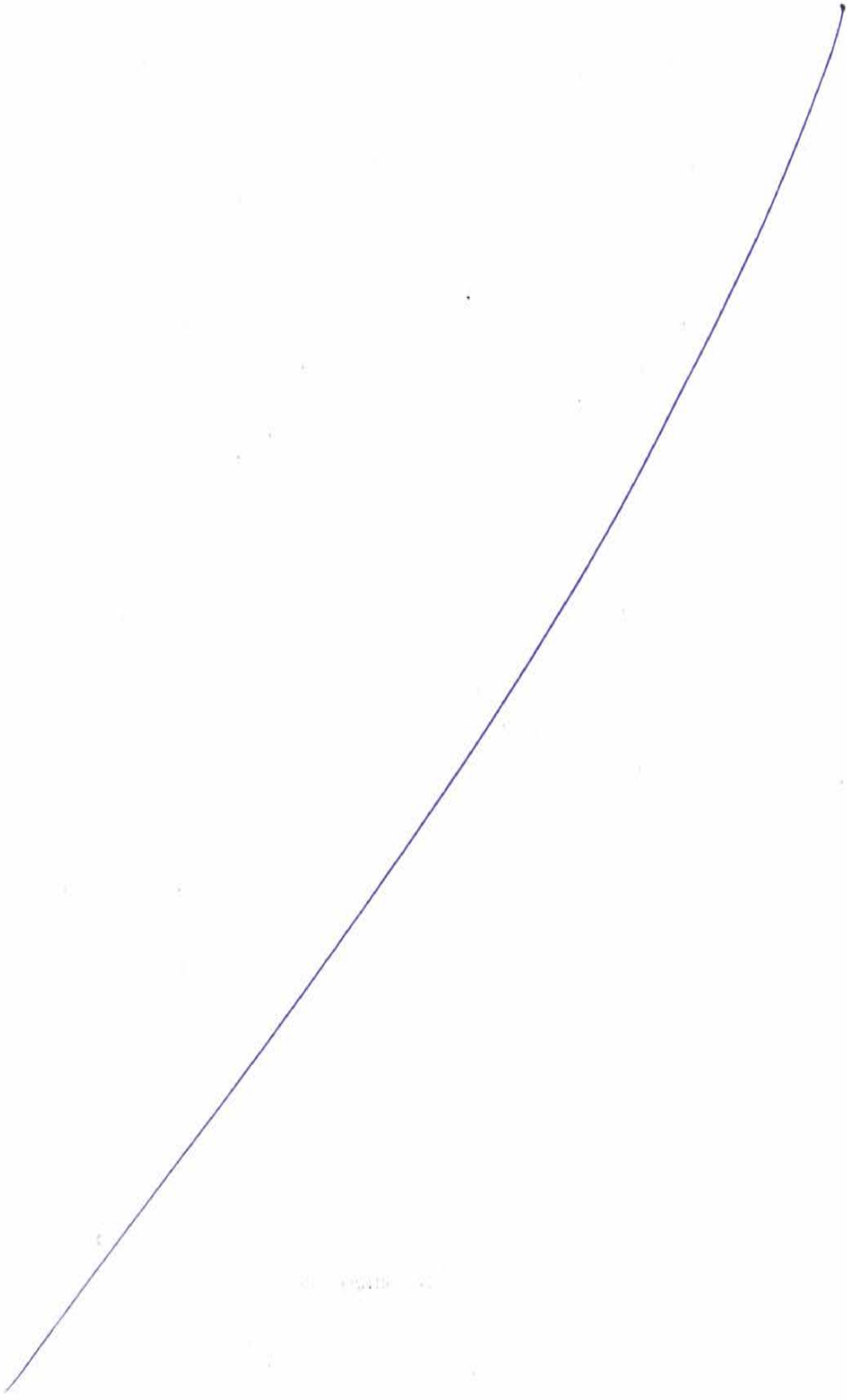
Following communication channels shall be used.

- (a) Concerned department Heads / In-charges shall prepare Master list of Documents to be made for the project and submit to Mumbai Metropolitan Region Development Authority (MMRDA) for approval through Documents Controller for monitoring later.
- (b) Project Manager and other concerned members shall attend weekly & monthly review meetings and furnish required information, discuss relevant points, if required contractually.



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- (c) Project Manager / Deputy Project Manager shall prepare, review and furnish Project status reports to customer at agreed frequency such as Weekly, Monthly, milestones etc.
- (d) Obtain written confirmation for verbal instructions given by Mumbai Metropolitan Region Development Authority (MMRDA) representatives.
- (e) Project Manager shall co-ordinate with concerned and resolve Customer Complaints.

7.3 DESIGN & DEVELOPMENT

Applicable Procedure: Procedure for Engineering Activities (Annexure-IV)

7.3.1 Design and Development Planning

Project Manager in coordination with Design Head shall prepare Engineering plan for the project. The plan shall describe or reference to the design and development activities and define responsibilities for their implementation. The Plan shall also identify the requirement of design review and verification. Design plan shall be updated as the design progresses.

7.3.2 Design and Development Inputs

Design Head shall receive design inputs for the project which include functional and performance requirements as stated in the contract, technical specifications, data sheets / drawings, applicable codes and standards, applicable statutory and regulatory requirements. Engineering Coordinator along with Engineering Consultant / Sub-Contractor reviews the inputs for adequacy and maintains records.

7.3.3 Design and Development Outputs

Design Head along with Engineering Consultant / Sub-Contractor ensures that the design output meets the following:

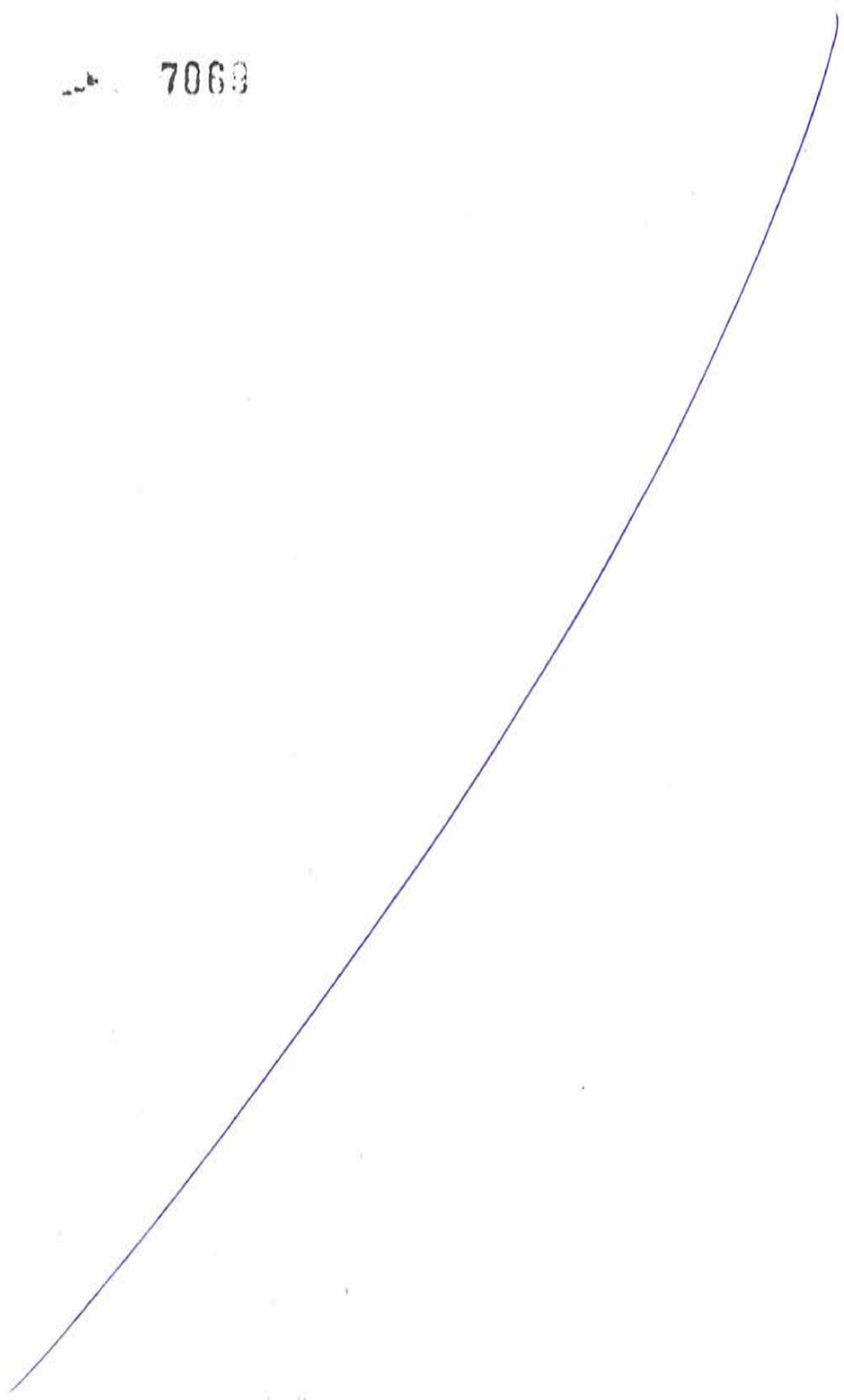
- a) Design Input requirements
- b) Contain or make reference to acceptance criteria.
- c) Specify the characteristics, which are critical to safety and proper functioning of the system / package after installation.

7.3.4 Design and Development Review



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Design Head shall carryout Design Review at appropriate stages as per Engineering plan to evaluate the ability of the results of design and development activity to meet the requirements. If any problem is identified, corrective actions are initiated. Records of reviews shall be maintained.

7.3.5 Design and Development Verification

Design Head shall verify the design documents as received from Engineering Consultant / Sub-Contractor to ensure that the design output conforms to design input requirements before submitting to Mumbai Metropolitan Region Development Authority (MMRDA) for approval. Design Head shall maintain records of design verification.

7.3.5.1 Control of Issue of Design documents (Drawings, Data Sheets)

- Design Head shall stamp "Approved for Construction" in red on the Design documents and issue to the concerned as per the distribution matrix along with Document Transmittal through Document Controller.
- Design Head shall maintain Master list of Design Documents, with revision status and made available to the concerned.

7.3.6 Control of Design and Development Changes

All design changes are identified, documented, reviewed and approved before implementation. While approving the changes, the effect of changes on parts / subassemblies already delivered to Project site shall be evaluated.

Design Head shall also issue the revised Design documents to all the concerned as detailed in paragraph 7.3.5.1

After receipt of revised design documents, the superseded version of the documents shall be withdrawn by the concerned.

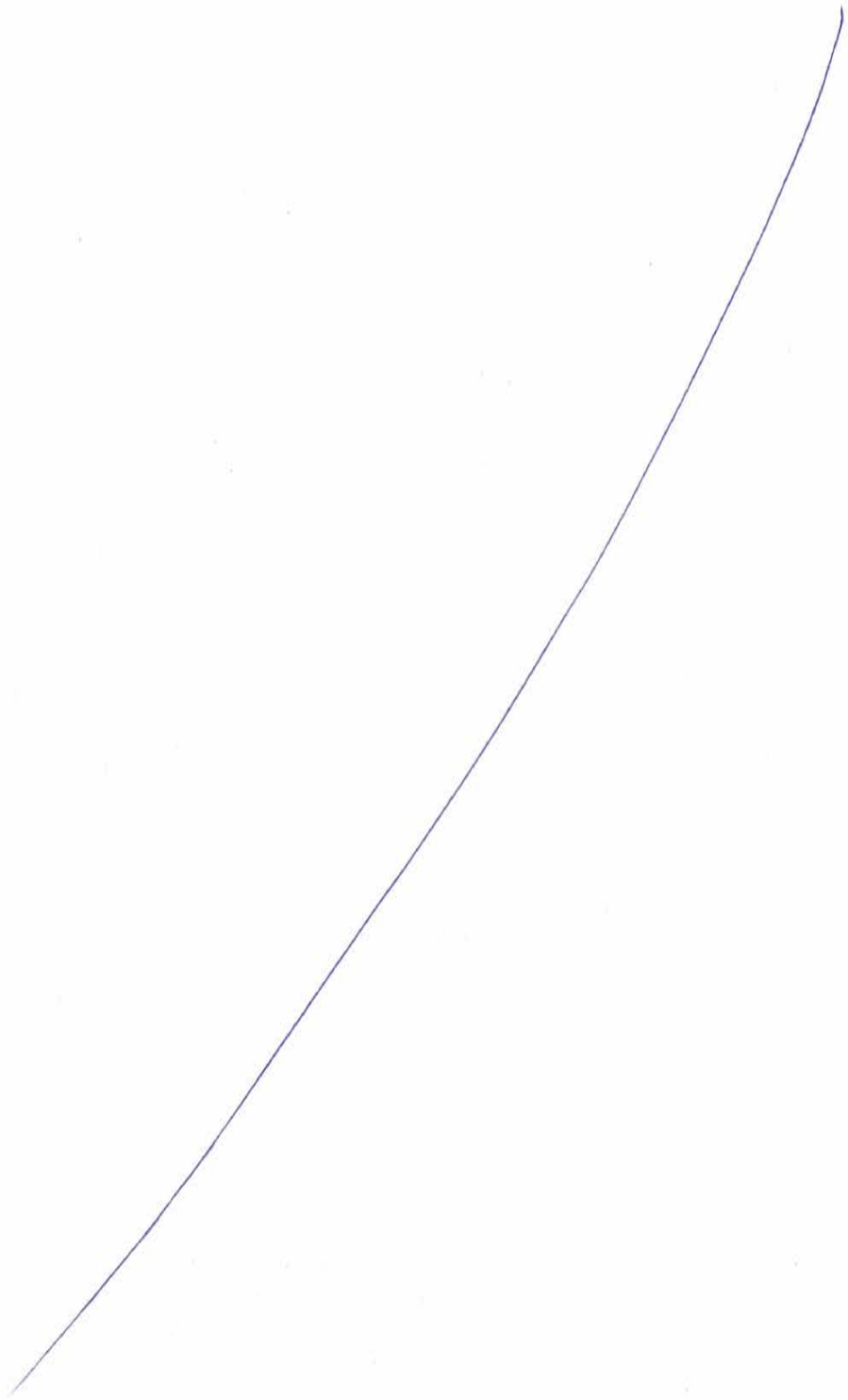
7.4 PURCHASING OF MATERIALS AND SUB-CONTRACTING OF WORKS / SERVICES

Applicable Procedure: Procedure for Supply Chain Management – SCP-7.4.0 (Annexure-IV).

Project Manager shall prepare schedules for the procurement and issue to Procurement Head for implementation.

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- a) Procurement Head is responsible to place orders and ensures delivery as per project schedule. Head-SCM, shall periodically review progress and take suitable action in case of delays.
- b) Procurement Head shall be responsible for procurement by placing POs / WOs / Contracts for Products / Systems / Services indented for the project as detailed in "Procurement Procedure".

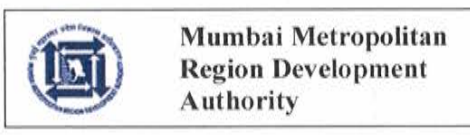
The Procurement Procedure covers the following activities:

- Vendors / Subcontractors Evaluation and Selection (Applicable Procedure: Procedure for Vendor / Contractor Capability Evaluation and Performance Monitoring – TCI – 14, Annexure-IV).
- Placement of Purchase Orders / Work Orders
- Follow-up and Expediting
- Contracts

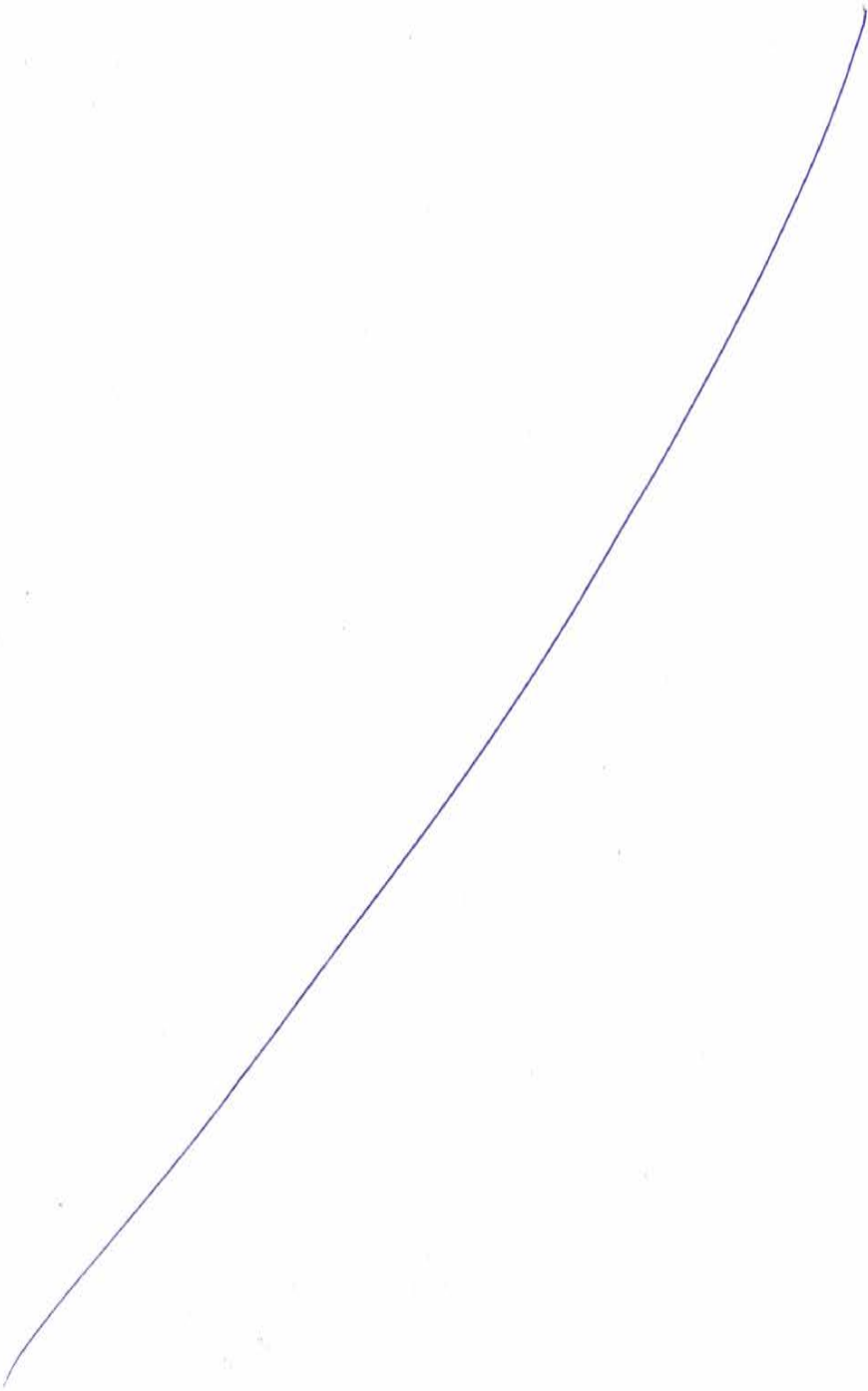
7.4.1 Verification of Purchased Product

Head-QMD shall be responsible for organizing inspection and testing of purchased / sub-contracted items at Vendor(s) / Sub-contractors premises.

- a. On receipt of MQP / QAP from vendor(s), Inspection Coordinator will review and Dy. Head-Supplies Inspection will approve the same and submit the same to Mumbai Metropolitan Region Development Authority (MMRDA) for Approval (as required).
- b. On receipt of related procedures for Inspection, Testing and any Special Processes from vendor(s), Inspection Coordinator will review and Dy. Head-Supplies Inspection will approve the same and submit the same to Mumbai Metropolitan Region Development Authority (MMRDA) for Approval (as required).
- c. After Receipt of Approval for MQP/ QAP from Mumbai Metropolitan Region Development Authority (MMRDA) the same will be issued to vendor for compliance.



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- d. Inspection Coordinator will provide approved MQP/ QAP, Purchase Order, relevant project specifications / drawings / data sheets to the concerned Quality Surveyor for carrying out the inspection.
- e. Stage Inspections and Final Inspections will be carried out as per approved MQP/ QAP.
- f. As and when the inspection calls are received from the Vendor(s) as per approved MQP / QAP, Inspection coordinator will coordinate with concerned Quality Surveyor and Mumbai Metropolitan Region Development Authority(MMRDA) (as required) for inspection.
- g. Concerned Quality Surveyor and Mumbai Metropolitan Region Development Authority (MMRDA) will carry out inspection of the Item(s) as per PO, Approved MQP / QAP, relevant Standards and Drawings / Data Sheets, as applicable.
- h. After satisfactory completion of inspection and review of the documents of the item(s) as per the Approved MQP / QAP, Concerned Quality Surveyor will issue Acceptance Cum Release Note (ACRN).

7.5 PRODUCTION AND SERVICE PROVISION

7.5.1 Project Execution

I. Planning:

a. Planning for Project Documents:

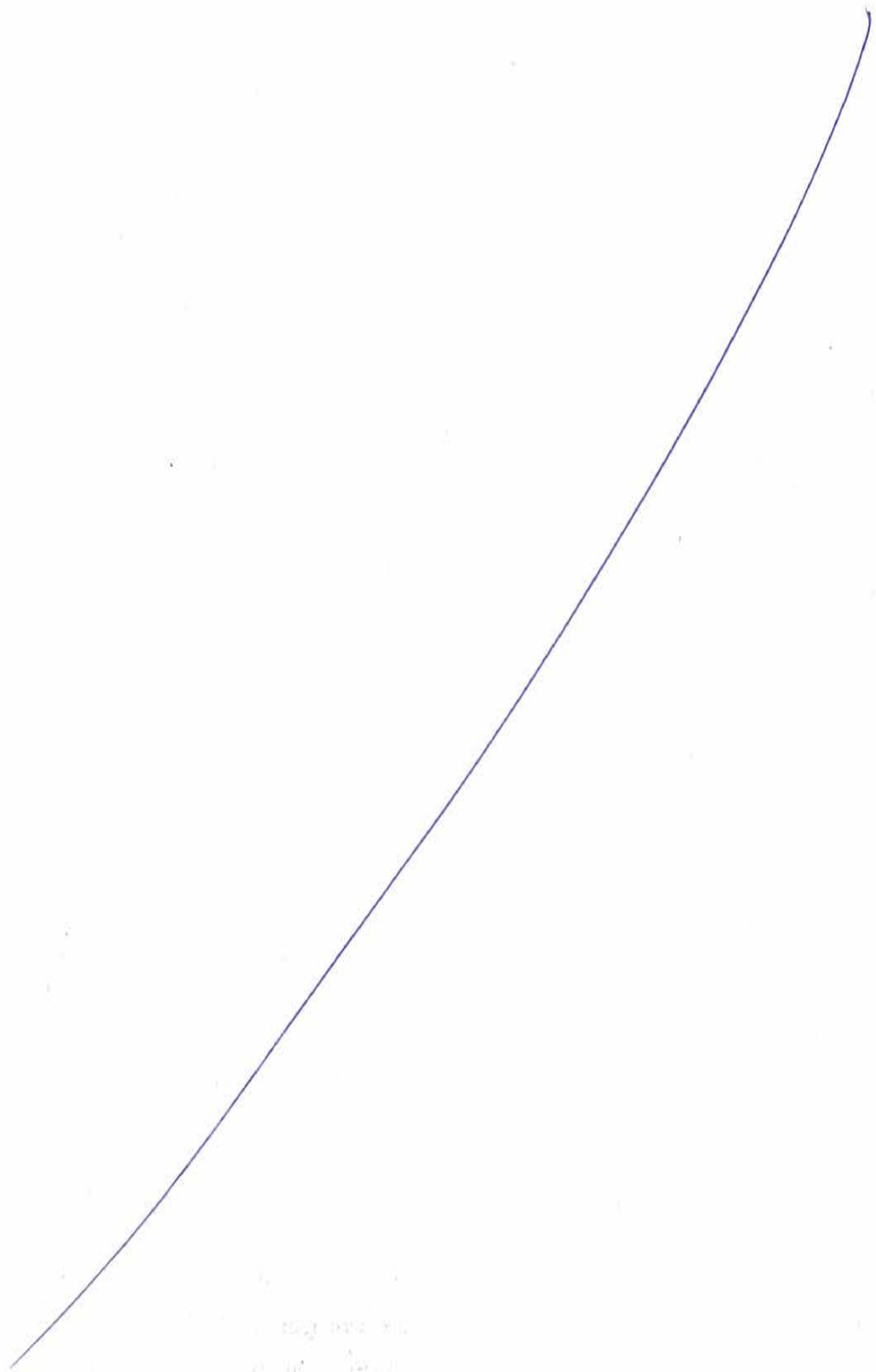
The following documents are issued to Project Manager to ensure that the construction and installation activities are carried out under controlled conditions.

- Contract and related specifications
- Approved Organogram
- Approved Project Quality Plan
- Approved SHE Plan
- Drawings / data sheets required for erection
- Approved ITP and Method Statements
- Equipment installation manuals
- Approved Project Schedules



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- Copies of POs for supplies and WOs for Construction and Erection services.
- Approved Construction Instructions
- Inspection clearance certificates for the material / equipment cleared by Maharashtra Metro Rail Corporation Ltd (MMRDA)

b. Planning for Construction Equipment / Tools / Tackles

- Project Manager coordinates with Deputy Project Manager and Head - Fleet Management to arrange dispatches to the site necessary construction equipment, tools and tackles that are available either at central stores, Hyderabad or at other sites and supplies the items, if any.
- Head - Fleet Management raises indents based on project requirement to Procurement Head for procurement of balance construction equipment, tools / tackles, if they are required to be purchased.
- Project Manager Purchases tools and tackles urgently required at site with prior approval of Project Manager and sends lists to Project Manager and Fleet Management for records. Procurement Head / Project Manager shall purchase tools and tackles as per technical specifications, Statutory & Regulatory requirements and get them inspected prior to use.

c. Planning for Project Materials and Equipment

- Project Manager shall prepare schedules for the procurement and issue to Head-SCM for implementation.
- Procurement Head shall arrange the project materials and equipment as per the Project Schedule as detailed in Paragraph no. 7.4.

d. Planning for Manpower

- Project Manager shall prepare manpower requirements of Engineers and Personnel for head office. Project Manager shall also prepare manpower requirement in consultation with Deputy Project Manager at project site and sends a requisition to Head - HR & Administration for the required manpower. Project Manager shall consider the skills and experience of personnel needed for the project while planning the manpower.



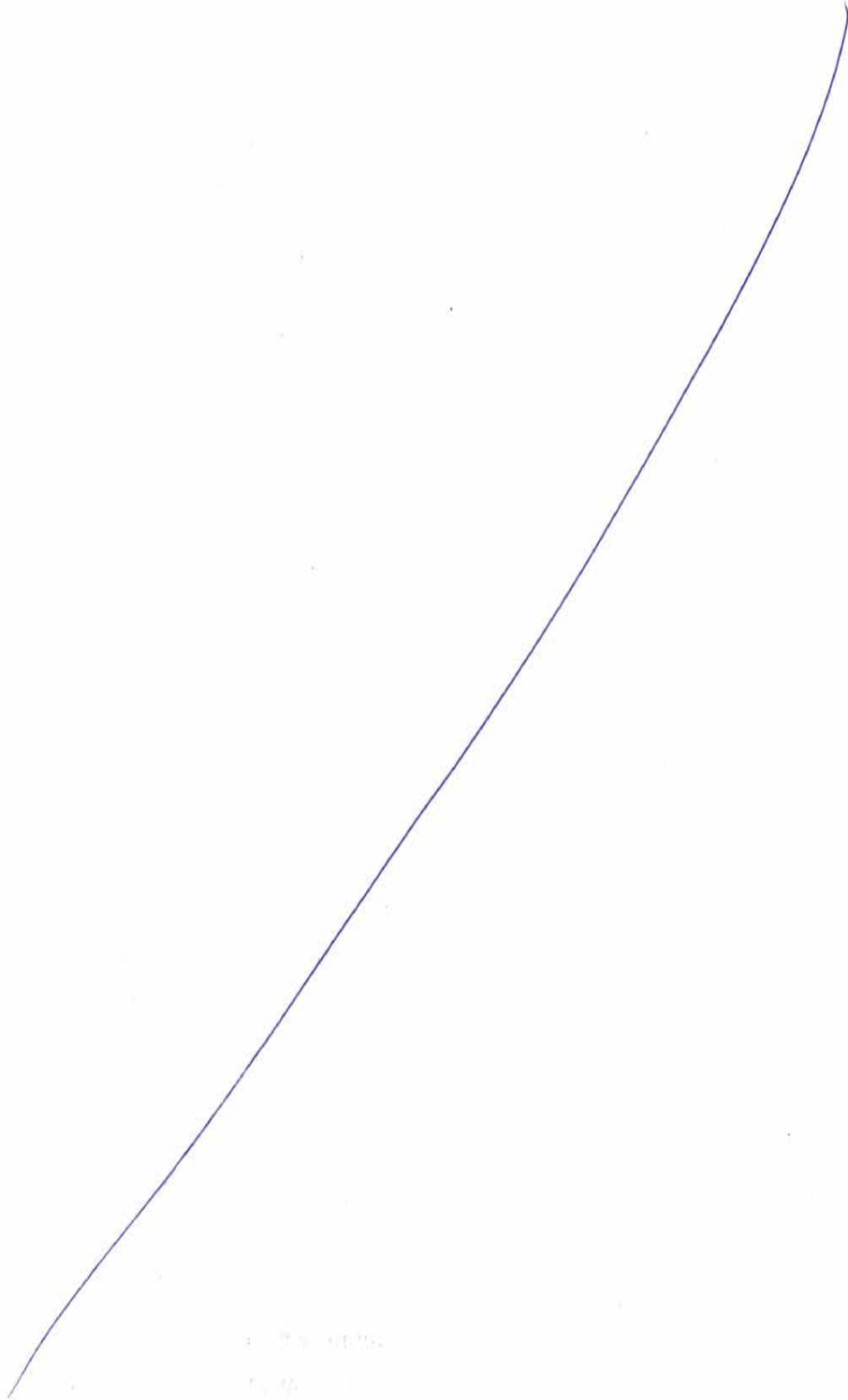
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- Head - HR & Administration shall arrange the required manpower. Project Manager shall coordinate with Head - HR & Administration for a phased deployment and demobilization as per work requirements at project site.
- e. Project Manager shall prepare schedules for the project site activities and issue to Deputy Project Manager for implementation. Project Manager shall be responsible for implementation of overall project schedules at site. Deputy Project Manager and Project Manager shall periodically review progress and take suitable action in case of delays.

II. Control of construction / installation processes at site.

- a. Project Manager shall be responsible for implementation of project schedules at site and ensure that construction activities are carried out in line with specified requirements.
- b. Project Manager shall assign the supervision of construction activities to Construction Engineers.
- c. Project Manager shall ensure that applicable special processes are identified and procedures and operators are qualified for the same (eg. Concreting, welding etc.). Records of the same shall be maintained.
- d. Project Manager shall ensure that suitable equipment, tools and tackles are used during construction and erection at site. He shall also ensure proper maintenance of the same at Project site.
- e. Field Quality Engineer / Inspector shall verify and ensure that installation activities are carried out as per applicable specifications / drawings / codes / standards / Method Statements / instructions.
- f. Concerned Construction Engineers shall ensure that the essential process parameters are identified and maintained properly during installation and commissioning to ensure that the process capability is maintained.

III. Project Monitoring

Project monitoring shall be done by Head-Operations by reviewing the progress of the project through project review meetings. Periodical information regarding the project status shall be informed to management through Management Information System (MIS) reports.

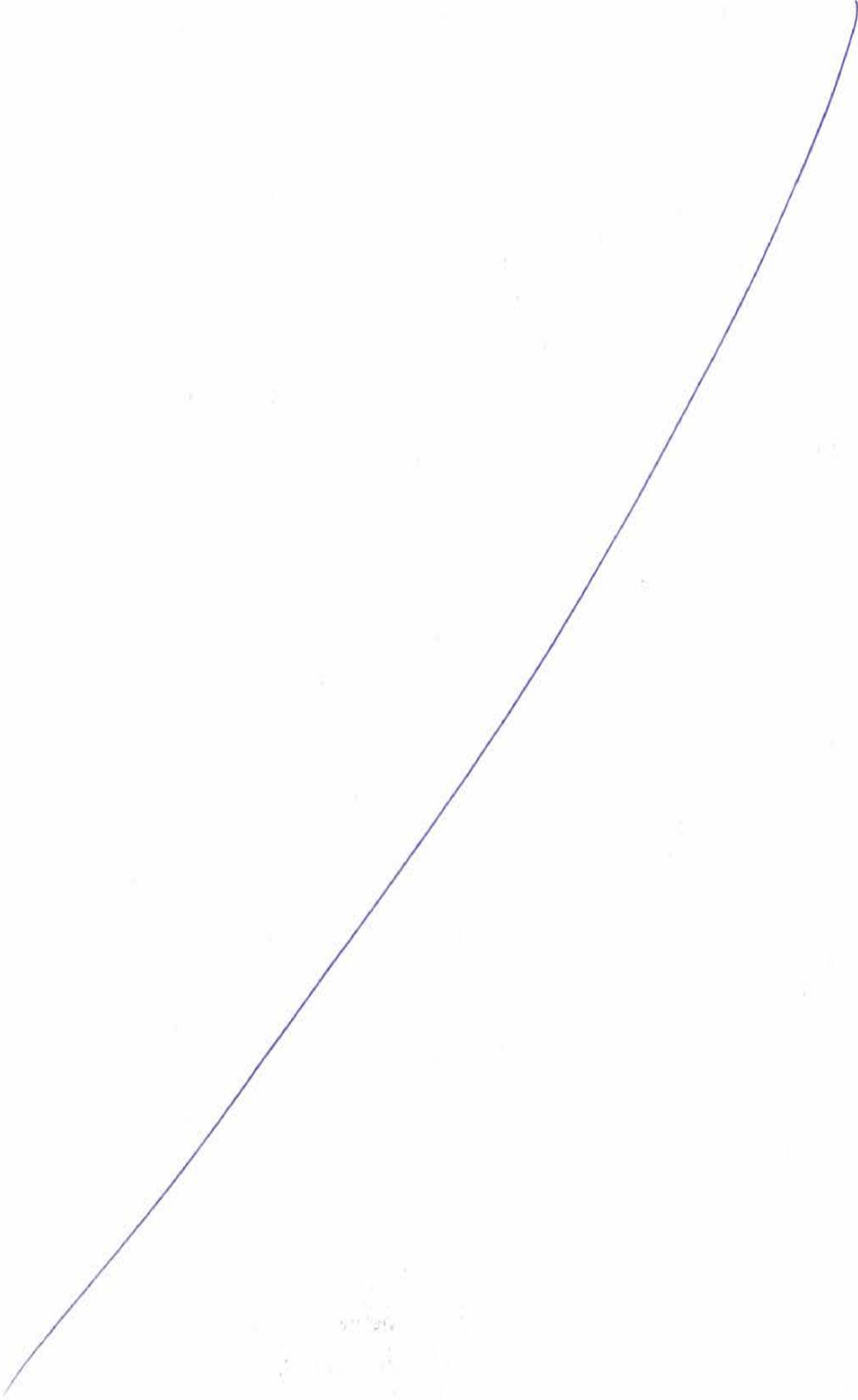


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IV. In-process inspection and testing

- a. Field Quality Engineer / Inspector and shall carry out stage inspection / final inspection of construction activities at predetermined stages as per approved ITPs and Method Statements.
- b. In case of nonconformity observed during inspection and test activities, Field Quality Engineer shall raise the NCR and process as detailed in Paragraph No. 8.3

V. Delivery

Project Manager shall be responsible for handing over the Project Systems / Sub-Systems to Customer after satisfactory completion of inspection and test activities as per related approved ITPs and Method Statements.

VI. Quality Compliance Index (QCI) – As per Annexure - VIII

QCI of Project site shall be assessed monthly based on following parameters for knowing the Quality status of the construction works at project site.

- Material testing as per ITP.
- Document and Data control.
- Material Storage.
- Process control
- Master list of measuring and test equipment.
- Post concrete checks.
- Quality Assurance.
- Training

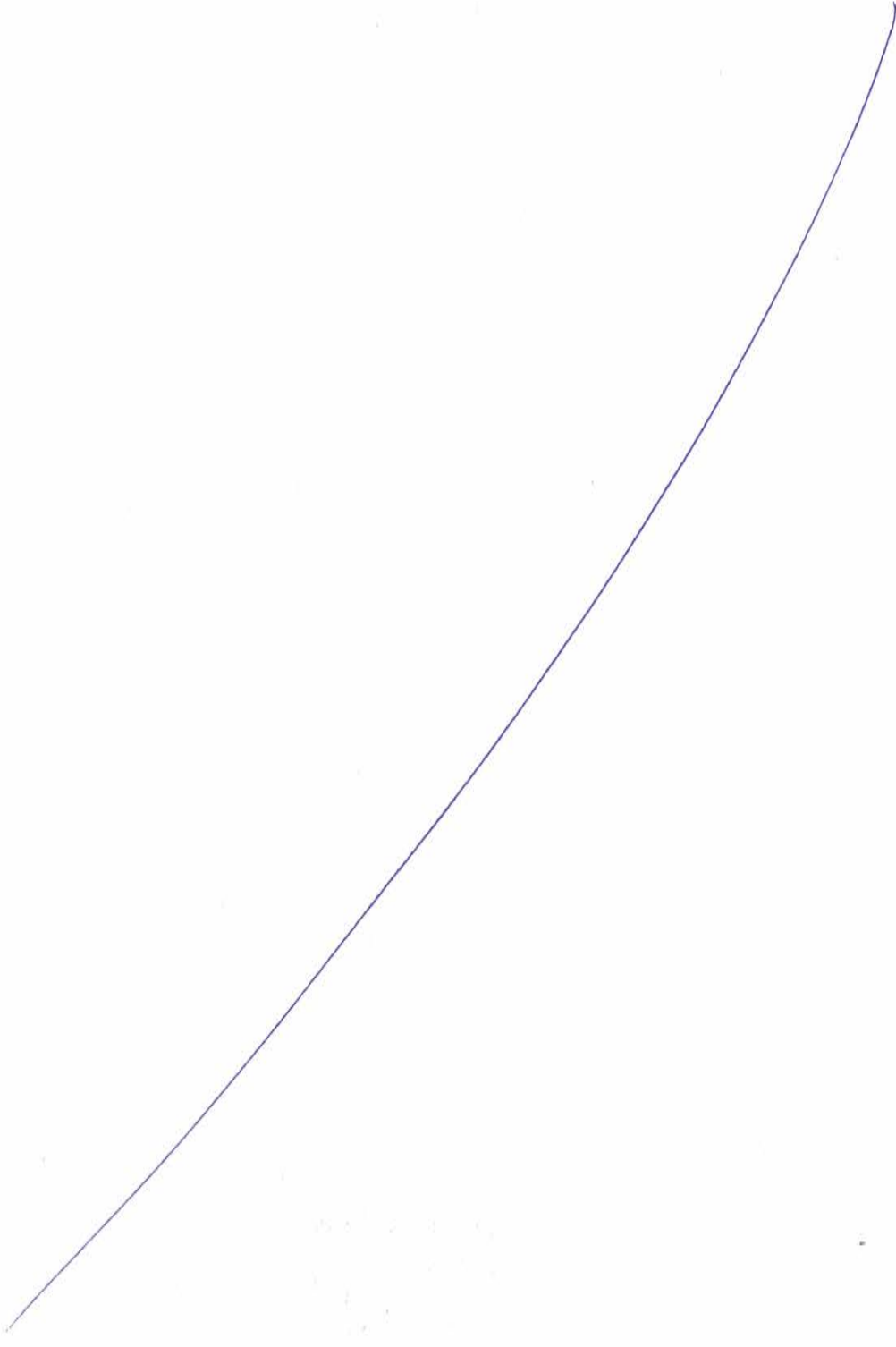
7.5.2 VALIDATION OF SPECIAL PROCESSES

QMD Manager in coordination with Project Manager shall ensure that applicable special processes are identified and procedures and operators are qualified for the same (e.g. Concreting) and Records of the same shall be maintained.

7.5.3 IDENTIFICATION, TRACEABILITY AND INSPECTION STATUS



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- a. Field Quality Engineer / Inspector shall verify the identification of products as per relevant specification during inspection and in addition ensure proper identification and traceability of products.
- b. Field Quality Engineer / Inspector shall ensure that identification of equipment / materials / components shall be maintained wherever it is required as per drawing / instructions. Field Quality Engineer / Inspector shall record the status of inspection and tests in the relevant inspection reports / test reports clearly indicating whether the products have been accepted, rejected, advised for rework, accepted with concession or kept on "HOLD".

7.5.4 CUSTOMER PROPERTY

- I. Project Manager shall be responsible for control of equipment / materials/ tools/ gauges/ instruments, received from Customer and ensure the following.
 - Verification on receipt.
 - Proper storage, handling and preservation
 - Maintenance of records.
- II. If any product received from the Customer is found to be short supplied, defective, damaged, lost or unsuitable, the same shall be reported to the Customer and records of such reports shall be maintained by Project Manager / Planning Manager / Stores officer.

7.5.5 PRESERVATION OF PRODUCT

I. Handling

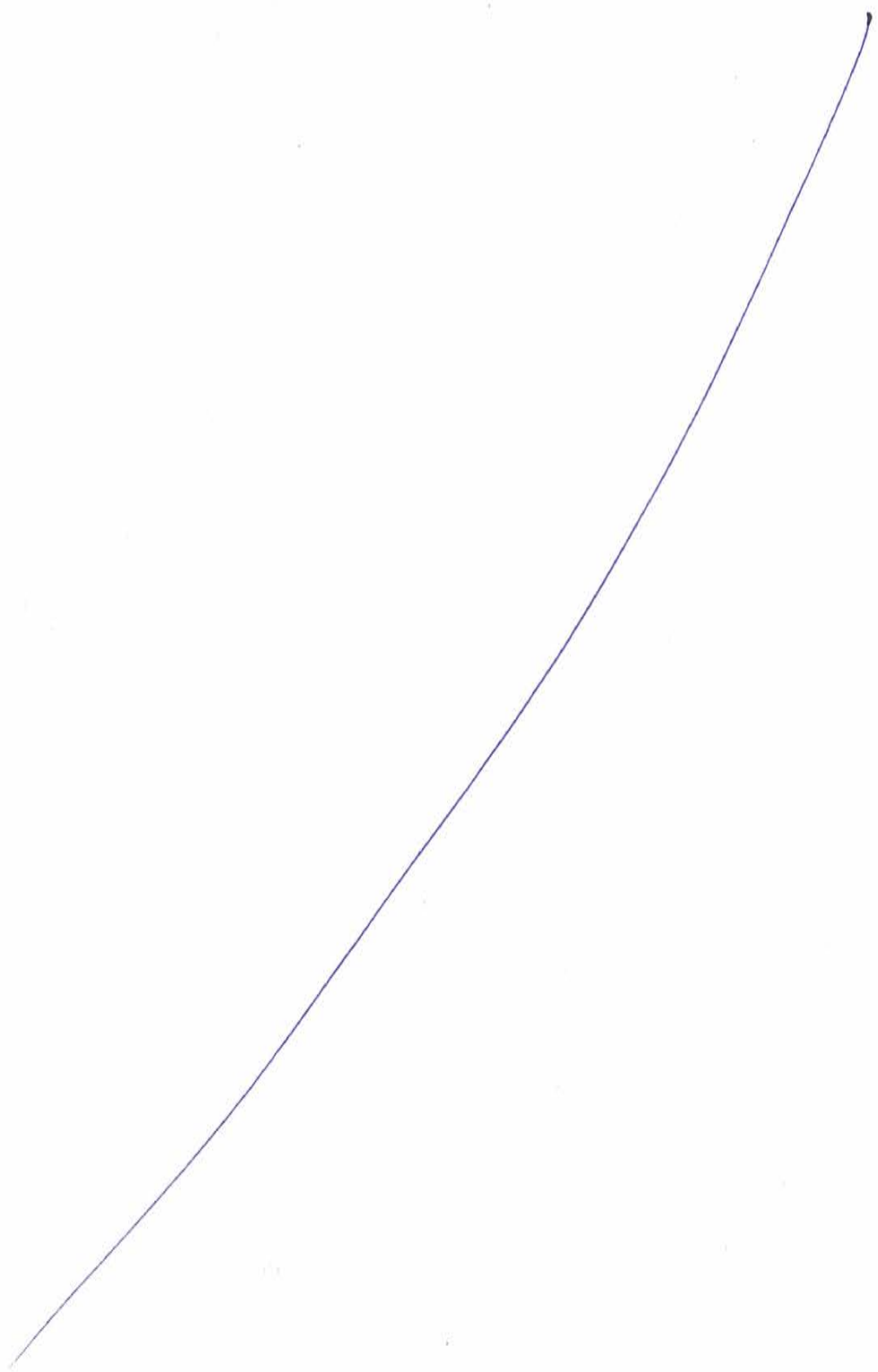
Project Manager shall be responsible to provide methods and equipment for handling to prevent damage / deterioration of items received at stores as well as during erection of equipment at site.

II. Storage

Stores Officer shall use designated storage area to prevent damage / deterioration of the products. Work instructions issued shall be followed for receipt and issue / dispatch from stores and also for physical verification of products in stock at appropriate intervals.

III. Preservation

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Project Manager / Stores Officer shall follow appropriate methods for preservation of items received at site as per applicable procedures / instructions.

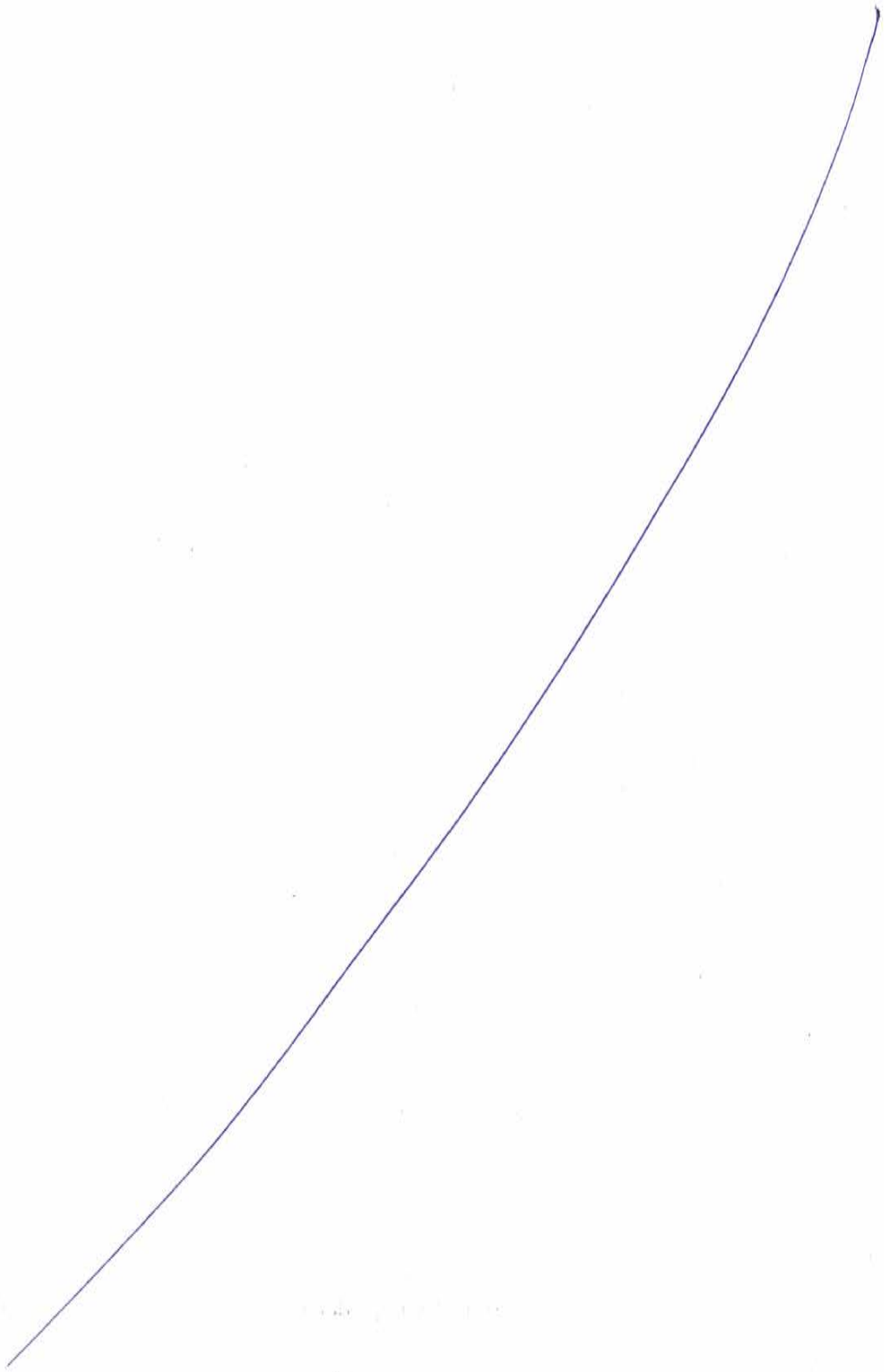
7.6 CONTROL OF INSPECTION, MEASURING AND MONITORING EQUIPMENT

Applicable Procedure: Procedure for Control of Inspection, Measuring and Monitoring Equipment – QSP-7.6.0 (Annexure-IV).

- I. Control Procedure for IMME used at Project Site
 - a. Field Quality Engineer shall ensure proper selection of IMME which are having necessary accuracy for the measurements to be made at site.
 - b. All inspection and measuring instruments shall be identified by calibration stickers / tags indicating calibration status.
 - c. Field Quality Engineer / Inspector shall ensure that the IMME are calibrated at prescribed intervals or prior to use by using masters traceable to National / International standards. The calibration shall be done at approved calibration agency or at site. After receipt of calibration reports from approved calibration agency, Field Quality Engineer / Inspector shall review the results of calibration and maintain the records.
 - d. Whenever measuring instrument is found to be out of calibration, Field Quality Engineer / Inspector assesses the validity of results of previous measurements and shall establish the action to be initiated regarding products measured as well as the instrument.
 - e. Field Quality Engineer / Inspector shall ensure that the instruments / gauges are stored, preserved and handled in such a way that the accuracy and function are maintained and are protected from damage / deterioration.
 - f. The periodicity of calibration for IMME and their acceptance criteria shall be as given under.



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<u>S.No.</u>	<u>Name of the Instrument</u>	<u>Periodicity of Calibration</u>	<u>Acceptance criteria (permissible error)</u>
01.	Verniers 0 – 300 mm range Above 300 mm range	12 Months 24 Months	± 0.05 mm
02.	Micrometers 0 – 100 mm range Above 100 mm range	12 Months 24 Months	± 0.01 mm
03.	Dial Gauges	12 Months	± 0.01 mm
04.	Pressure & Vacuum Gauges	12 Months	1% FSD
05.	Temperature measuring Instruments	12 Months	1% FSD
06.	All electrical instruments such as Voltmeters, Ammeters, Potentiometers & Watt Meters, Kelvin Bridges, Micro-ohm meters except Megger	12 Months	0.2% FSD
07.	Megger	12 Months	5%FSD
08.	Auto Level	12 Months	
09.	Total Station	12 Months	

8. MEASUREMENT, ANALYSIS AND IMPROVEMENT

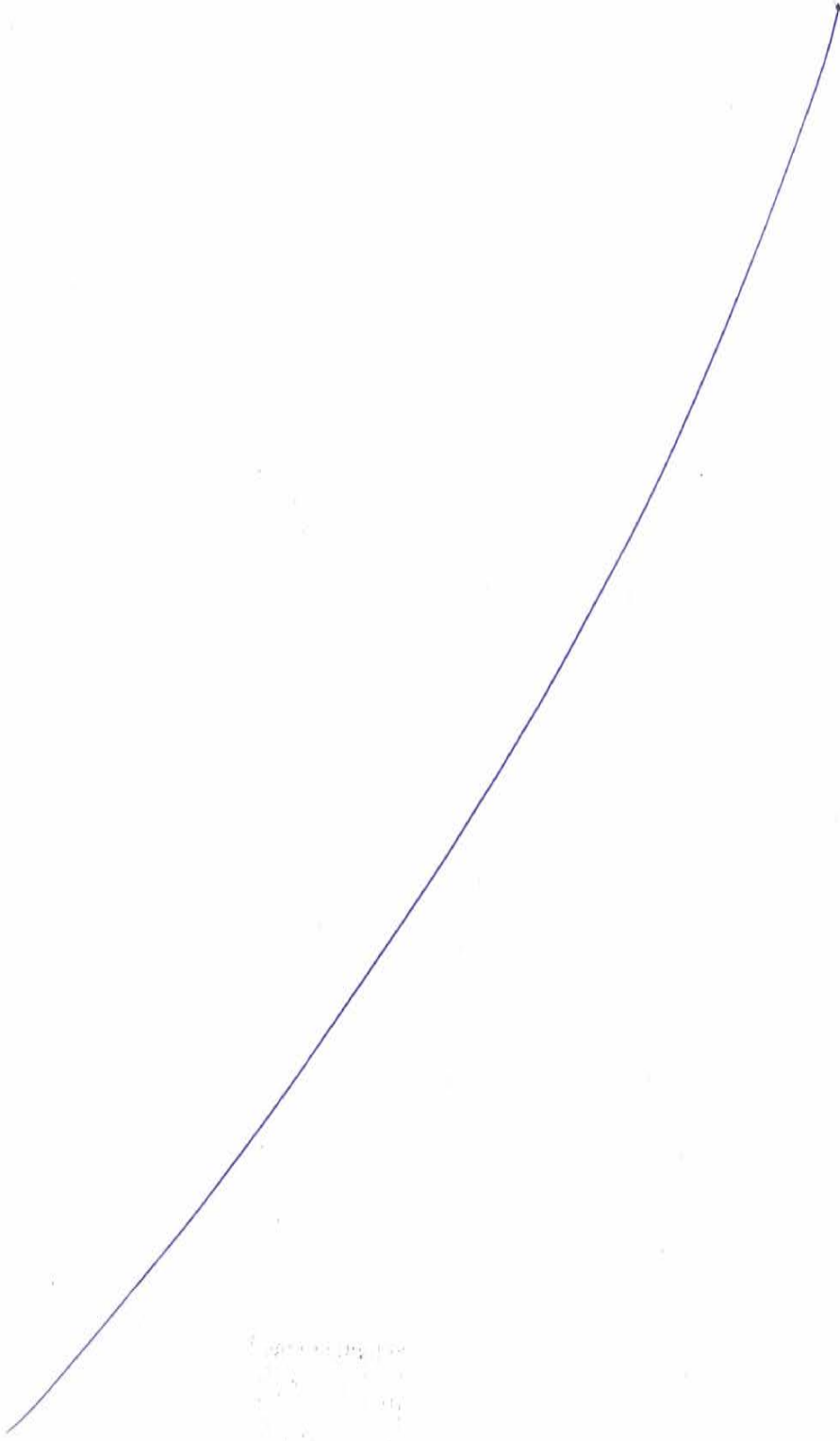
8.1 General

8.1.1 The Process to ensure Product conformity in Supplies is detailed in "Procurement procedure".

8.1.2 The Process to ensure the Product conformity in construction activities is detailed in Paragraph No. 7.5.1.

8.1.3 The process to ensure the conformity of Project Quality Management systems is detailed in "Project Quality Audit Procedure".

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8.1.4 The actions to continually improve the effectiveness of the Project Quality Plan are detailed in Paragraph No.8.5.

8.2 MONITORING AND MEASUREMENT

8.2.1 CUSTOMER SATISFACTION

- (a) DAEWOO -TPL JV performance indicated in various Customer Review Meetings and appreciation letters given by the Customer are considered for measure of Customer Satisfaction.
- (b) Head QMD shall compile the data on Customer Complaints and carryout analysis for root causes. This is used as a measure of Customer dissatisfaction.
- (c) Customer Feedback on DAEWOO E&C-TPL JV performance and results of analysis of Customer complaint analysis are presented in Project Quality Review.

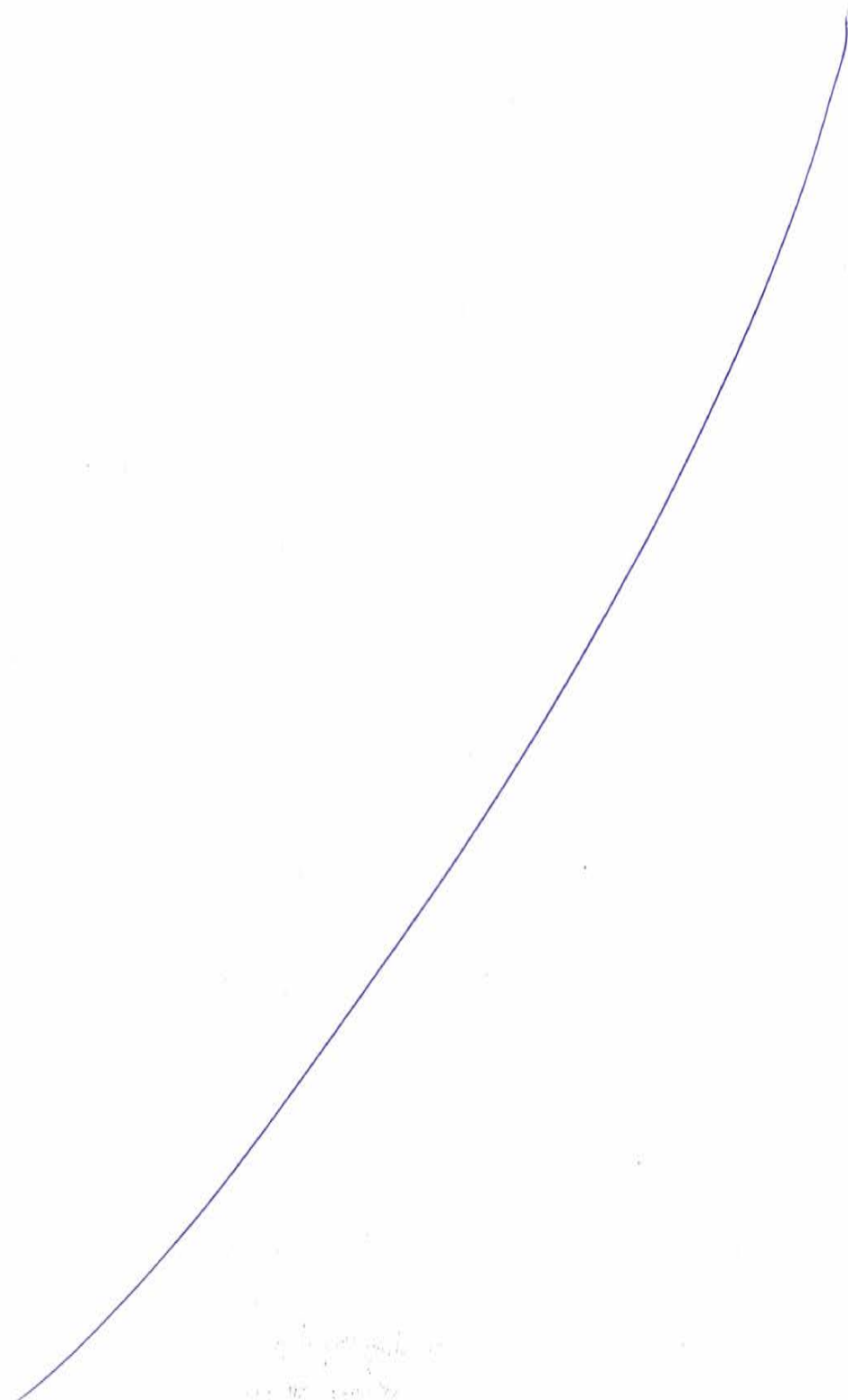
8.2.2 PROJECT QUALITY AUDITS

Applicable Procedure: Procedure for Internal Quality Audits by Internal Quality Auditors of QMD at Project Sites – Document No. QMD – PRO – 02 (Annexure-IV)

- (a) Project Quality Audits shall be carried out as per 'Project Quality Audit Procedure' (as attached in Annexure-IV) to verify whether quality activities and related results comply with Quality System as described in the Project Quality Manual and to determine the effectiveness of the quality system.
- (b) Project Quality Audits shall be carried out at 30%, 60% and 90% of Progress of the Works at site.
- (c) Head-QMD shall plan Project Quality Audits indicating areas to be audited, the Auditees & Auditors and issue the schedule along with Audit Check list, Audit report / Continuation sheet formats for conducting the audits. Audit schedule shall be communicated in advance to the Auditees concerned and also to the Auditors assigned in the audit schedule.
- (d) The Auditors shall conduct Project Quality Audits as per the scope and audit check list and record objective evidence, observations and recommendations for improvement in the audit report.

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- (e) The Auditors shall discuss with the Auditee about time frame for completion of corrections / corrective actions as required on nonconformities and record the same in the nonconformity report.
- (f) The Auditors shall submit audit report to Head-QMD and one copy each to QMD Manager, Project Manager (PM), Head –Metros, Tunnels & Waterways and Customer.
- (g) QMD In-Charge shall ensure that corrections / corrective actions are implemented in the respective areas within the time frame.
- (h) Follow up Audits, if required shall be planned and carried out to ensure the correction / Corrective actions and to close the Nonconformities.

8.2.3 MONITORING AND MEASUREMENT FOR THE PROJECT

8.2.3.1 Receiving Inspection and Testing

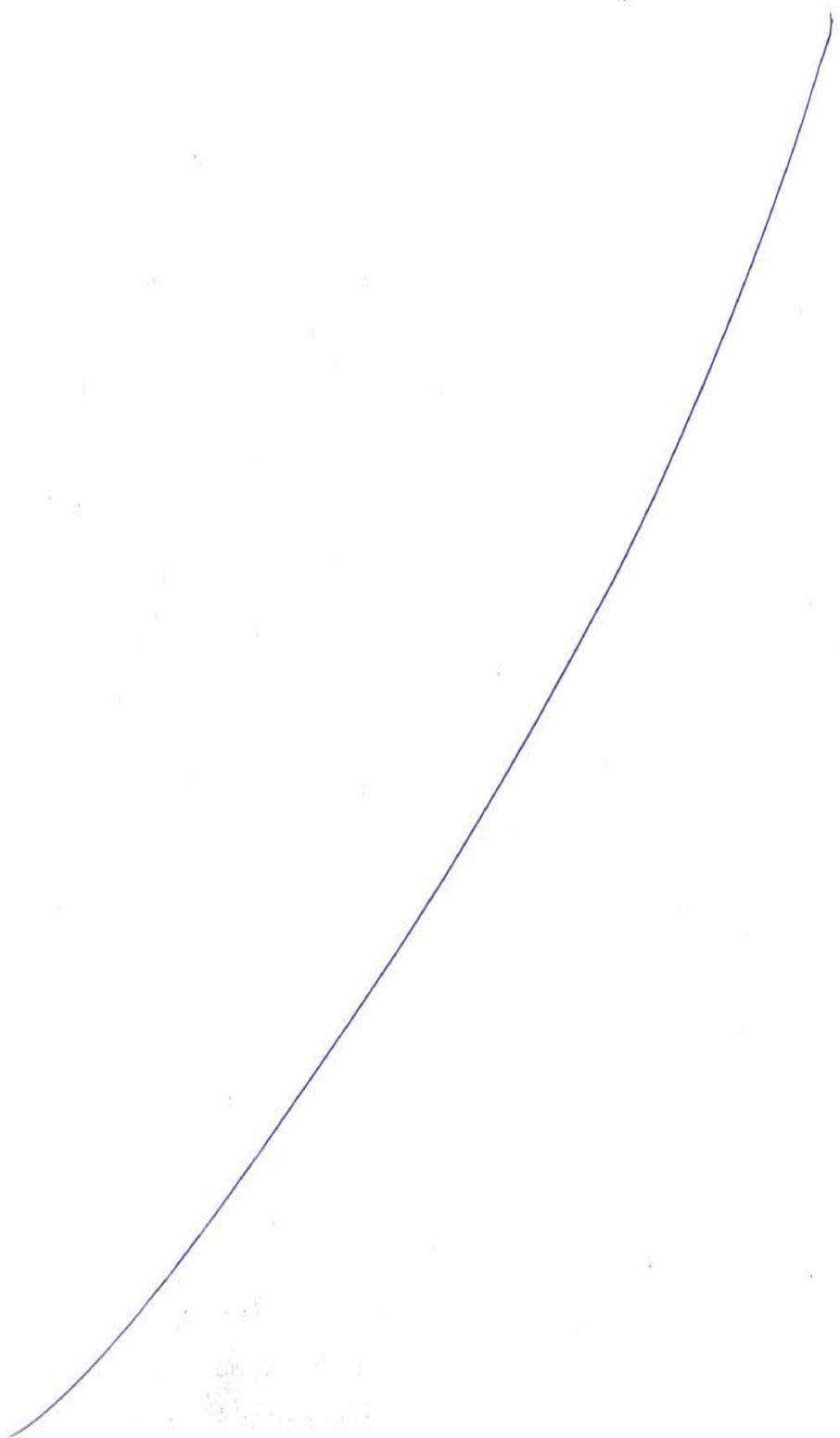
- (a) Quality Surveyors shall inspect the product at supplier's works and release the acceptable product meeting specified requirements as per applicable MQP / QAP.
- (b) Concerned Field Quality Engineer / Inspector shall verify incoming materials / Equipment and correlates with the related Inspection Release Certificates and Inspection & Test reports and sign on Material Receiving Report (MRR) if found acceptable. Stores Officer shall verify for the quantity and for damages if any and make specific comments on the MRR.
- (c) In case of any Non-Conformity / discrepancy is observed in the supplied materials / items / equipment, the same will be taken with the vendor(s) through Project Manager for necessary correction / replacements.
- (d) Field Quality Engineer / Inspector shall prepare IMIR for the material received and offer to Mumbai Metropolitan Region Development Authority (MMRDA) (as required) at site and obtain their clearance before issue for construction activities.

8.2.3.2 In process Inspection

- (a) Concerned Field Quality Engineer / Inspector shall carry out stage inspection of construction activities as per approved ITPs and Method Statements. Field Quality Engineer / Inspector shall coordinate with Mumbai Metropolitan Region Development Authority (MMRDA) for inspection at the stages of the FQP / FITP and obtain clearance.



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- (b) Field Quality Engineer / Inspector shall hold the product until required inspections and tests are satisfactorily completed and reports verified.
- (c) In case of any Non-Conformity / discrepancy is observed in the Construction activities, concerned Field Quality Engineer / Inspector will take up with Sub-contractor by issuing Field Inspection Note through Deputy Project Manager. The required rework / correction in the sub-contractor's works will be recorded in the Field Inspection Note (FIN) which will be signed by the sub-contractor. Field Quality Engineer / Inspector / CE shall monitor the progress of the required work / correction as indicated in the FIN. After completion of the rework / correction the same will be informed to Mumbai Metropolitan Region Development Authority (MMRDA) as required.

8.2.3.3 Final Inspection

- (a) Concerned Field Quality Engineer / Inspector shall carry out final inspection and testing of all items fabricated / installed at site as per Approved drawings, ITPs and Method Statements, Procedures and Codes. This shall include verification of completion of receipt inspection and in-process inspection.
- (b) Project Manager shall hand over the completed Sub-Systems / Systems of Project to Customer after ensuring that all relevant activities have been satisfactorily completed and related inspection and test records are available and cleared by Mumbai Metropolitan Region Development Authority (MMRDA).
- (c) Inspection and test activities at construction site shall be in accordance with applicable procedures.
- (d) In case of nonconformity observed during inspection and test activities, the same shall be handled as per Paragraph 8.3.

8.2.3.4 Inspection and Test records

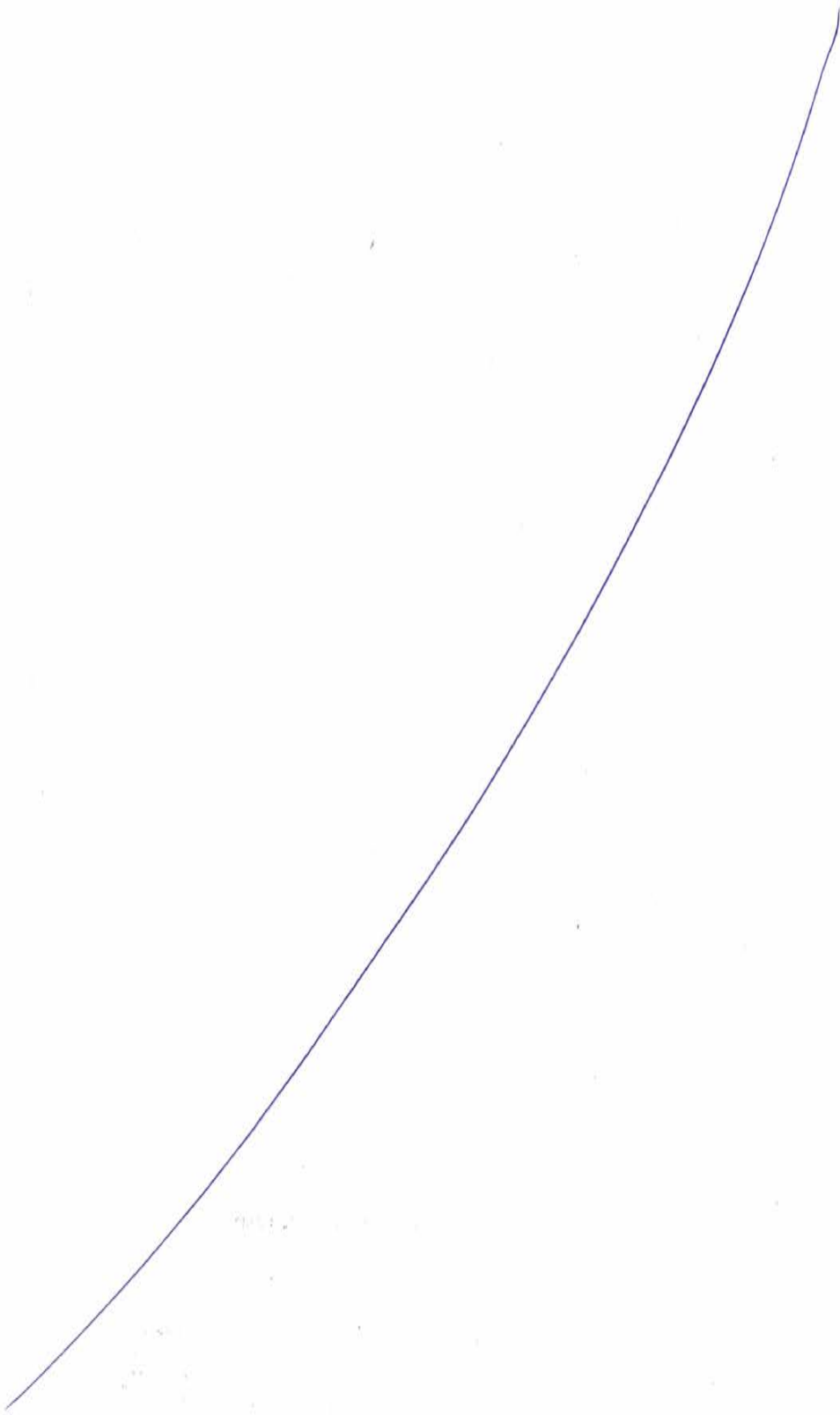
- (a) Inspection Coordinator shall maintain inspection and test records of Projects Supplies.
- (b) QMD Manager shall maintain inspection and test records for Construction Activities at site.
- (c) Receipt inspection, in process inspection & Final inspection records shall identify the authority responsible for release of product for further erection and handing over activities.



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8.3 CONTROL OF NONCONFORMING PRODUCT

Applicable Procedure: Procedure for Control of Non-Conformity Products – NCP - 8.3.0 (Annexure-IV).

8.3.1 Handling of Nonconformities in Project Supplies.

- (a) Quality Surveyors shall identify non-conformities observed during inspection, if any, and take suitable action regarding rework, rejection or seek disposition from Head- QMD.
- (b) Head-QMD shall give disposition in coordination with Engineering Coordinator on nonconformities reported. Wherever required, the Non-Conformities shall be referred to customer for the dispositions.
- (c) In case disposition calls for repair/ rework of the product, Quality Surveyor shall re-inspect the product after repair /rework, before closing NCR.

8.3.2 Handling of Nonconformities at Site

- (a) QMD Manager shall identify non-conformities observed during inspection, if any and take suitable action regarding rework / rejection in coordination with Customer.
- (b) Where repair/ rework is carried out on the nonconformities, the items shall be re-inspected prior to closing the NCR.
- (c) QMD Manager / Project Manager shall obtain approval from Mumbai Metropolitan Region Development Authority (MMRDA) for the non-conformities observed.

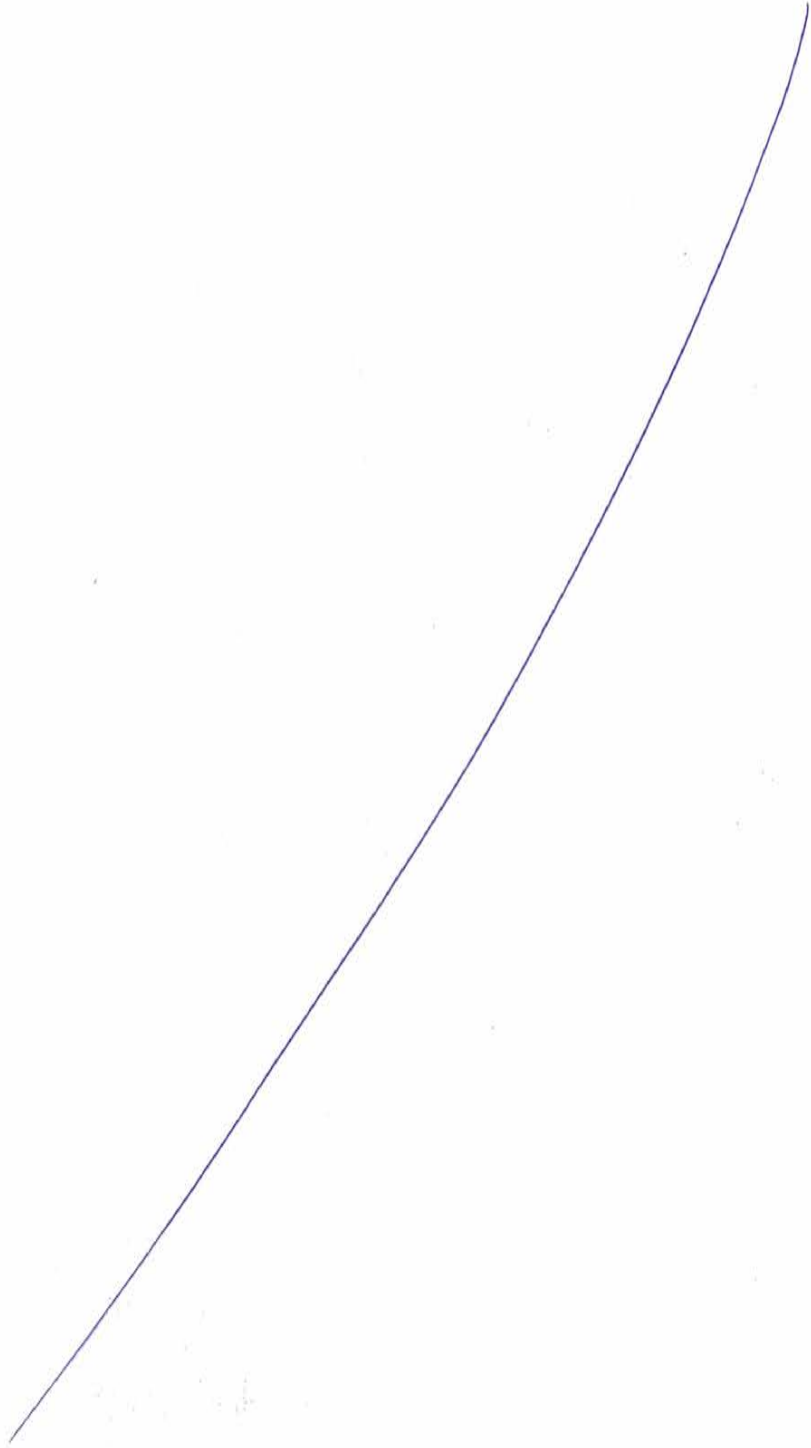
8.4 ANALYSIS OF DATA

The Analysis of data pertaining to the following is carried out by the respective departments as identified below.

- (a) Customer Satisfaction - Head –Metros, Tunnels & Waterways and Head - Safety.
- (b) Inspection and test results on projects supplies and field quality - Head-QMD



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- (c) Project Quality Audits - Head - QMD
- (d) Non conformities - Head - QMD
- (e) Customer complaints - Project Manager

The results of the analysis shall be used by the respective departments for initiating continual improvement actions.

8.5 IMPROVEMENT

8.5.1 Continual Improvement

Continual improvement of the effectiveness of the Project Quality Management System shall be achieved through reviews in Project Review meetings.

8.5.2 Corrective Action

Applicable Procedure: Procedure for Corrective Actions - CAP - 8.5.2 (Annexure-IV).

Corrective Actions are initiated based on Non-Conformities, Customer Complaints and Customer Feedback by the concerned Head – Metros, Tunnels & Waterways, after identifying root cause, to determine and implement corrective actions to prevent recurrence of nonconformities / complaints. The corrective actions taken are reviewed in Project Review Meetings.

8.5.3 Preventive Action

Applicable Procedure: Procedure for Preventive Actions - PAP - 8.5.3 (Annexure-IV).

Based on analysis of nonconformities, Customer complaints, Customer feedback and the results of analysis under clause nos. 8.4 & 8.5.2, potential nonconformities are identified and preventive actions to prevent occurrence of nonconformities are determined and suitable actions are taken.

The preventive actions taken shall be presented and reviewed in Project Quality Management Review Meetings.

8.6 INTERFACING/CO ORDINATION.

The MMRDA Representative has provided information regarding the expected interfaces managed the site organization shall produce:

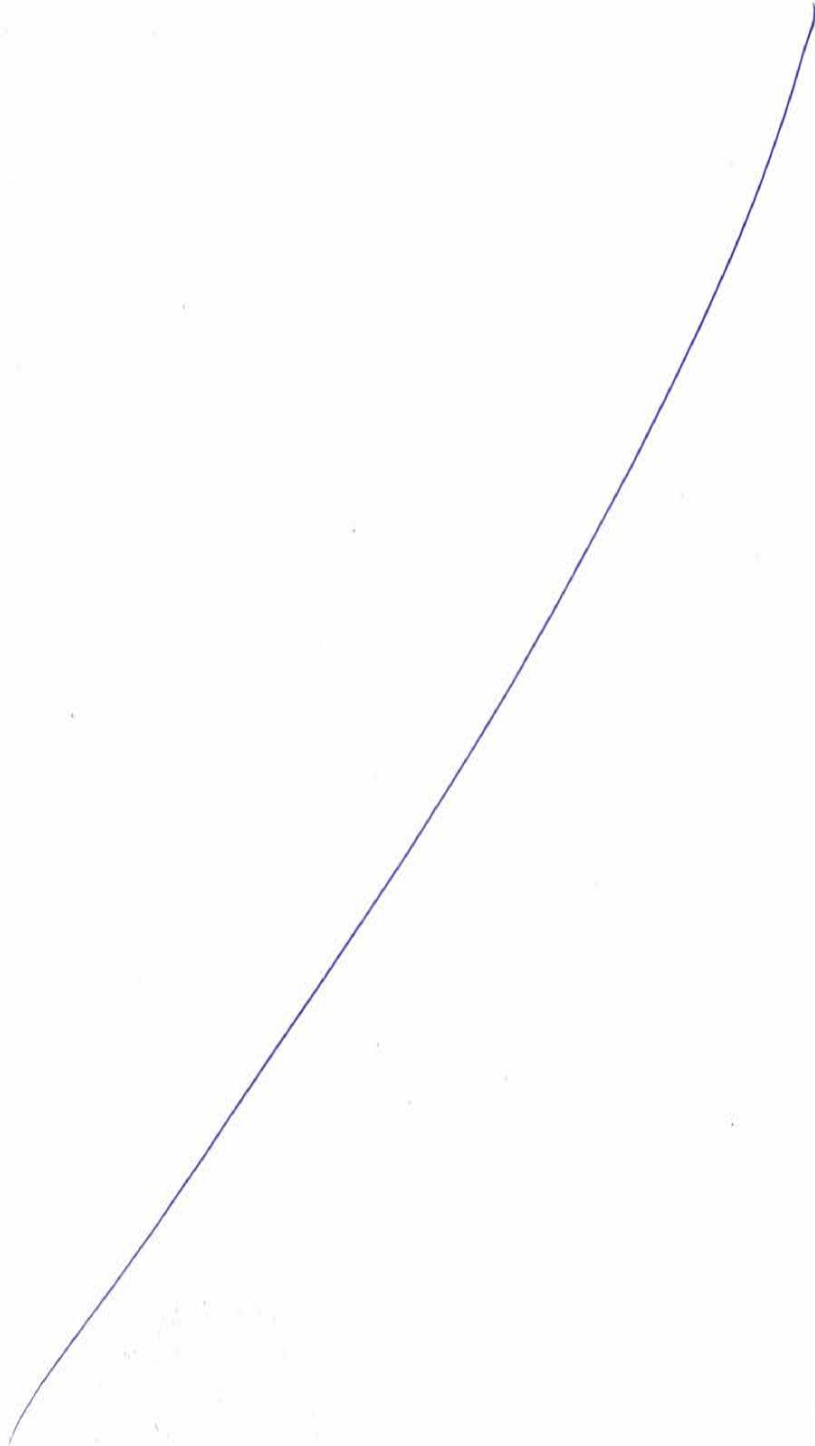


**Mumbai Metropolitan
Region Development
Authority**

DOCUMENT TITLE

Quality Assurance Plan

7097





Mumbai Trans Harbour Link Project

Package-2

TATA PROJECTS
Simplify. Create

- a. An interface Management Plan and;
- b. An Interface Management Programme

The Interface co-ordination programme shall be continually reviewed in line with the construction operations and programmes of each interfacing contractor. As a contractor on this project it will be necessary to co-ordinate design inputs or changes and plan the access arrangements for the interfacing contractors in a timely an effective manner thus ensuring that the operations being conducted by all parties do not present an unrecognized risk to each other.

To aid the communication process, interface meetings shall be arranged either by site organization or as a request from interfacing contractors to promote the coordination of activities in respect of programme change, design information, design changes, access, restrictions and monitoring arrangements etc.



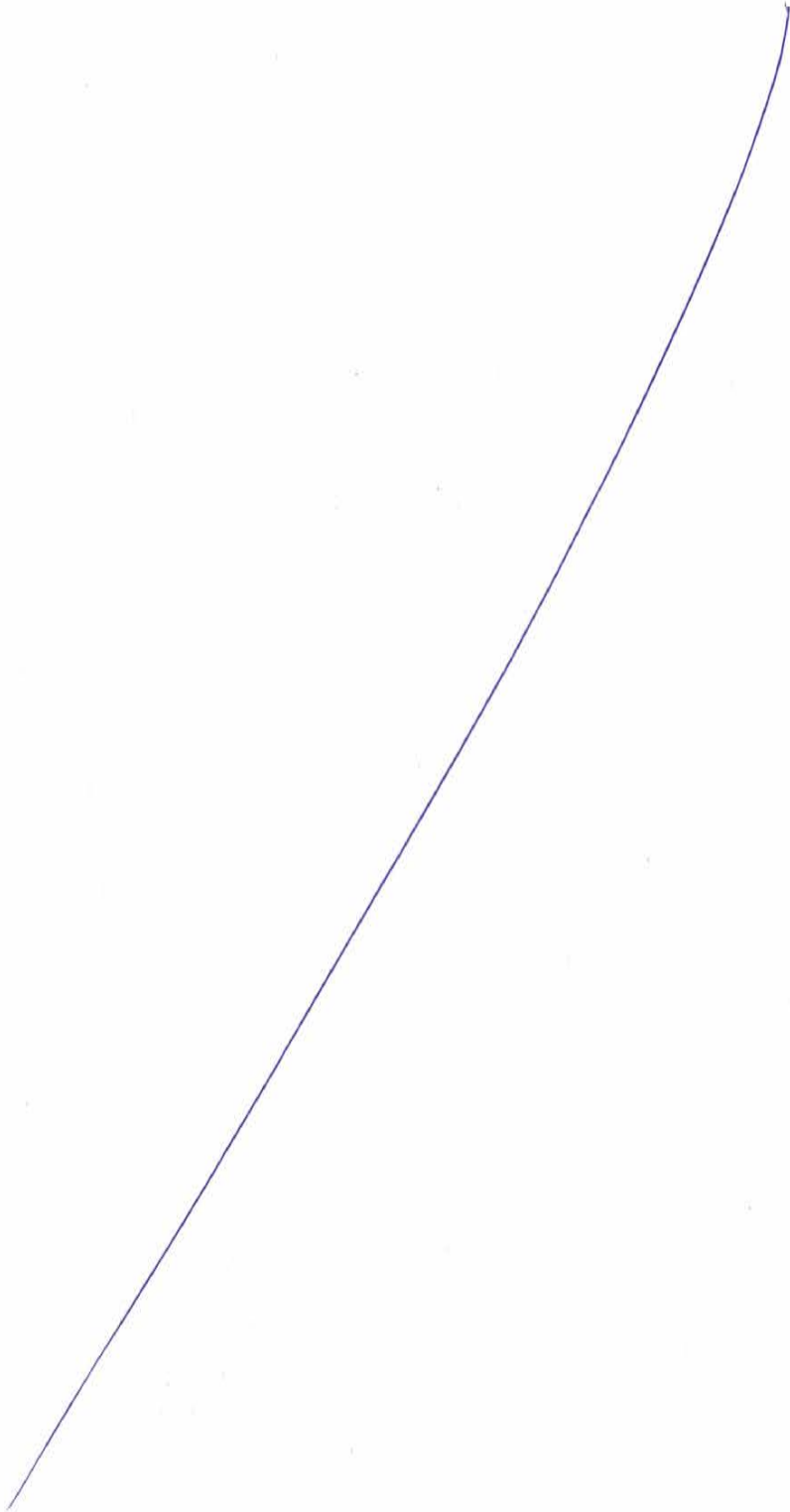
**Mumbai Metropolitan
Region Development
Authority**

DOCUMENT TITLE

Quality Assurance Plan

001776-200

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Mumbai Trans Harbour Link Project

Package-2

TATA PROJECTS
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Annexure-V LIST OF METHOD STATEMENTS

S No	Description	Document No.	Remarks
1	Method statement for Surveying work	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/001	
2	Method statement for Site clearance and levelling work	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/002	
3	Method statement for Geotechnical Investigation work	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/003	
4	Method statement for Excavation	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/004	
5	Method statement for Rock Anchors	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/005	
6	Method statement for Shotcrete	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/006	
7	Method statement for Formwork	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/007	
8	Method statement for Reinforcement Work	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/008	
9	Method statement for Concreting Work	DAEWOO -TPL JV/QMD/MTHL PKG2/MS/009	

Note: The method statement for the above activities shall be submitted after getting the GFC, Design Note & other related approved documents before start of activity. Also the activity mention above may be decreased or increase as per contract requirement.



Mumbai Metropolitan
Region Development
Authority

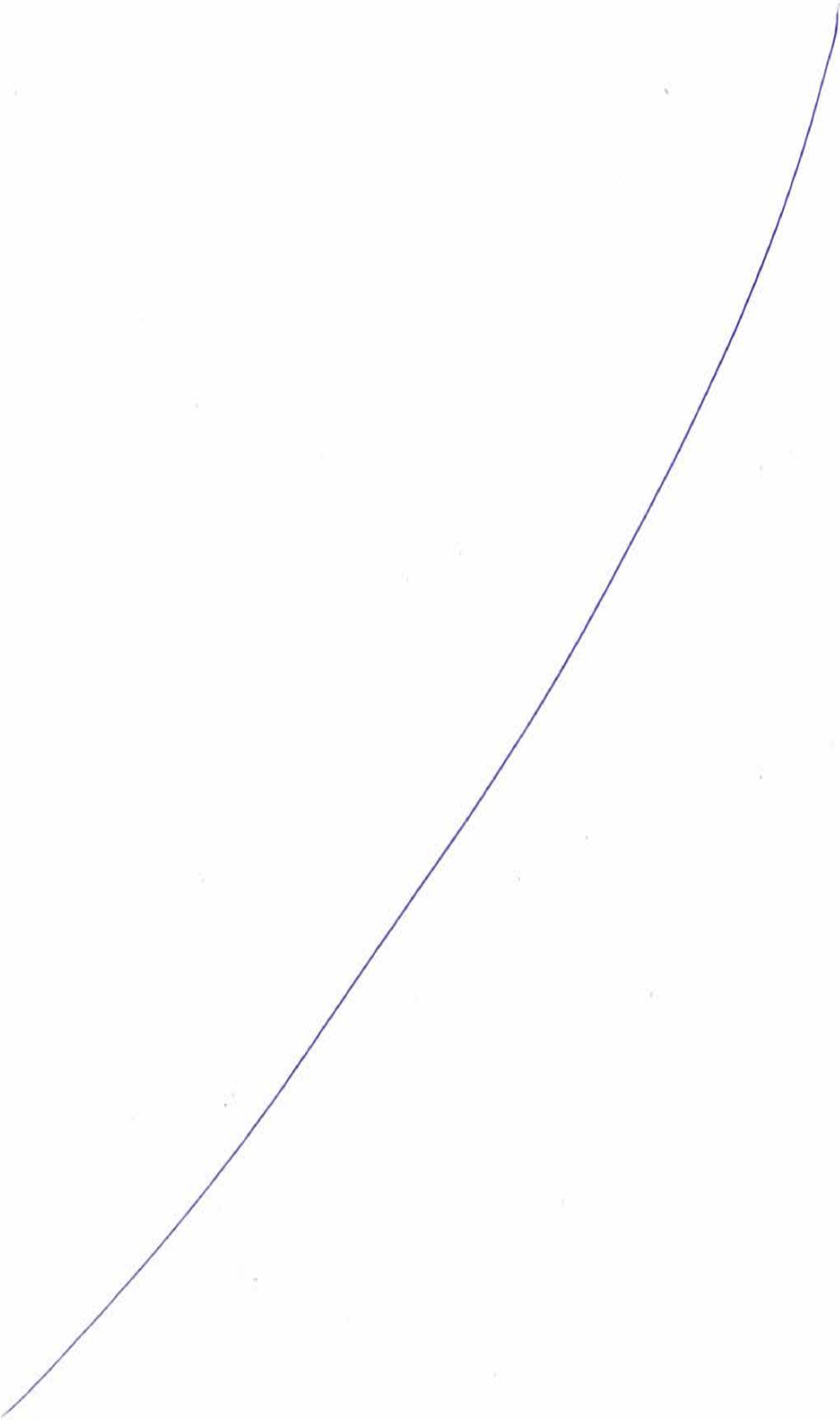
DOCUMENT TITLE

Quality Assurance Plan

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**Mumbai Trans Harbour Link Project
Package II**

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TATA PROJECTS
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DESIGNER'S DETAILS

- M/s Ramboll

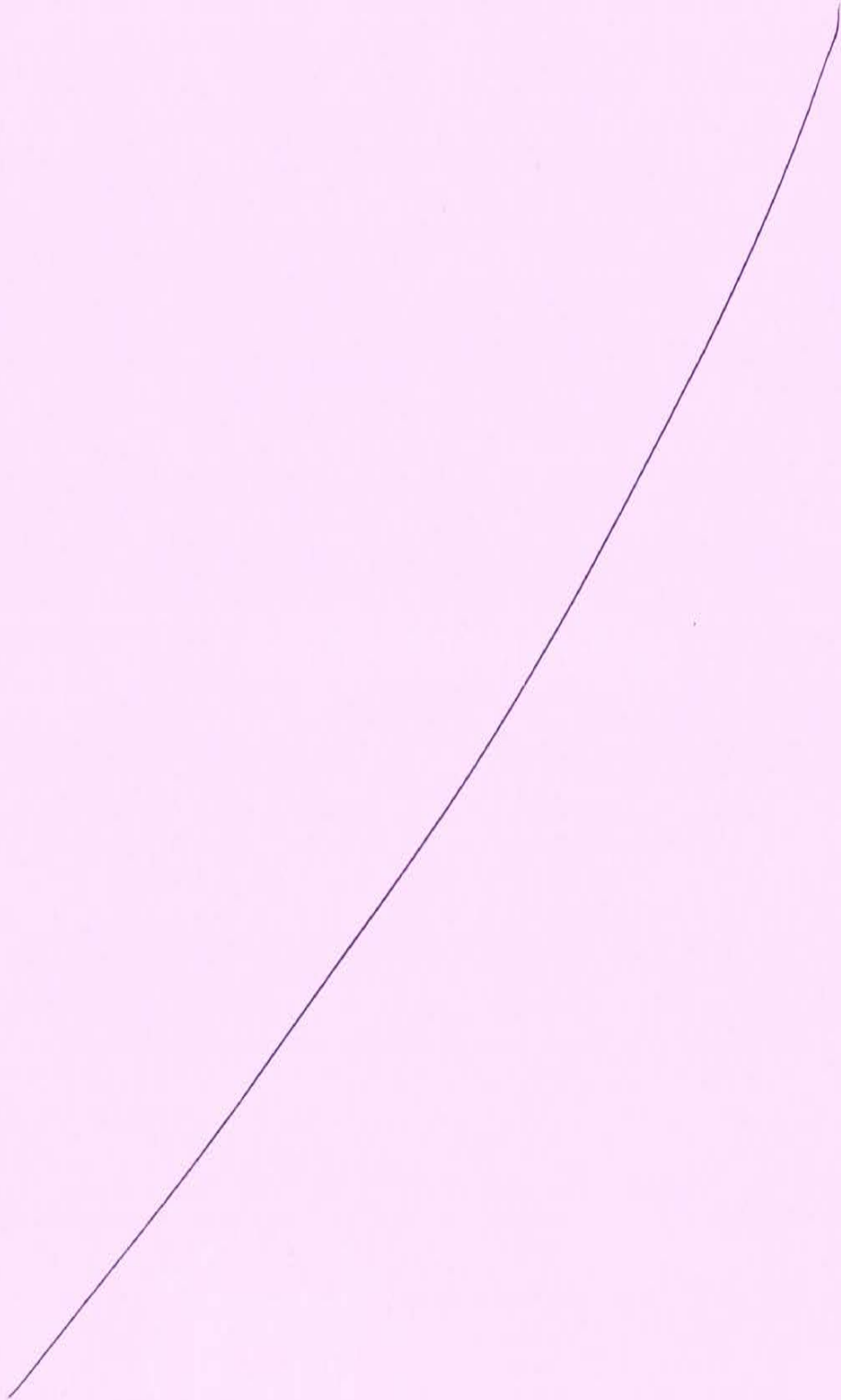


**Mumbai Metropolitan
Region Development
Authority**

**Project: Project: Mumbai Trans Harbour Link Project (Package-2)
(Construction of a 7.807 km long bridge section (CH 10+380 –
CH18+187) across the Mumbai Bay including Shivaji Nagar
Interchange)**

1941 116

7103



RAMBOLL

RAMBOLL INDIA

Ref No: RI/MTHL/PKG-02/17

Date: 12th July 2017

LETTER OF UNDERTAKING

To,
Engineer-in-Chief / Chief Engineer
 Engineering Division,
 Mumbai Metropolitan Region Development Authority (MMRDA)
 2nd Floor, New Office Building,
 Plot No. R-05, R-06 & R-12, 'E' Block,
 Bandra-Kurla Complex,
 Bandra (E), Mumbai
 Maharashtra, INDIA 400051
 Phone: 91 22 2659 1239
 Fax: 91 22 2659 4179
 Email: chiefengineer1@mailmmrda.maharashtra.gov.in

Ramboll India Pvt. Ltd.
 17th Floor, Tower-B
 Building -5
 Cyber City Phase-III
 Gurgaon-122002.
 Haryana, India.

T + 91 124 4611 999
 F + 91 124 4611 998
www.ramboll.com

Ref: **Mumbai Trans Harbour Link Project (Package-2) - (Construction of a 7.807 km long bridge section (CH 10+380 - CH18+187) across the Mumbai Bay including Shivaji Nagar Interchange) IFB No.- MMRDA/ENG1/000753.**

Dear Sir,

We understand that Daewoo Engineering & Construction Co. Ltd. & Tata Projects Ltd. are jointly bidding for the above mentioned tender. We hereby confirm our association for "**Detailed Design Consultant for all the Permanent Structure excluding steel bridge superstructure in line with tender requirement**" and also undertake that we will meet delivery deadlines proposed by them in their Tender program on the basis of mutually agreed terms & condition.

Thanking You,

For Ramboll India Private Limited.

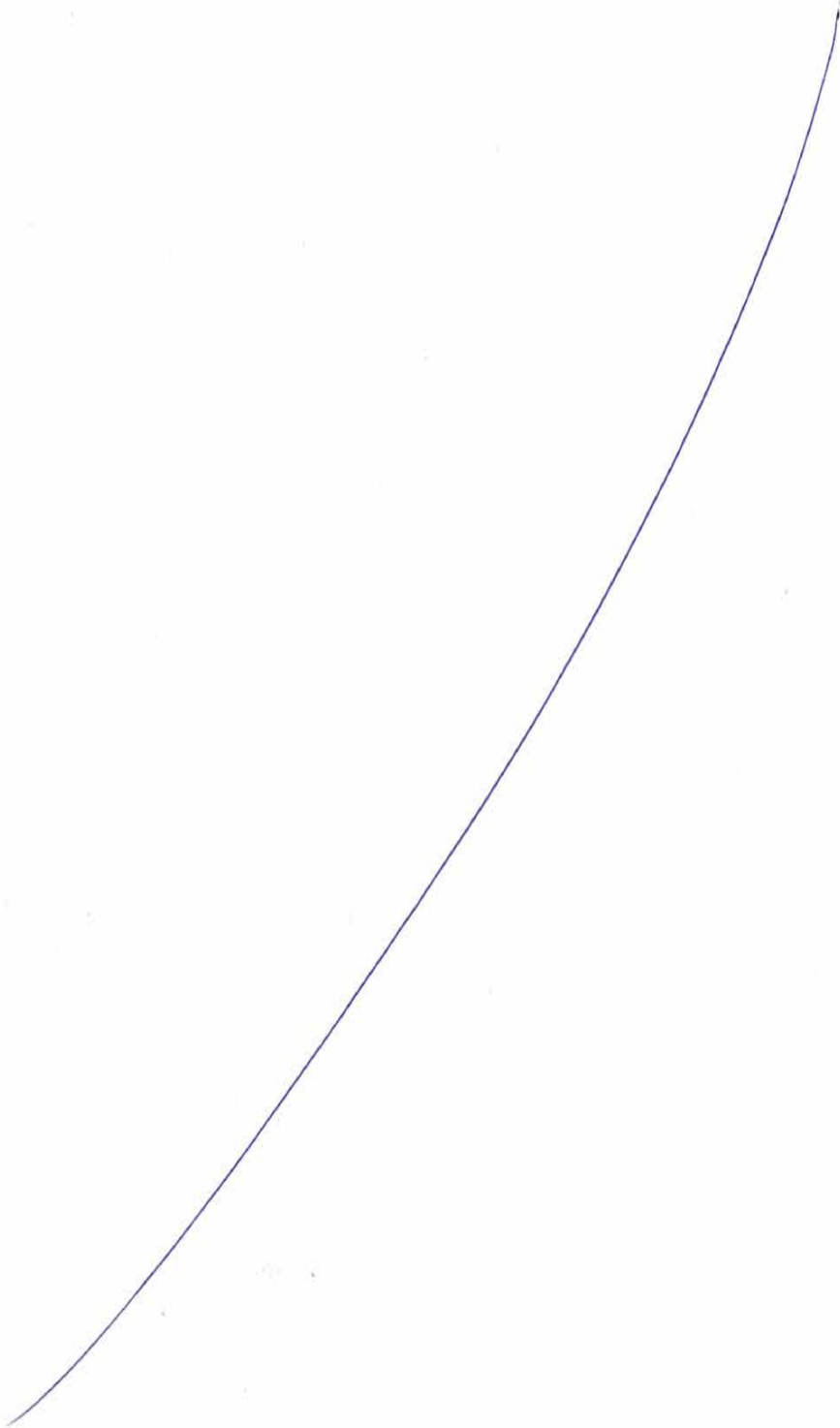
Authorised Signatory




Aditya C Sharma
 Director, Highway & Structure



7105





To whom it may concern

Copenhagen, 29 December 2000

Our ref.: sas2403

Consultancy Services for the Øresund Link

This is to certify that The Øresund Link Consultants (ØLC) consisting of:

RAMBØLL (DK), (lead partner)
Scandiaconsult AB, (S)
Sir William Halcrow & Partners, (UK)
Tunnel Engineering Consultants, (NL)

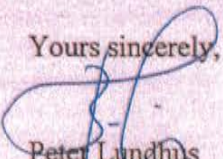
with main subconsultants:
Dissing + Weitling, (DK), (Architects)
DHI/LIC (DK), (Marine Engineering)

has performed the following consultancy services to Øresundsbron.

Construction Value: 15 billion DKK (2 billion US \$), 1991 price level
Consultancy Fee: 435 mio DKK (55 mio US \$)
Commencement Date: July 1993
Completion Date: July 2000
Scope of Work: Outline Design, Tender Design, Tender Evaluation for Tunnel, Dredging & Reclamation and Bridges.
Contract Management, Design and Construction Audit for Tunnel and Dredging & Reclamation

ØLC has performed the consultancy services in a professional manner.

Yours sincerely,


Peter Lundhus
Technical Director



Øresundsbro Konsortiet

• Vester Søgade 10
DK-1601 København V
Telefon: +45 33 41 60 00
Telefax: +45 33 41 61 02
CVR-nr.: 24 24 67 87

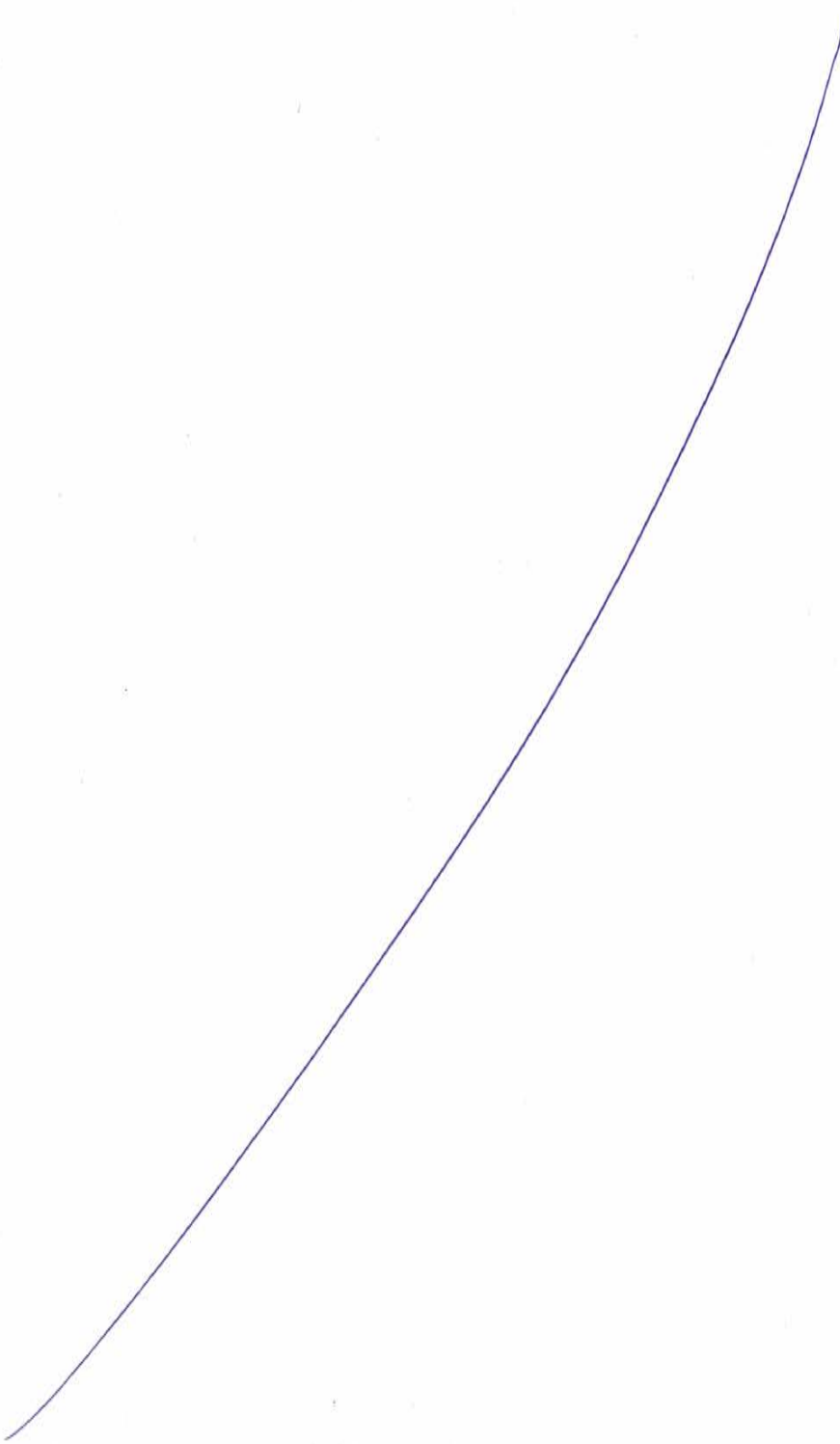
• Kalendegatan 18
Box 4132 SE-203 12 Malmö
Telefon: +46 (0) 40 660 60 00
Telefax: +46 (0) 40 660 60 40
• Org-nr.: 946001-3387

info@oeresundsbron.com
www.oeresundsbron.com



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Project Data Sheet

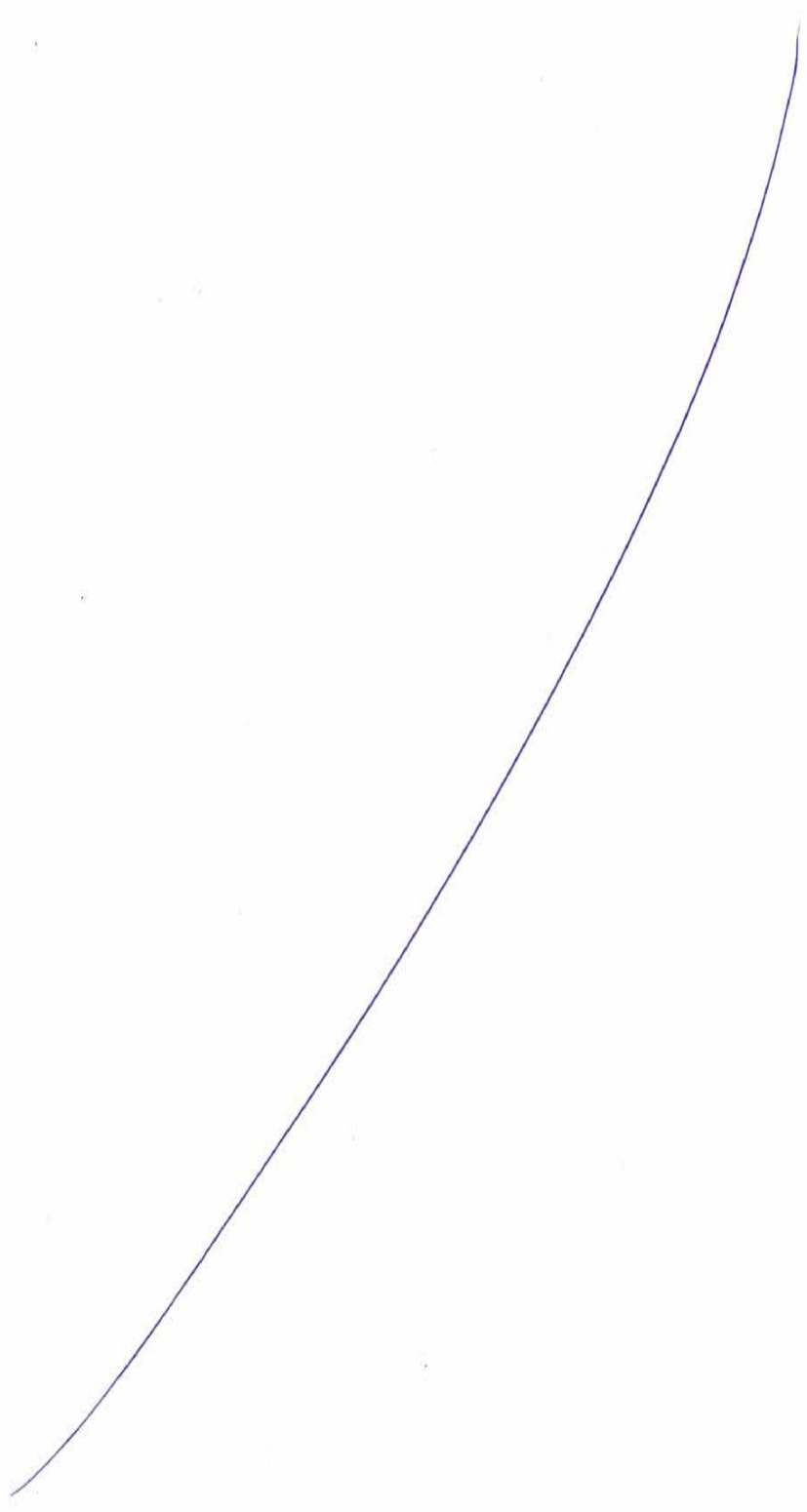
Name of the Project:	Detailed Design and Engineering of Bridge across river Brahmaputra at Bogibeel in, Assam, India
Length of Bridge in km or other particulars	4.94 Km
Description of services performed by the Applicant firm:	Rambøll has undertaken the detailed design of the superstructure and any modification during fabrication. In addition providing the technical support/guidance to bridge contractors during pre/post fabrication and launching. Design of this bridge is unique compared to other bridges for the Railways in India. It consists of a composite deck with steel truss integrated with reinforced concrete roadway. In the design of the bridge, Rambøll exploited the advantages of new materials of higher strengths and many technological improvements in the fields of steel bridge design, fabrication & erection. <ul style="list-style-type: none"> ➤ Introduction of welded truss joints. ➤ Composite construction in trusses. ➤ Incremental launching of truss girders. ➤ Application of performance concepts for seismic design.
Project Location	Assam, India
Associates	RITES Ltd. , India
Name of client and Address:	RITES Ltd, RITES Bhawan No.1, Sector-29, Gurgaon-122001 For N.F. Railway of India, Maligaon, Guwahati – 781 011, India
Estimated capital cost of Project (in Rs crore or Euro million):	1300 M Euro / INR 9557 Crore, Cost of superstructure is 1200 Crore
Payment received by the Applicant (in Rs. crore):	25,000,000DKK INR 24.7 Crore
Start date and finish date of the services:	2007 – 2009
Expert assigned by Ramboll	John Elnegaard Hansen & Farzin Hosseini

Brief description of the Project:

The bridge across the Brahmaputra river in Assam, India has a **total length of 4942m, with 39 spans of 125m and two end-span of 33 m supported on 42 piers.** The bridge superstructure is a two-level composite structure with two railway tracks on the lower deck and roadways on the upper deck. As the first of its kind in India the bridge breaks new ways for railway bridges in the country, with respect to the structural concept, the design basis and the construction methods.



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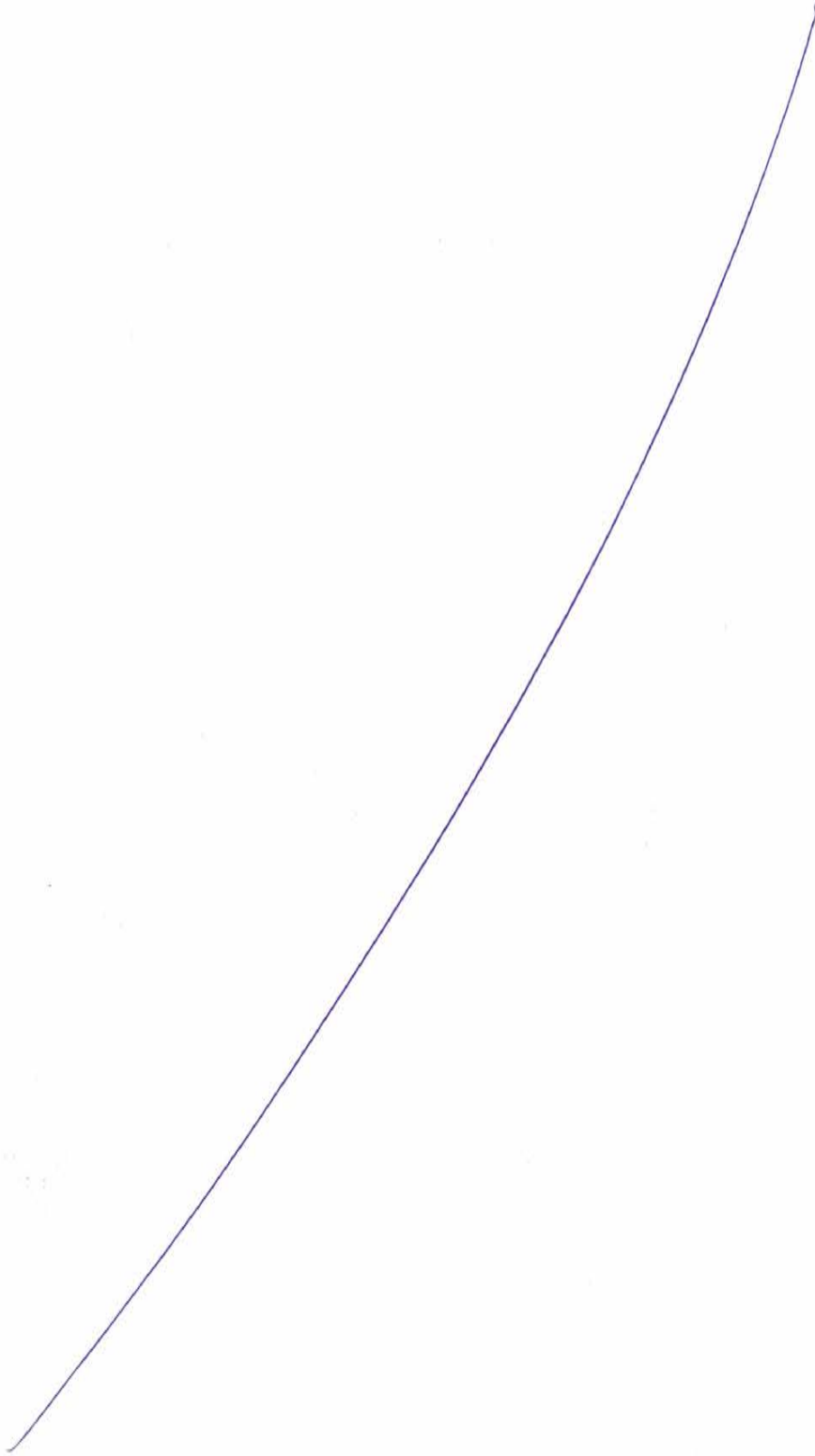
4

Project Data Sheet

Project Name: Consultancy Services for the principal Contract on the Forth Replacement Crossing.		Country: UK
Location within country: Scotland		Professional Staff Provided by your firm: Project Manager, Sr. Bridge Design Engineer, Sr. Highway Engineer, Material cum Geotechnical Engineer, Traffic & Transportation Engineer
Name of Client: Transport of Scotland/Forth Crossing Bridge Constructors		No. of Staff: 6
Address: Principal Contract Project office, King Malcolm Drive, Rosyth, KY 11 2DY		No. of Staff Months: 146
Start date (month/year): April 2011	Completion Date (month/year): August 2016	Approx. Value of Services (in USD): 28.75 Million USD
Name of Senior staff (Project Director/ Coordinator, Team Leader) involved and functions performed: Project Manager- Peter Curran		
Narrative Description of Project: In December 2007 the Scottish Government announced its decision to construct a new cable-stayed bridge across the Firth of Forth and in December 2008 confirmed the details of the crossing which is to be financed by government. The new crossing comprises a dual two-lane carriageway with widened hard shoulders. The overall length of the bridge is 2.65km between abutments comprising a southern approach viaduct of 550m , three towers, and two cable-stayed main spans each of 650m and back spans of 400m . North of the Forth the new crossing will connect to the existing A90 at Ferrytoll via a new dual two-lane carriageway with hard shoulders. Significant upgrading and remodeling of the existing grade separated junction will be required. South of the Forth, the replacement crossing will be connected to the existing A90 and M9 spur in the vicinity of the existing Scotstoun Junction via 2.7km of new dual two-lane carriageway. A new grade separated junction will be provided between the new crossing and the Scotstoun Junction. Ramboll, a lead partner in design joint venture, including Grontmij and Leonhardt Andre and Partner are supporting Forth Crossing Bridge Constructors (FCBC) - a consortium comprising Hochtief Construction AG, American Bridge International, Dragados and Morrison Construction.		
Detail description of Actual Services Provided by your firm: Following the dialogue and tender in early 2011, the crossing is now being delivered under a Design and Build Contract. <ul style="list-style-type: none"> Detailed Design & Design management. Design support to FCBC during the Invitation to Participate in Dialogue period. Participation in Dialogue period meetings with Transport Scotland. Design of marine and onshore abutments and foundations for the main bridge and approach Viaducts. Design of the approach viaduct piers and deck. Design of the cable stayed bridge deck. Geotechnical design. Environmental co-ordination including assessments of alternative designs and value. Engineering proposals. Design of land structures. 		



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Project Data Sheet

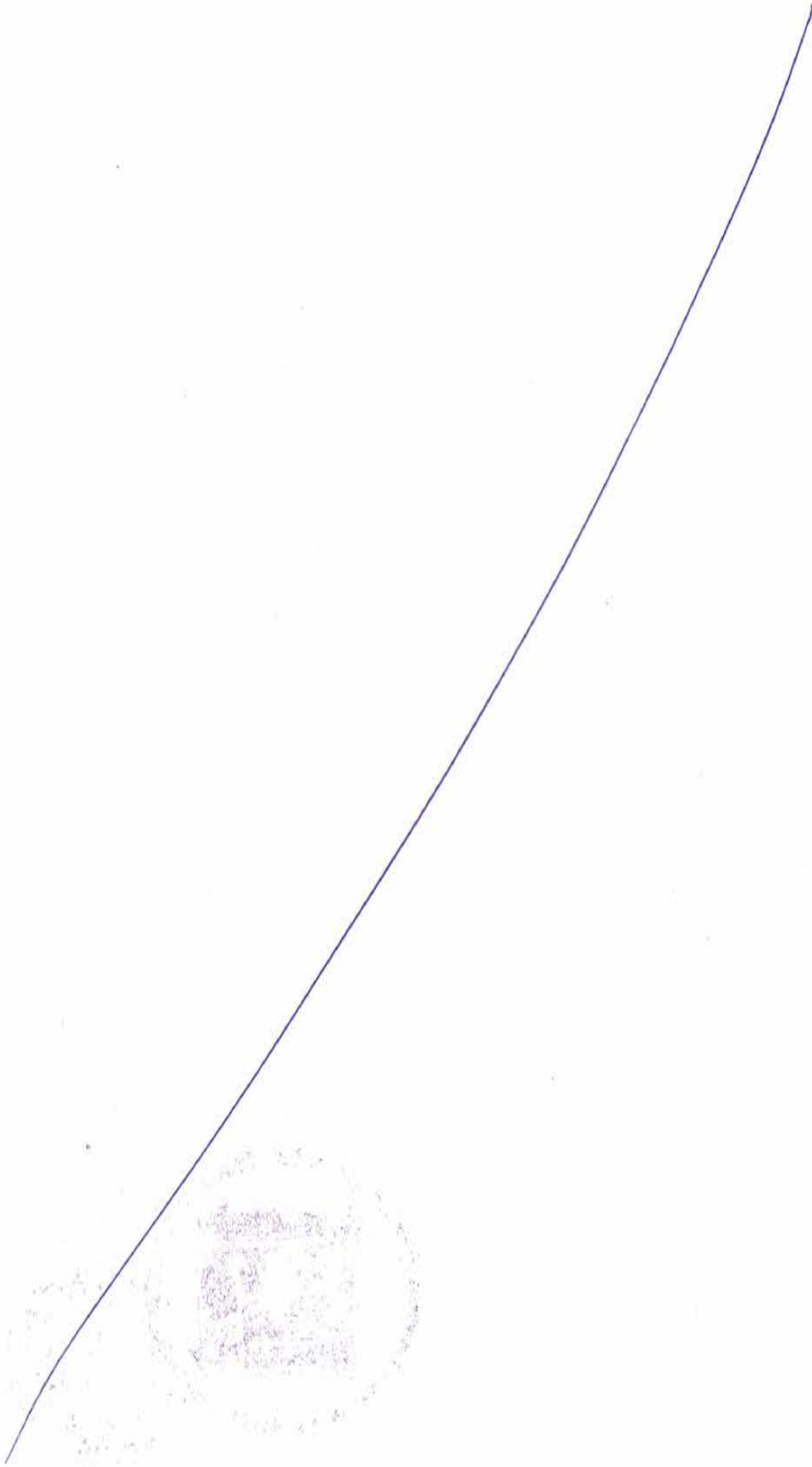
Name of the Project:	Feasibility & Preliminary Project Report for Mersey Gateway, Halton, UK
Length in km or other particulars	8km overall scheme, 1931 M main crossing (cable-stayed), 6 Lane.
Description of services performed by the Applicant firm:	<p>Ramboll was appointed as the lead Technical Advisor to Halton Borough Council in 2001 for this prestigious project and have since provided project management services and technical advice (including bridge and structural engineering, highways engineering, geotechnical engineering, environmental, transportation, surveying and tolling technology) for the following stages of the project:</p> <ul style="list-style-type: none"> • Desk Studies • Feasibility studies into alternative options and Preferred Option Selection • Major Scheme Business Case Submission • Preparation of Orders and Applications (including the Environmental Statement) • Public Inquiry (Including Expert Evidence) • Outline Business Case • Procurement (under a Competitive Dialogue Process) • Advance Works • Preferred Bidder • Construction
Name of client and Address: (Indicate whether public or private entity)	<p>Mersey Gateway Crossings Board Block 2 Forward Point Tan House Lane Widnes WA8 0SL</p> <p>The Mersey Gateway Crossings Board Ltd (the Board) is a special purpose vehicle established by Halton Borough Council with the delegated authority to deliver the Mersey Gateway Bridge project and to administer and oversee the construction and maintenance of the new tolled crossings including the tolling of the existing Silver Jubilee Bridge. It is a commercial but not for profit organization.</p>
Name, telephone no. and fax no. of client's representative:	<p>Steve Nicholson Email: Steve.nicholson@halton.gov.uk</p> <p>UK Tel No. +44 (0)151 495 4090</p>
Estimated capital cost of Project (in Rs crore or US\$ million):	<p>600M Pound 942M USD INR5652 Crore</p>
Payment received by the Applicant (in Rs. crore):	<p>15,029,000DKK 2.25M USD INR13.52 Crore</p>
Start date and finish date of the services (month/year):	July 2001 – July 2014

Brief description of the Project:

The Mersey Gateway DBFO project comprises the construction of a new **6-lane fixed-link iconic 3 tower cable stayed bridge**. The total length of proposed bridge is **1931m comprising of 1000m of cable stayed portion** having spans of **(185m+300m+300m+215m)** and approach spans in range of **60m to 100m**. There are three lanes on either side of the tower including total deck width of approximately **35m**. The proposed bridge is crossing over the River Mersey in Halton, North West England, together with connections into, and modifications to, the existing highway network in Widnes and Runcorn on either side of the river (a total length of over 8km) and modifications to the existing Silver Jubilee Bridge to return it to local use and to encourage sustainable transport modes. Both the new bridge and the existing crossing will be tolled, and the main contract, which has been let to a Project Company (Merseylink), includes tolling operations and maintenance (excluding the maintenance of the existing crossing).



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ENABLING SUSTAINABLE MOBILITY

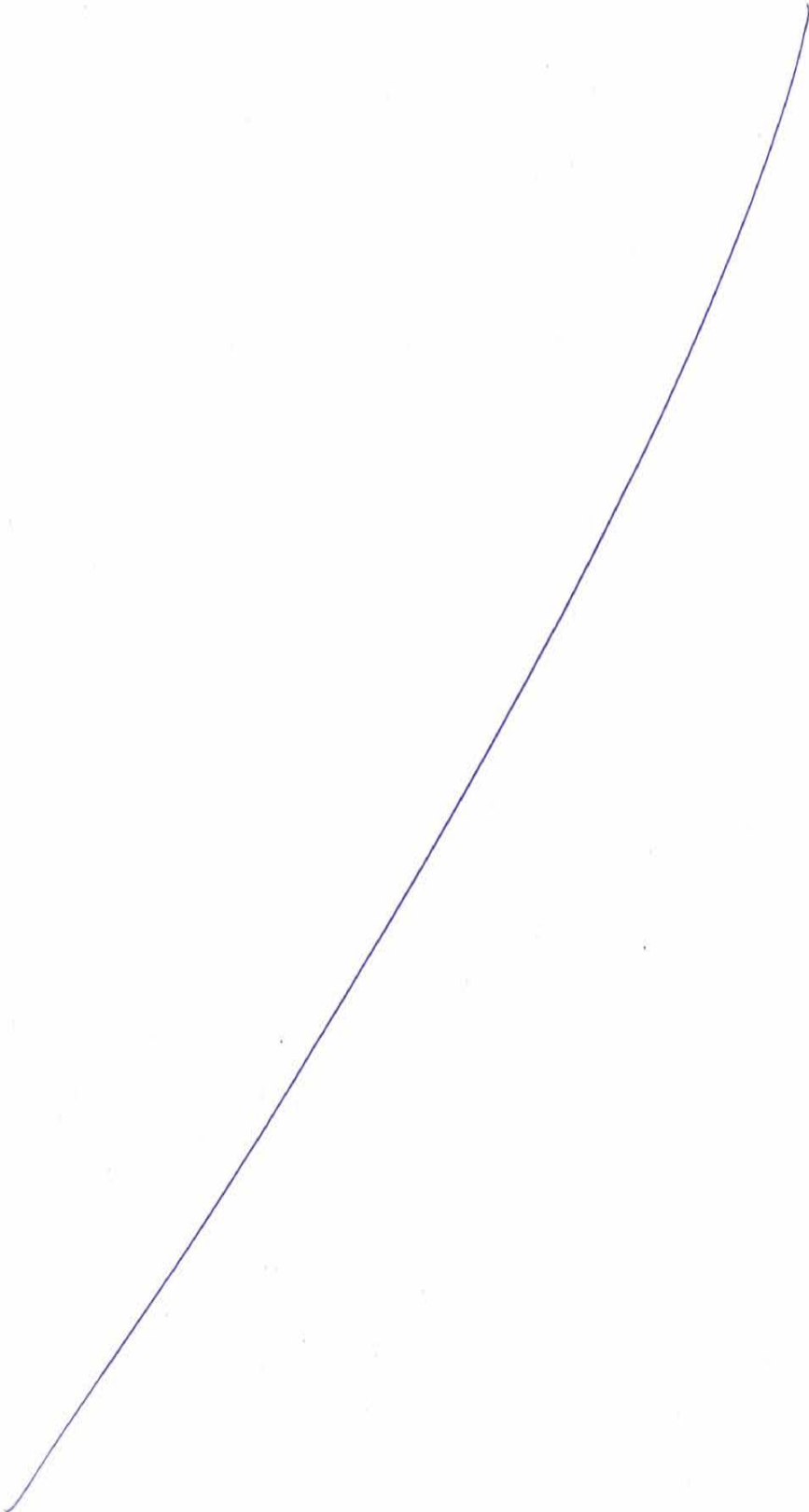
TRANSPORT
ENGINEERING AND CONSULTANCY SERVICES

WWW.RAMBOLL.COM/TRANSPORT

RAMBOLL



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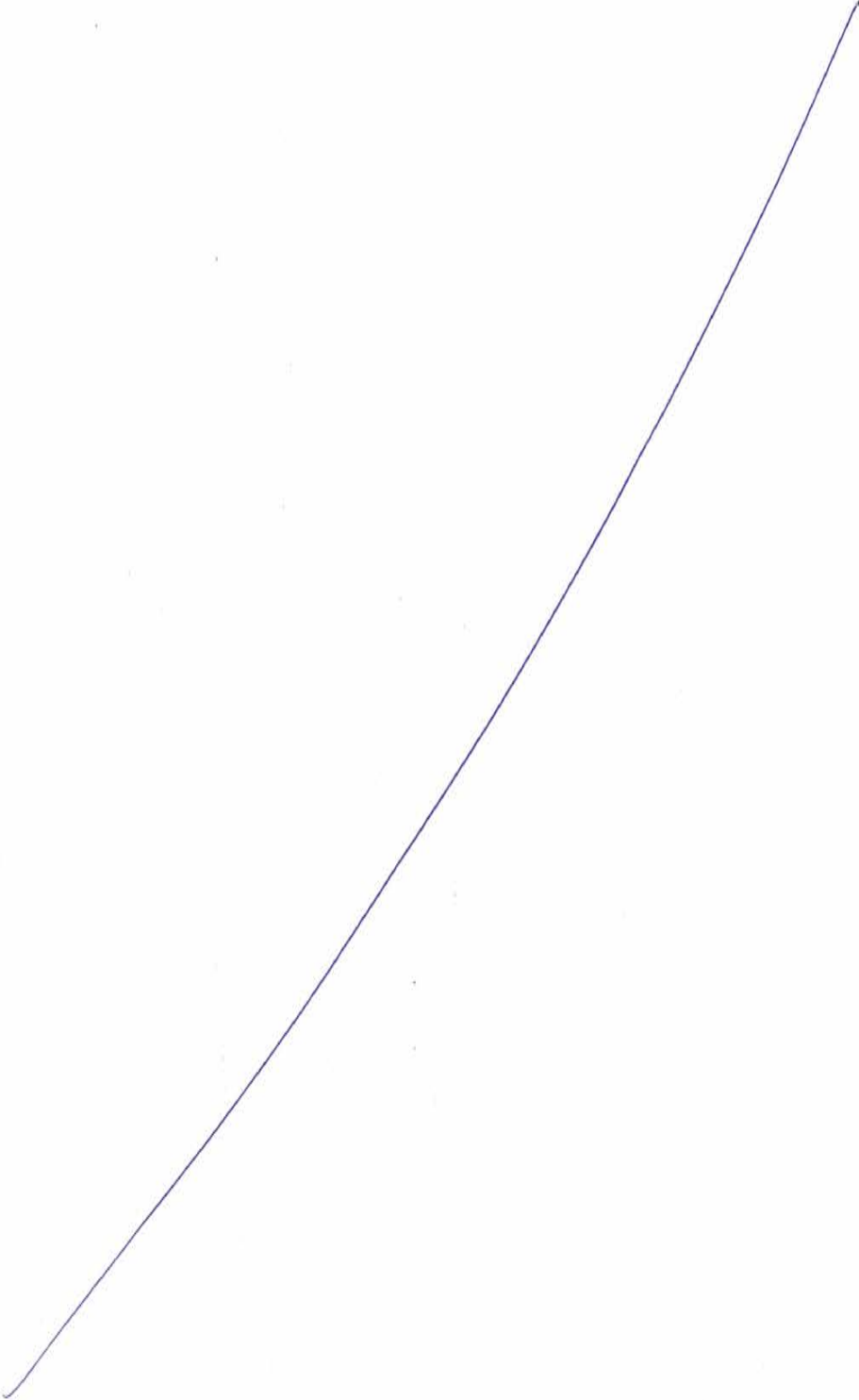


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RESPONDING TO TODAY'S GLOBAL CHALLENGES

Urbanisation, globalisation, and climate change represent three of the biggest global challenges and megatrends - and they all have a profound effect on infrastructure and transport. Ramboll is able to provide our clients with bespoke solutions to ensure the mobility of people and goods regardless of transport mode.

Urbanisation necessitates solutions pertaining to everything from public transport to increased freight and an ever-increasing demand for roads, ports, railroads, and airports. The need to create denser residential environments within existing urban areas requires engineering that is both innovative and cost-effective. It also requires hands-on sustainable engineering within the boundaries set by the environment and local regulations.

Globalisation calls for easy exchange of goods and manpower across the globe. The upgrading of cross-national transportation networks has become a priority. This has led to an increased focus on the establishment, refurbishment and maintenance of roads, rail, ports and airports. Also, bridges and tunnels are considered essential for connecting communities.

Climate change puts major demands on our infrastructure. It calls for more environmentally friendly and sustainable means of transport such as railways and sea transport. In order to alleviate the consequences of climate change, we have to come up with new and innovative solutions to address problems like increased precipitation and its effects on transport infrastructure.

ABOUT RAMBOLL

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. We employ 13,000 experts globally and have especially strong representation in the Nordics, UK, North America, Continental Europe, Middle East and Asia Pacific.

With more than 300 offices in 35 countries, we emphasise local experience combined with a global knowledge-base. We constantly strive to achieve inspiring and exacting solutions that make a genuine difference to our clients, the end-users and society as a whole.

Ramboll works across the markets: Buildings, Transport, Planning & Urban Design, Water, Environment & Health, Energy, Oil & Gas, and Management Consulting.

Ownership

The Ramboll Foundation is the main owner of Ramboll Group A/S and has as its main objective to promote the company's continuance alongside the long-term development of the company, its employees and the communities it serves. All shares in Ramboll Group A/S are owned either by the Ramboll Foundation or by employees in Ramboll.

Mission

Create sustainable societies where people and nature flourish.

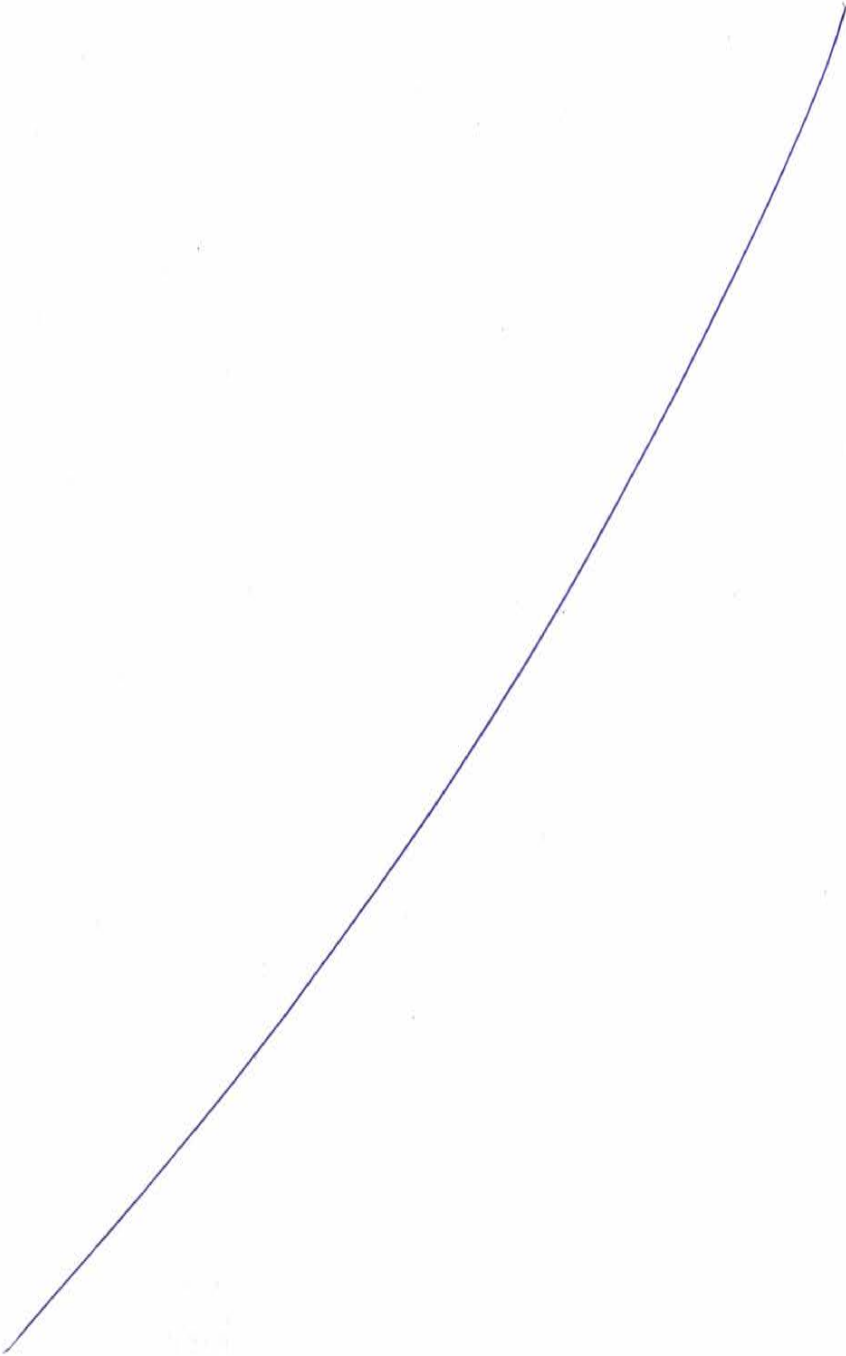
WWW.RAMBOLL.COM



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TRANSPORT

Who we are

We are part of Ramboll, a multi-disciplinary company with a strong customer focus. We provide state-of-the-art infrastructure and transport services, and our specialists have the expertise and experience to rise to the challenges of the demanding and ever-increasing complexity of any transport and infrastructure project.

Our customers range from public authorities at the national, regional and municipal levels, to contractors, investors, transport operators, and other private companies.

What we do

We offer every service required for project development, completion, and maintenance: from management consulting, feasibility studies, assessments and research, design and construction management, to asset management. Additionally, we apply our holistic view of the world and our environmental expertise to each one of these steps.

Our spearhead services cover the four main transport sub-sectors: aviation, ports, rail and roads.

Within Transport, we embrace thirteen different disciplines:

- Acoustics and noise
- Aviation
- Architecture and landscaping
- Bridge engineering
- Ground engineering
- Infrastructure asset management
- Ports and marine engineering
- Project and construction management
- Rail engineering
- Road and motorway engineering
- Transport planning, traffic engineering and traffic safety
- Tunnel engineering
- Urban development and master planning.

Holistic community consultant

The true uniqueness of Ramboll's value proposition lies in our customer partnerships. We provide our customers with a unique combination of wide ranging services, a holistic business approach, and global knowledge and experience coupled with a local presence.

We firmly believe that a local presence is essential - both to develop strong relationships with our customers, but also to fully understand the local conditions that influence our service delivery. At the same time, we leverage the benefits of being a large organisation with global reach by sharing and pooling our collective expertise and best practices across the organisation.

Among other things, this enables us to combine risk management methodology with technical know-how - which means that we can help our customers identify potential future obstacles, whether they're related to time, cost or technical matters.

Partner to the global community

Our distinctive approach to the design of the built environment is defined by our design focus, knowledge and passion, and founded on high ethical standards and a holistic business philosophy.

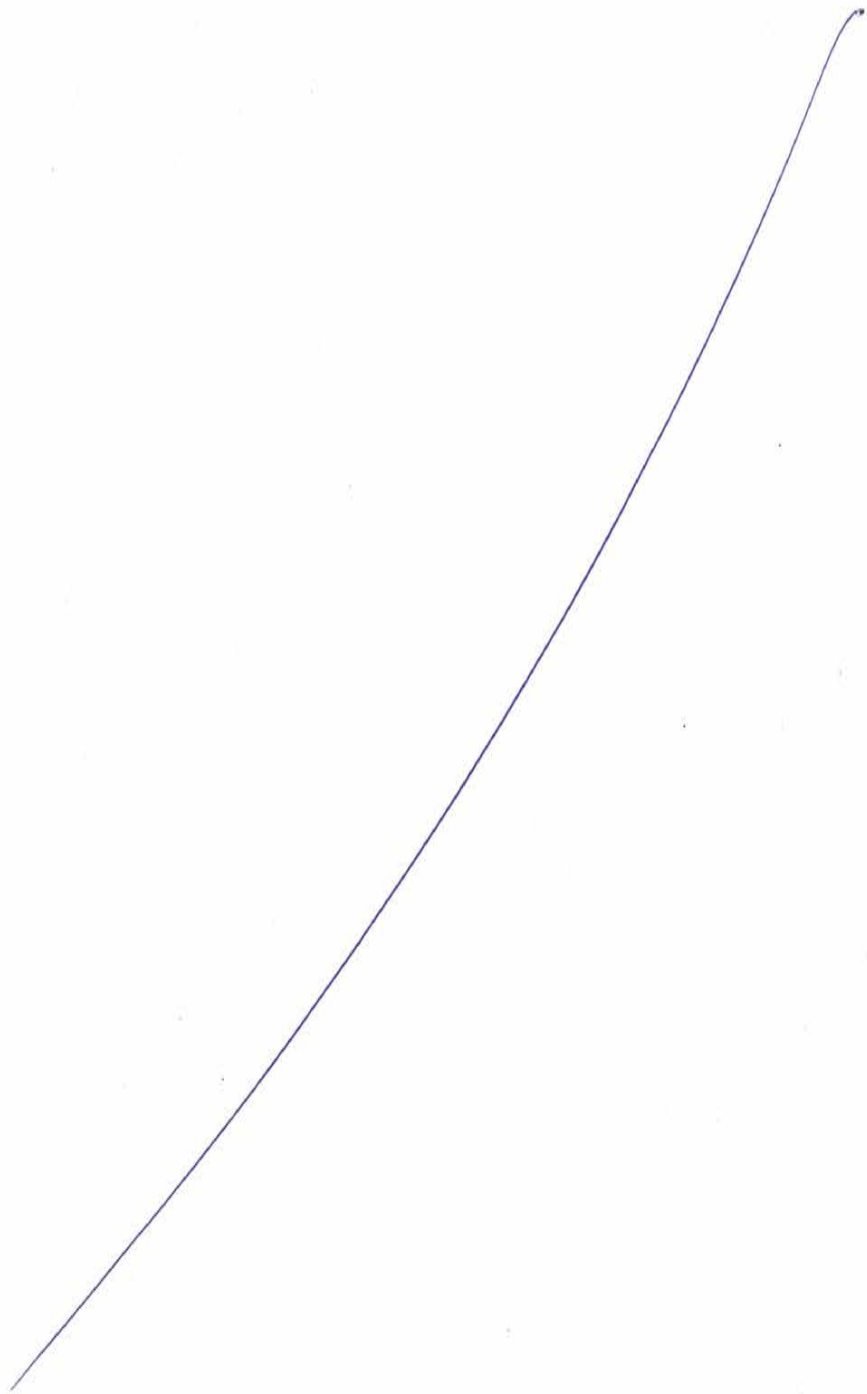
We use this approach to produce imaginative, exacting, and sustainable solutions. We question the way things are done in order to optimise the outcome of the project (including cost, durability, life-span, and design) to the benefit of the client and the overall community. We are dedicated to developing new sustainable technologies and creating innovative solutions for the future.

To show you how we're truly different, we have included lists of outstanding project references on the following pages.

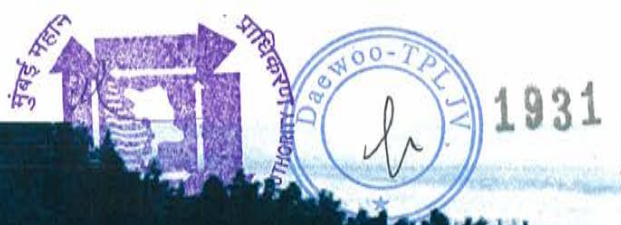




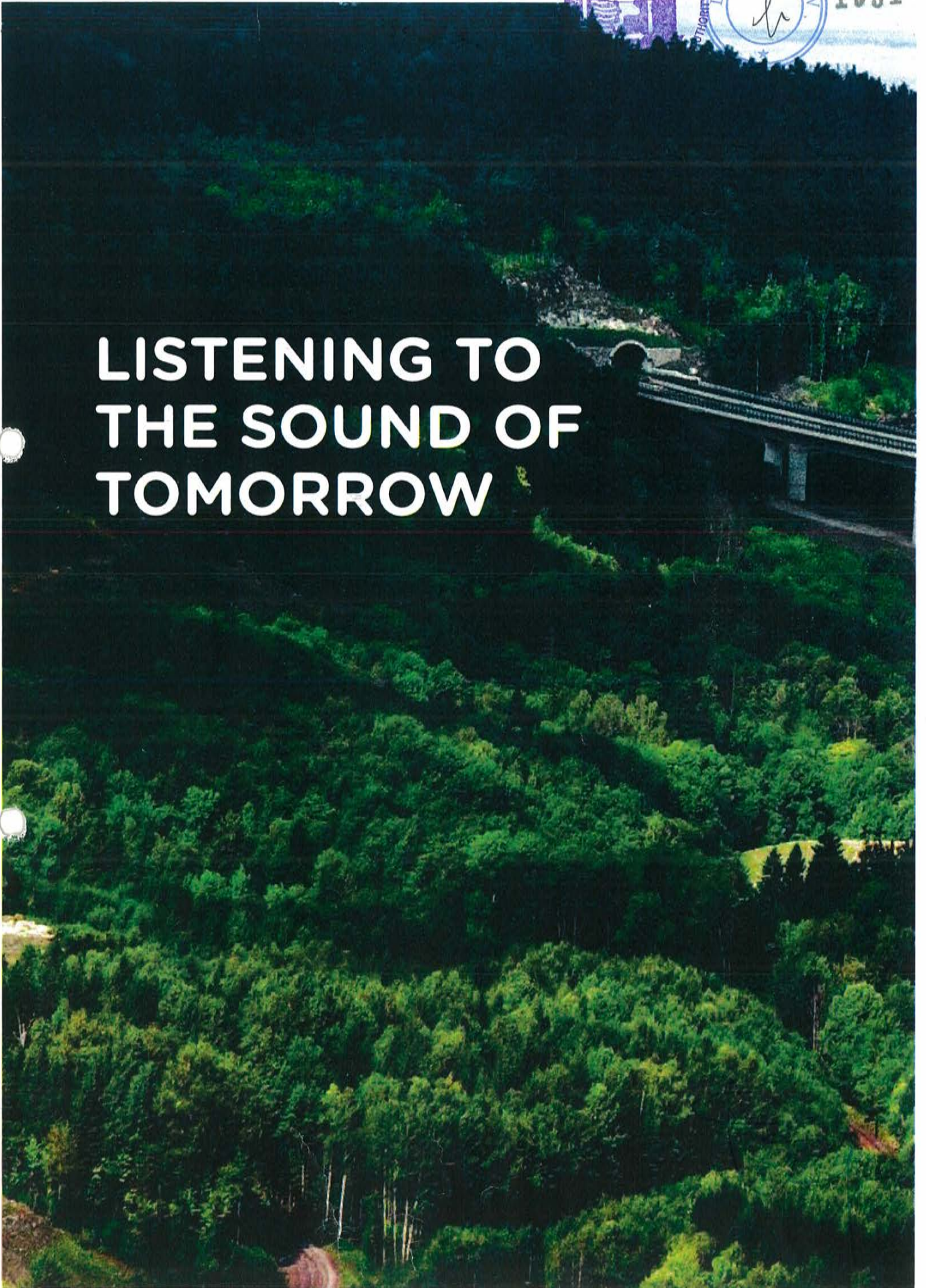
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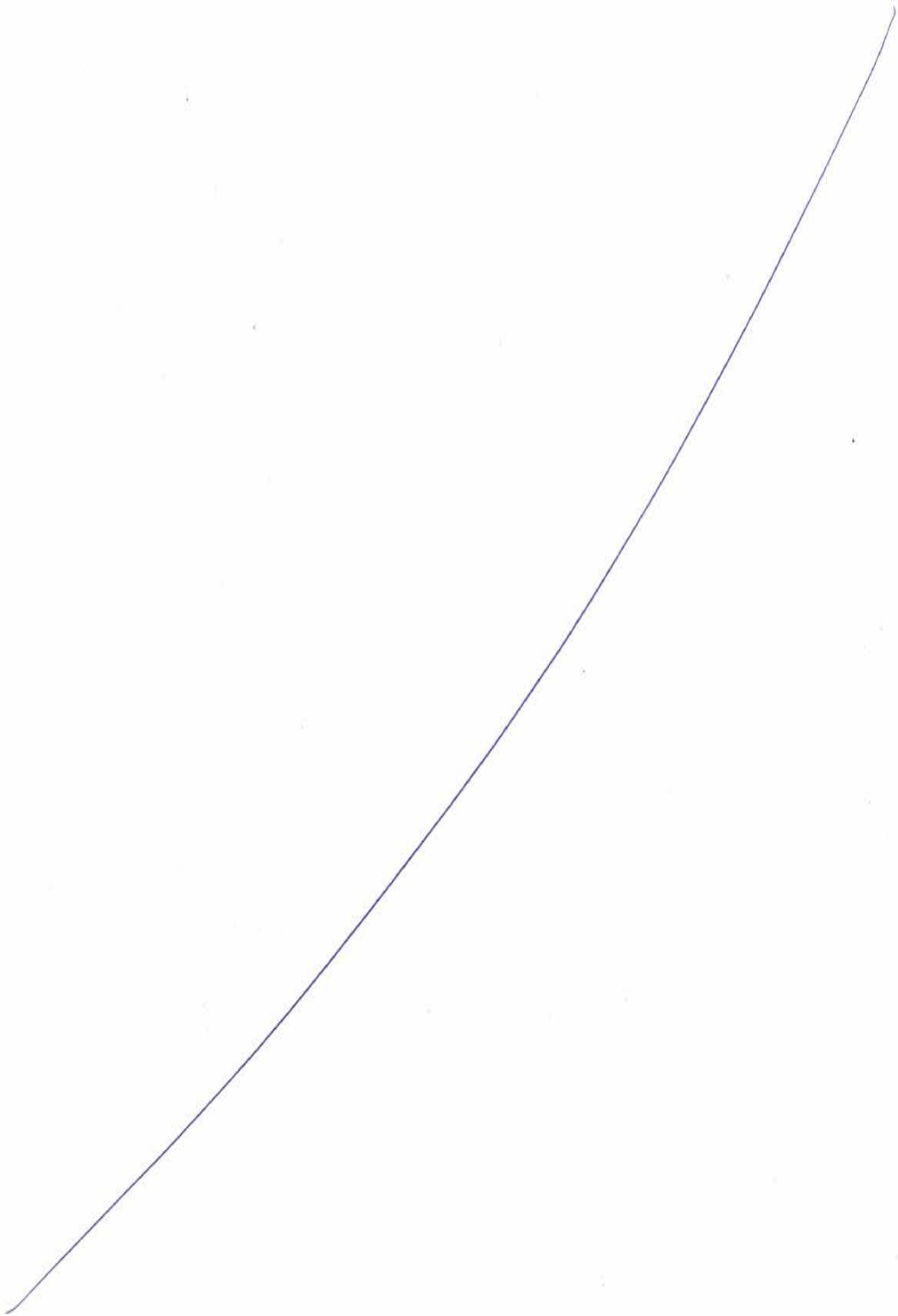
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LISTENING TO THE SOUND OF TOMORROW



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ACOUSTICS AND NOISE

Noise from road traffic, railways, and industrial machinery can have a negative impact on human health, communication and productivity. In order to improve acoustic ambience, regulating bodies have reinforced certain rules and regulations. These rules are now part of the Environmental Impact Assessment (EIA) of all major infrastructure projects. Ramboll has experienced specialists dedicated to comply with EIA and offer the expertise needed to address all these challenges.

Our acoustic services include planning advice and surveys for building acoustics, environmental noise and vibration, and acoustic performance. Our project experience covers a wide range of acoustic environments, from public spaces such as market squares and parks, the environment along roads and railways, to commercial spaces including offices, hotels, and shopping centres.

Effective noise surveys, analysis and protection

We use sophisticated computer programmes and sound measuring equipment to perform noise calculations. Our findings are used to help our customers identify the optimal solutions for proper noise protection, such as noise barriers, low noise pavement, and extra façade insulation on buildings.

We provide the facts you need to make your decisions and plan for the future, and enable you to have a dialogue with decisions makers, authorities, and the public. By using state-of-the-art computer models according to internationally recognised

standards, we provide noise maps showing the noise impact levels at the present and future situations compared with noise limits. The calculations used for noise mapping are based on a combination of information collected in cooperation with you and the application of our know-how.

By utilising a 3D model along with the calculations, we have the ability to not only see but also listen to a model. This can be used to establish external environmental noise when planning a new urban area, and room acoustics when designing a lecture hall or conference centre.

Creative and innovative approach

Our expertise enables us to provide a unique range of acoustic services covering all aspects of planning advice, environmental noise and vibration, surveying and acoustic performance and building acoustics.

OUR SERVICES

- Calculation or control measurement of noise from roads and railways to assess their environmental impact
- Specification of sound requirements for acoustic programmes
- Identification of noise reduction solutions that satisfy both the regulations and our customers' wishes
- Collaboration with other consultants regarding acoustics dimensioning or choice of products
- Utilisation of 3D models to see and listen to the sound or noise for both environmental noise and room acoustics.
- Final inspection and control measurement or calculations

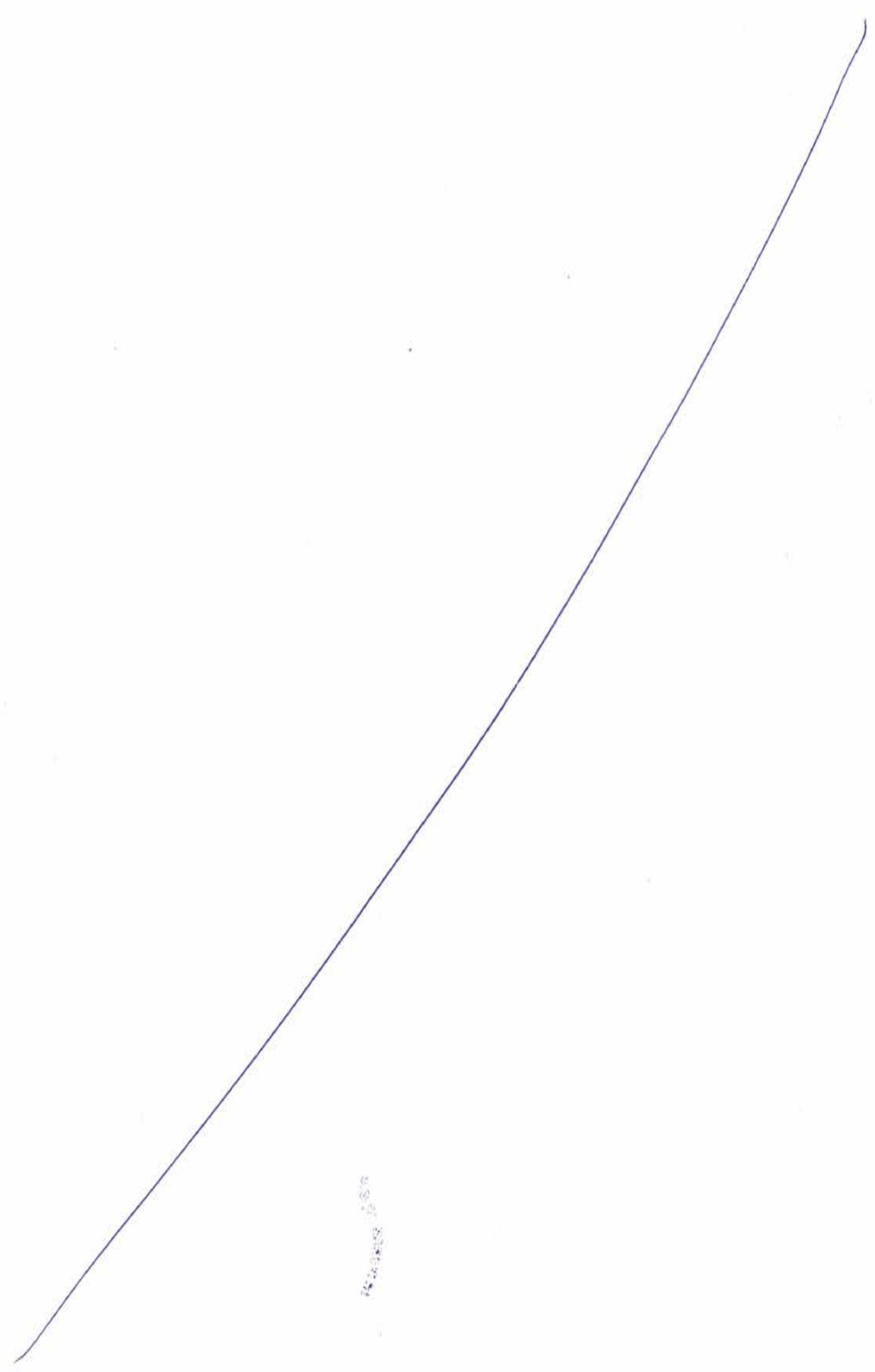
The Ramboll Acoustics network comprises specialists on all issues related to environmental noise (incl. industry, road, traffic, rail, air, off shore) and building acoustics.



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03

PROJECT REFERENCES

01 Noise surveys and noise reduction
 action plan for Finnish Road
 Administration. The plan follows EU
 noise directive and environmental law.

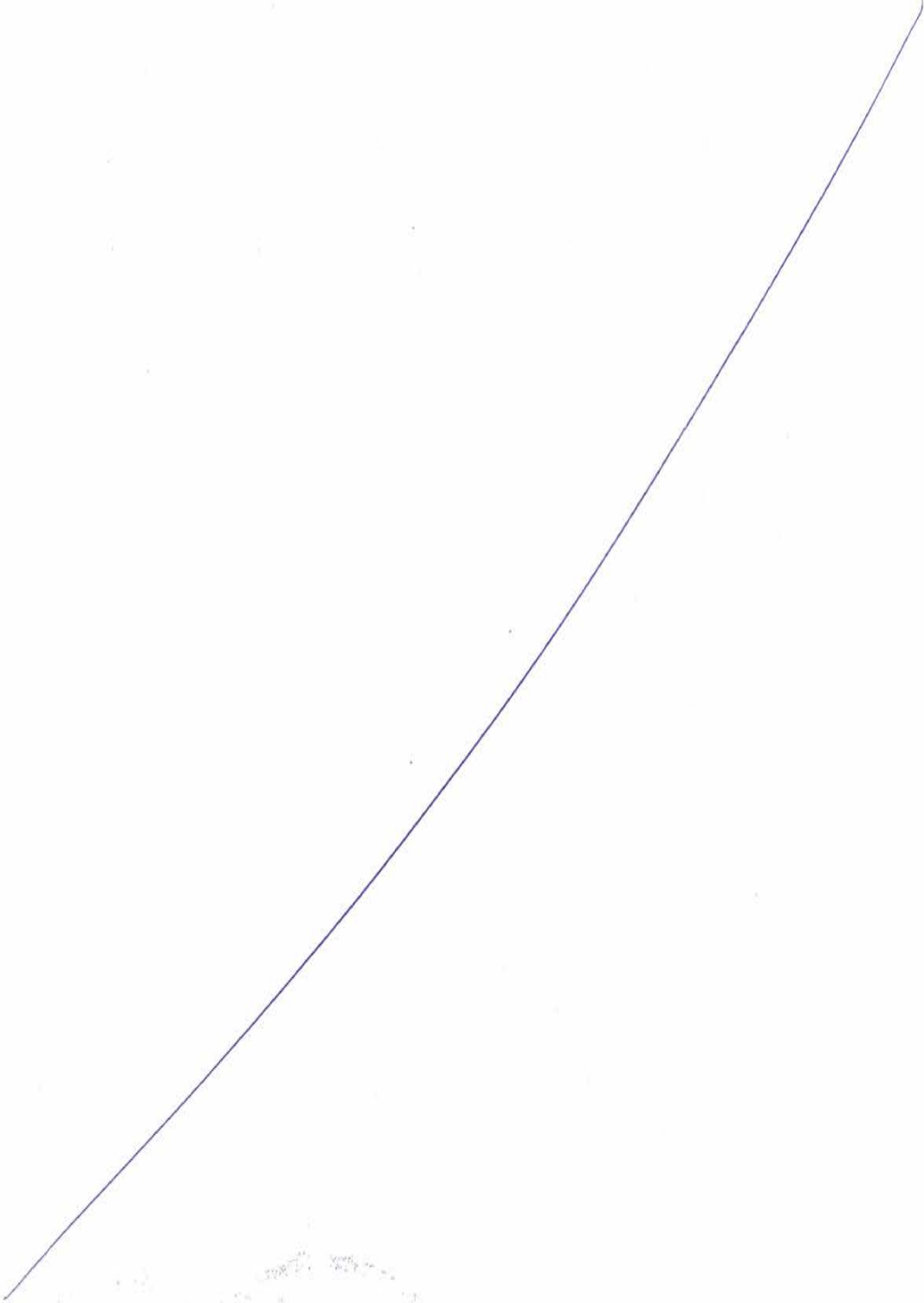
02 Lilla Essingen. Environmental
 sound diagnosis and auralisation.
 Ramboll helped the contractor by
 making a 3D-model with sound so
 tenants can see and hear what the
 new development will be like.

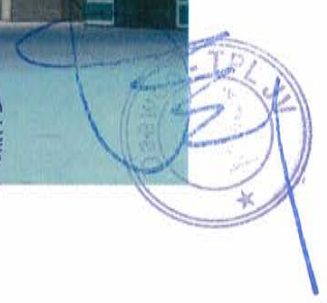
03 Stockholm Water Front. The office
 building allows for individual adaptation
 of office space for each tenant. Ramboll
 made the adaptations to make the
 office efficient and cost effective.

Noise surveys for new Helsinki
 metropolitan area shooting center.

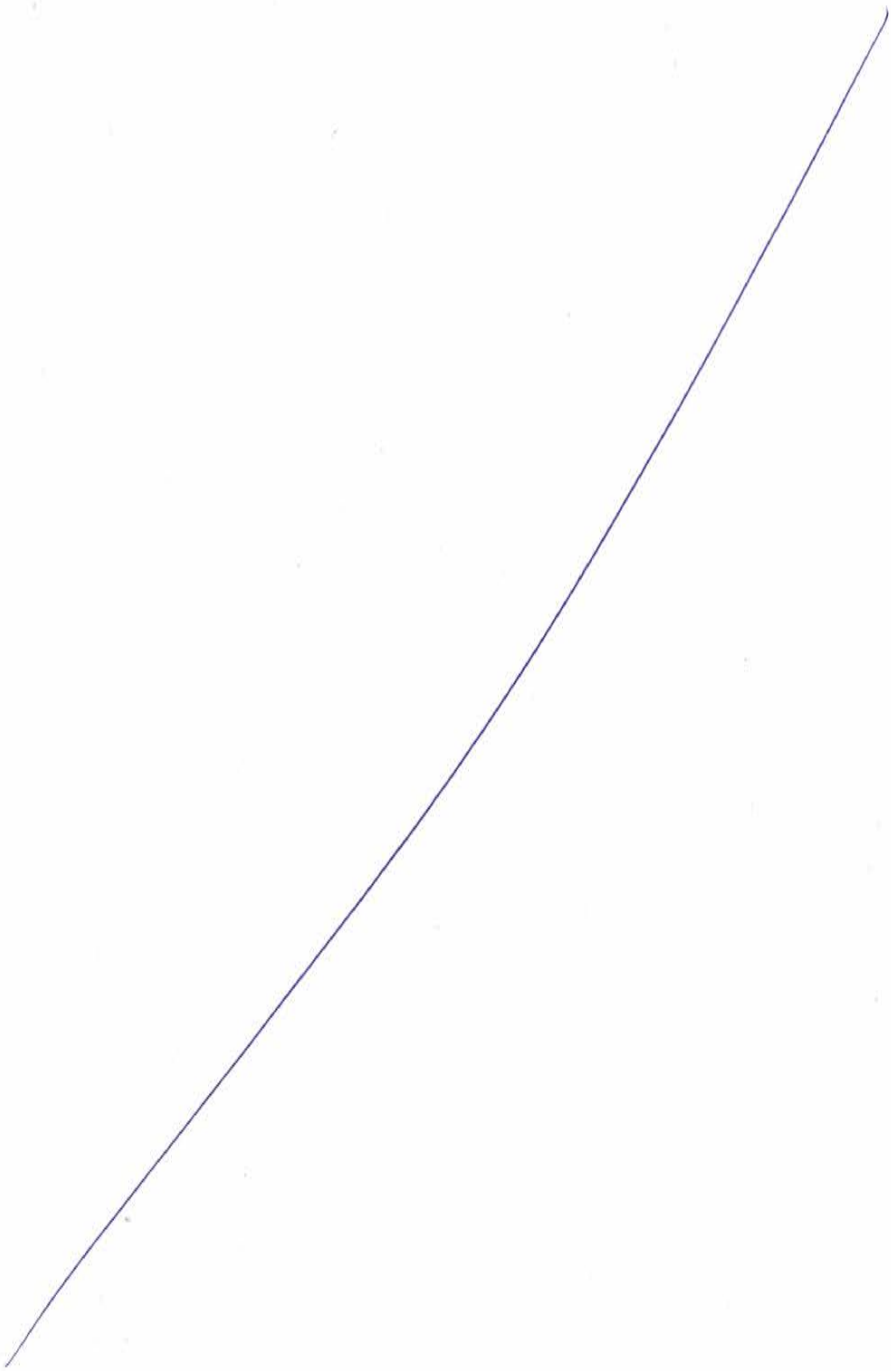


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AVIATION



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The international aviation sector is a growth sector, primarily due to continued investments in the upgrade of existing airports.

Ramboll has worked on some of the biggest and most complex airport projects in the world, and we offer complete solutions for airport developments. Our services cover everything required to plan, design, implement and maintain aviation infrastructure - from economic evaluations and master planning to the detailed design of terminals and pavement maintenance.

Our approach

Our work is underscored by an in-depth understanding of the airport operators' needs, particularly when it comes to securing long-term performance at a reasonable cost.

We believe that, at times, it is worth challenging conventional assumptions in the interest of driving best industry practices.

This means that we are more likely to design a smaller runway refurbishment followed up with a close monitoring regime than to suggest an over-engineered solution that delivers a long life performance at a high capital cost. We believe so strongly in the wisdom of this approach that we developed our own airfield pavement management system, Airpave, to assist operators in managing this key asset area.

Our focus on delivering well analysed, context-appropriate solutions is informed by a commitment to sustainability.

Our services

We have extensive international experience within all the services required for aviation infrastructure - and we take a multidisciplinary approach by combining our services, thus delivering complete, fully integrated solutions to our customers.

Our expertise covers the following areas

Feasibility and master planning
Ramboll is well positioned to advise customers on all aspects of the early planning stages of airport development.

Our planners have advised governments, regulatory bodies and private developers around the world on air safety, emissions reductions, and flight pattern optimisation. We are experienced in providing the feasibility data necessary for successful applications for EU funding for major infrastructure projects.

We understand the need for a fully integrated approach that takes into account how aviation sits within a broader network of infrastructure provision - often a key consideration in sustainability strategy.

Design and engineering

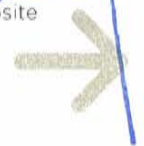
Our multi-award winning building and design team excels at delivering optimised terminal buildings. From Heathrow to Gatwick, Hyderabad to Moscow, we have engineered numerous new buildings and refurbishments, often within live airport environments. When it comes to airside infrastructure, we take a sound approach to phasing, composite

PROJECT REFERENCES

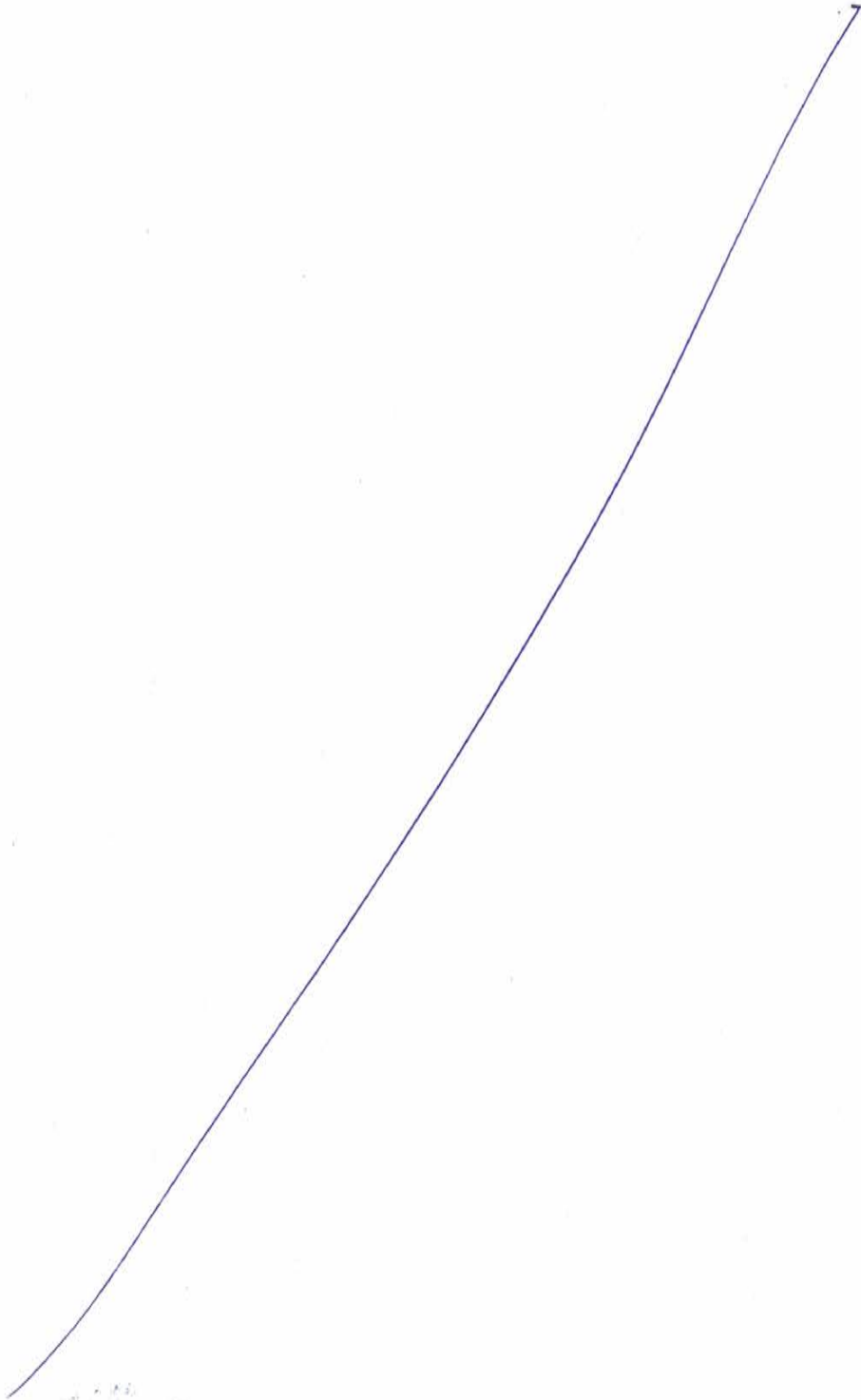
01 Sandefjord airport - master plan. When air traffic at Sandefjord airport rose sharply in 2004 due to the opening of low cost routes, in particular by Ryanair, the airport operator commissioned Ramboll to masterplan a phased expansion to meet increased passenger demand.

02 Sydney Airport. Ramboll has supplied Sydney International Airport with an air pavement management system. The system provides a precise and economic framework for managing the airport's 3 million m2 of paved assets.

03 Pulkovo Airport. Ramboll is the lead consultant for the redevelopment of airside and landside assets at Pulkovo airport in St. Petersburg - one of Europe's largest aviation projects.



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→ materials use and future planning, so we may deliver high performance pavements to the most efficient programme.

We supply all the disciplines necessary for the full project delivery, embracing every aspect of design from acoustic engineering to security planning and baggage handling systems. Clear communications with the design team and diverse stakeholders groups underpins our multidisciplinary approach, and ensures effective integration across services.

Asset management

Ramboll has a proven track record providing holistic operational and maintenance support to the aviation sector. Our experience is wide-ranging. We provide consultancy in change management and planning, environmental reporting and air traffic control, as well as support in the long-term maintenance of key infrastructure.

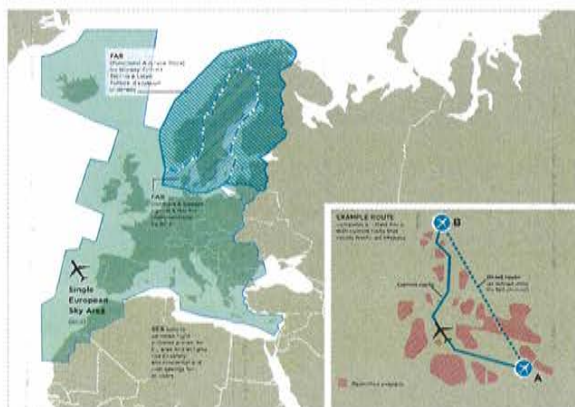
We are known for our numerous innovations in air pavement engineering, and ever advancing industry practise in the use of more elegant, less intensive solutions. Our research in this area has developed hand-in-hand with our work on Airpave, our own air pavement management system.

The result is a fully integrated approach to safety and performance - an approach that supports clear asset management and long-term financial planning.

PROJECT REFERENCES

04 Single European Sky in the Nordic and Baltic Countries. Ramboll was commissioned to investigate the socio-economic impacts of establishing common airspace blocks across national boundaries.

05 Copenhagen International Airport - long term collaboration. Since 1992, Ramboll has served as in-house consultant for all the airport's maintenance, refurbishment and expansion needs.



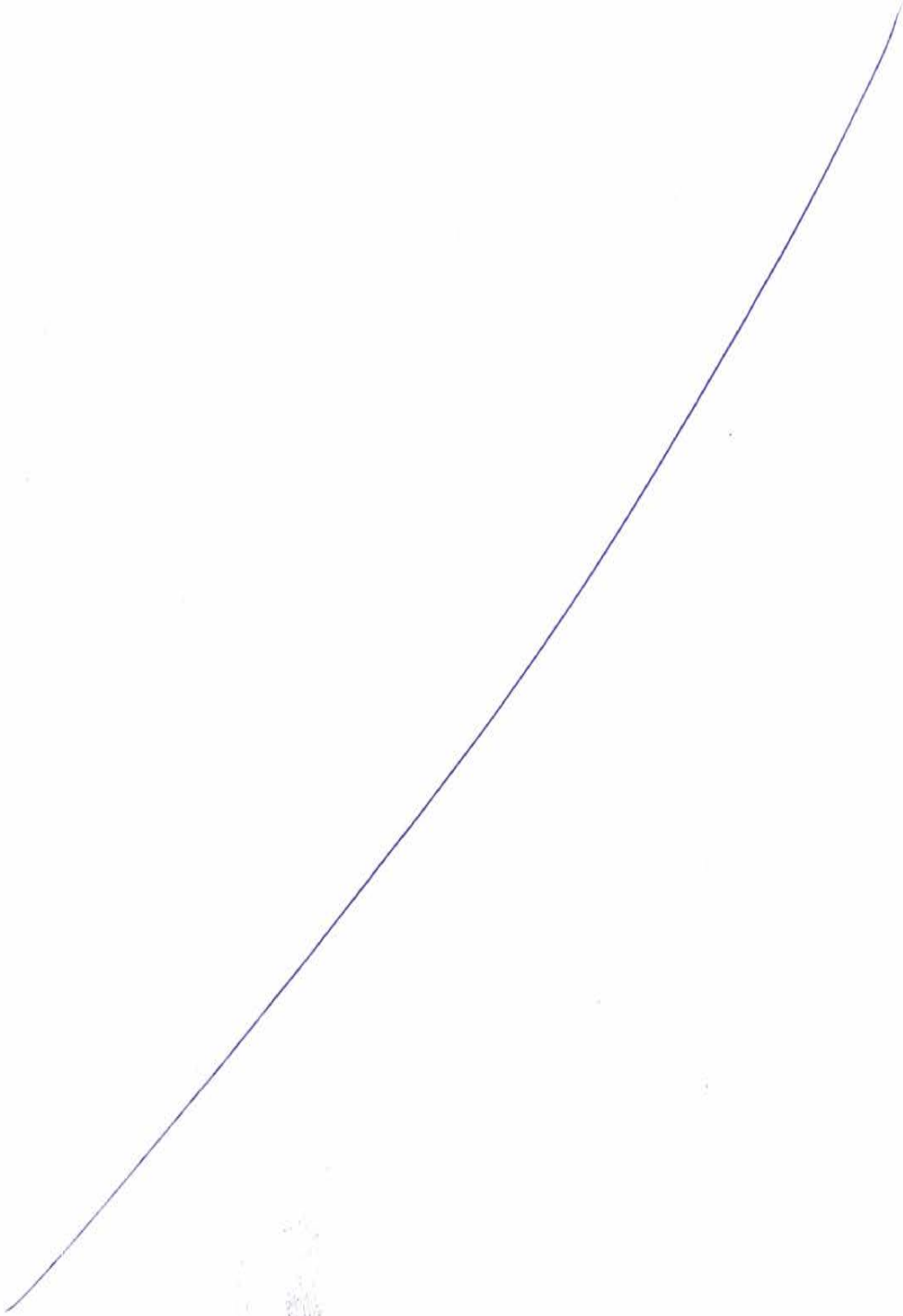
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ARCHITECTURE AND LANDSCAPING

The challenges of creating attractive outdoor environments have become more pronounced with increased urbanisation. Public areas are expected to be functional and pleasant for everyone, including pedestrians, cyclists, and car users. Ramboll landscape designers create environments that contribute to people's well-being, increase our appreciation of nature, and preserve cultural heritage. We do this by planning and designing outdoor and public spaces that both enhance the surrounding environment and ensure public enjoyment.

Our landscape designers have experience in all stages of the design process, from pre-surveys to complete implementation plans. We get involved in civil engineering and infrastructure projects at an early stage to ensure a smooth process from start to finish. We provide analyses and assist with site surveys, configuration, and environmental impact assessments. We have extensive experience with transport infrastructure projects, including roads, railways, and ports. By getting involved as early in the process as possible, we can help ensure that the infrastructure is integrated with the surrounding environment.

Social, aesthetic and ecological aspects

Sustainable development is an increasingly important focus of urban renewal. Ramboll's team of landscape architects, landscape designers and urban planners work in an interdisciplinary way to achieve functional and beautiful designs

that are sustainable on a social, ecological and economic level.

Landscape architecture is about designing outdoor and public spaces for a specific purpose, whether it's social, aesthetic, or ecological. We are dedicated to creating environments that encourage people to make sustainable lifestyle choices. Sustainable cities and areas are planned with minute considerations of their environmental impact.

All-encompassing experience

Landscaping includes planning and design for infrastructure and transport developments, residential and mixed-use areas, offices, hospitals, schools and other public spaces, as well as major industrial sites. Landscape architects are involved in projects from the earliest stage design studies, throughout the planning process, to construction and management plans, covering everything from broad landscape concept designs to small-scale landscape detailing. Our projects all have an environmental focus based on consideration of alternative solutions and assessment of the environmental impact of the design.

Ramboll has approx. 120 employees working within the architecture and landscaping area, the majority of whom are located in the Nordic countries and Estonia.

Areas of expertise

Landscape Design and Planning is driven by human, technical and ecological factors.



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PROJECT REFERENCE

01 Krokslätt factory, Gothenburg, Sweden. Ramboll is doing the planning for a new housing area where multifunctional green areas enrich urban life. Vegetation is used for guiding and slowing down storm water.

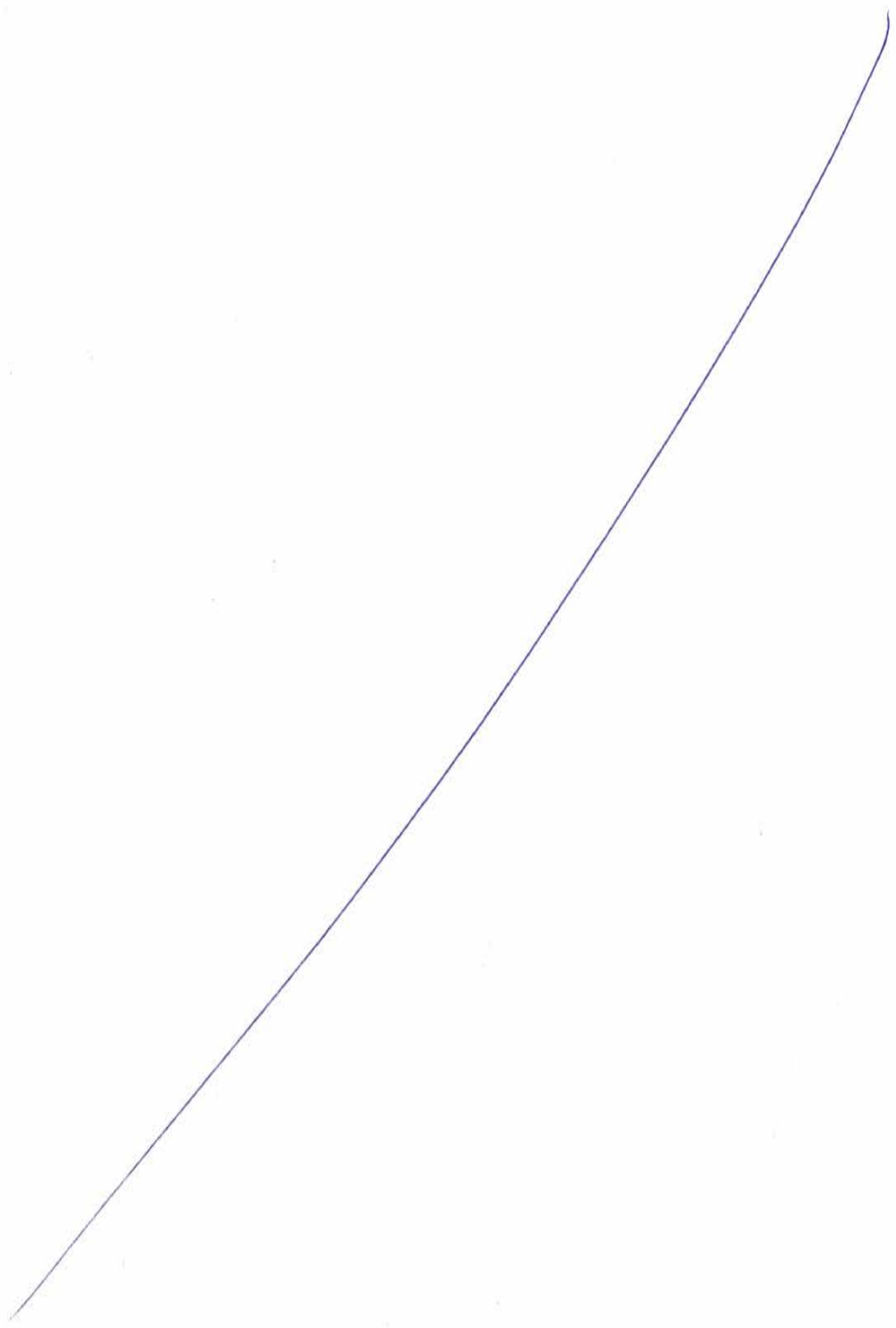
TYPICAL COMMISSIONS

- Landscape integration (road, railways, bridges and tunnels, landscape reclamation, water constructions)
- Urban environment integration (residential areas, offices and industries, gardens, parks and green belts, pedestrian areas, cemeteries, design programs)
- Recreational planning (Camping resorts, recreation areas, marinas, preservation areas)
- Physical planning (planning programs, master plans, landscape analyses, impact studies)



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BRIDGE ENGINEERING



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Today's society requires the creation of new bridges to ensure a better overall infrastructure, as well as the safeguarding of existing bridges. This is true for both urban and rural areas, and for roads, railways, and other transport modes incl. bicycles. Bridge engineering is one of Ramboll's strengths, where we offer unique services within design, optimisation, and asset management.

Within all of these services, we prioritise the safe, easy transportation of people and goods. Drawing on our deep understanding of bridge lifecycles, we implement cost-effective solutions that reduce travel time and improve connections.

Our approach

Our approach ensures that we can provide all the design, engineering, environmental, sustainability, and project and cost management skills needed to deliver any project. Our reputation for imaginative design is based on the way our ideas translate to practical application. We are supported by a multidisciplinary group of consultants within the areas of environmental planning, landscape architecture, and transport and sustainability. This makes for a winning combination of experience and innovative thinking. Many of our bridges have become landmark structures.

Bridge consultancy

We provide consultancy services for all bridge types, from the smallest culverts, over pedestrian walkways to the world's largest bridges. Our specialists are experienced in urban analysis and planning requirements, and skilled at working in historic townscapes and rural landscapes.

We know how to improve connectivity, support sustainable transport initiatives, and create bridges sensitive to their settings.

Our consulting services cover the entire bridge lifecycle and include:

- Environmental evaluation
- Geotechnical and geological investigations and foundation of bridges
- Architectural design
- Hydraulic analysis
- Traffic studies
- Transport economic studies
- Risk analysis
- Integration with city squares and roads
- Railway bridge engineering
- Design of hydraulic and mechanical systems for moveable bridges
- Construction management.

Our bridge team works closely with our transport and infrastructure teams to provide a fully integrated approach specific to each project.

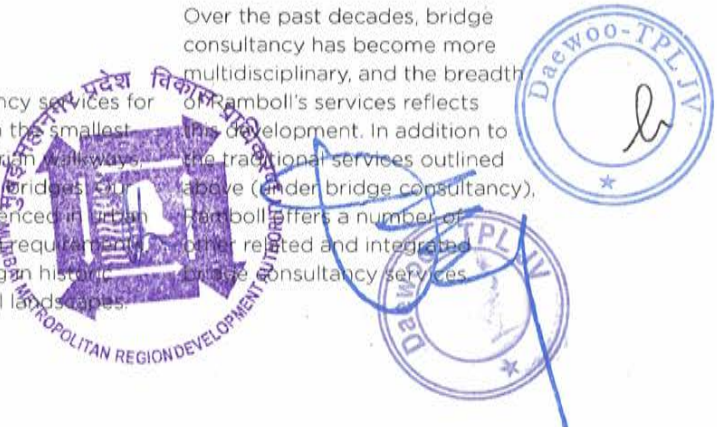
Our customers are typically bridge owners and contractors. We undertake extensive consultations with planning authorities, statutory bodies, and local interest groups to enable delivery of bridges that will secure regulatory approval, are safe, cost effective and easy to construct.

Multidisciplinary engineering

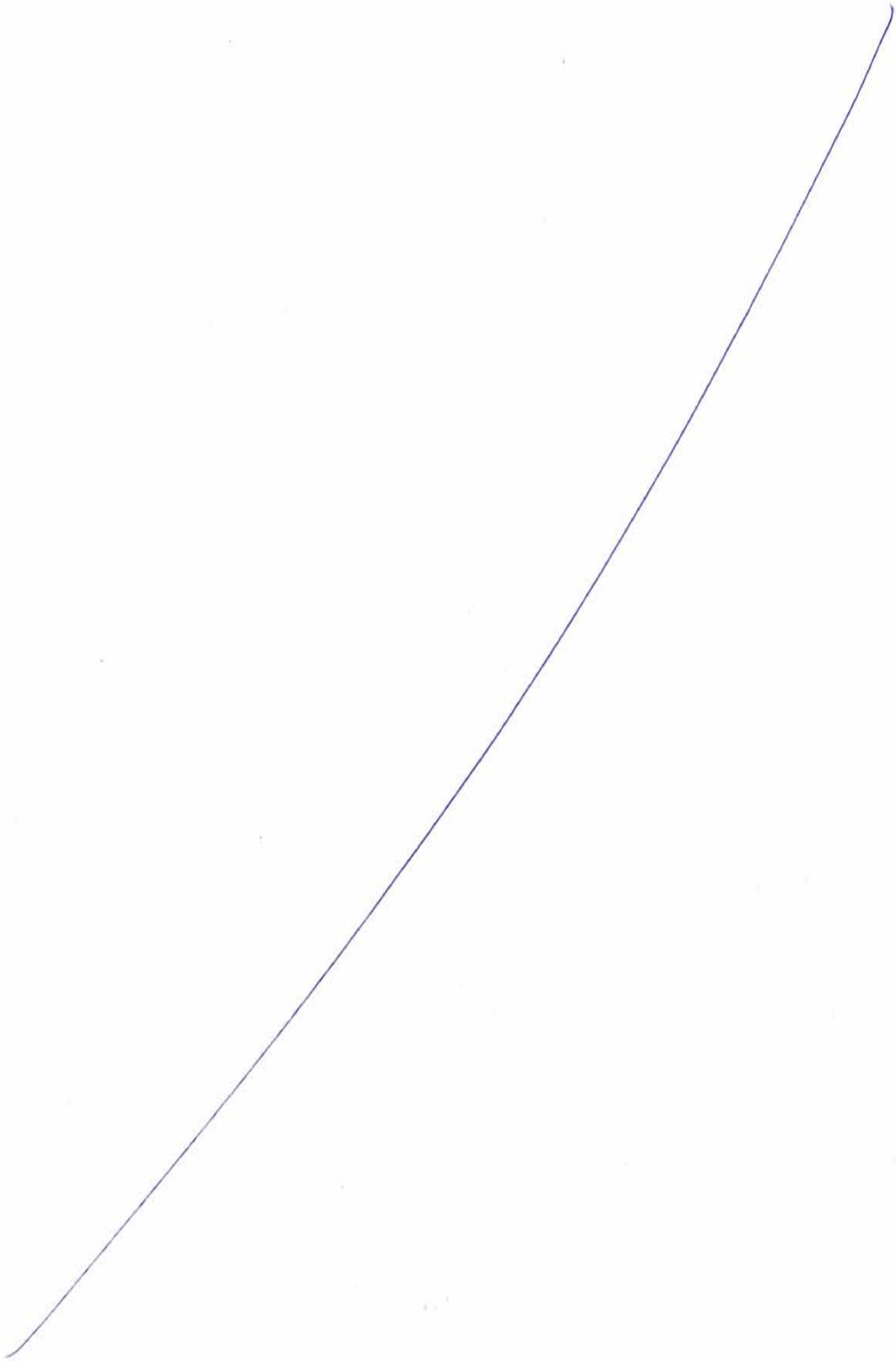
Over the past decades, bridge consultancy has become more multidisciplinary, and the breadth of Ramboll's services reflects this development. In addition to the traditional services outlined above (under bridge consultancy), Ramboll offers a number of other related and integrated bridge consultancy services.

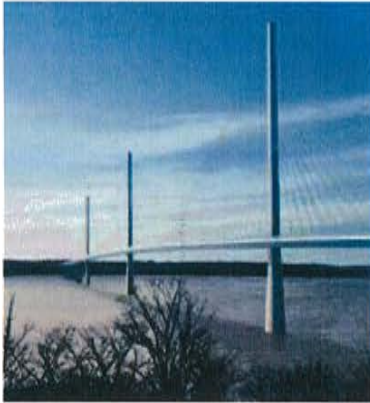
OUR SERVICES

- Planning
- Feasibility studies
- Outline proposals
- Preliminary design
- Detailed design
- Tender
- Construction management
- Operation and maintenance
- Repair
- Strengthening
- Demolition or replacement



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PROJECT REFERENCES

01 Riverside bridge over River Cam, Cambridge, UK. A landmark bridge serving pedestrians and cyclists. The bridge snakes across the water and adjacent flood plain. The bridge received the International Bridge Conference Award Arthur G. Hayden Medal 2010.

02 Forth Replacement Crossing, Scotland. Currently Scotland's and Northern Europe's largest bridge construction project. Ramboll is lead partner in the joint venture designing the bridge roads and land work structures.

03 Mersey Gateway, Halton, UK. Ramboll has been lead technical consultant for this regeneration project since 2001. The project received a grant of funding from the UK Department of Transport in October 2011.

04 The Farris bridge on road E18 at Larvik, Norway. Ramboll won the Norwegian Road Authorities' design competition for the bridge together with L2 Architects in Oslo.

05 Lövä Bridge in Kemiönsaari, Turku archipelago, Finland. The 500m long bridge was designed by Ramboll.

06 The new railway drawbridge in crossing the canal in Södertälje, Sweden. Ramboll provided all design drawings needed for the new steel bridge. The bridge carries 120 trains per day.



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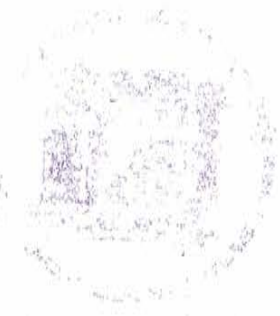
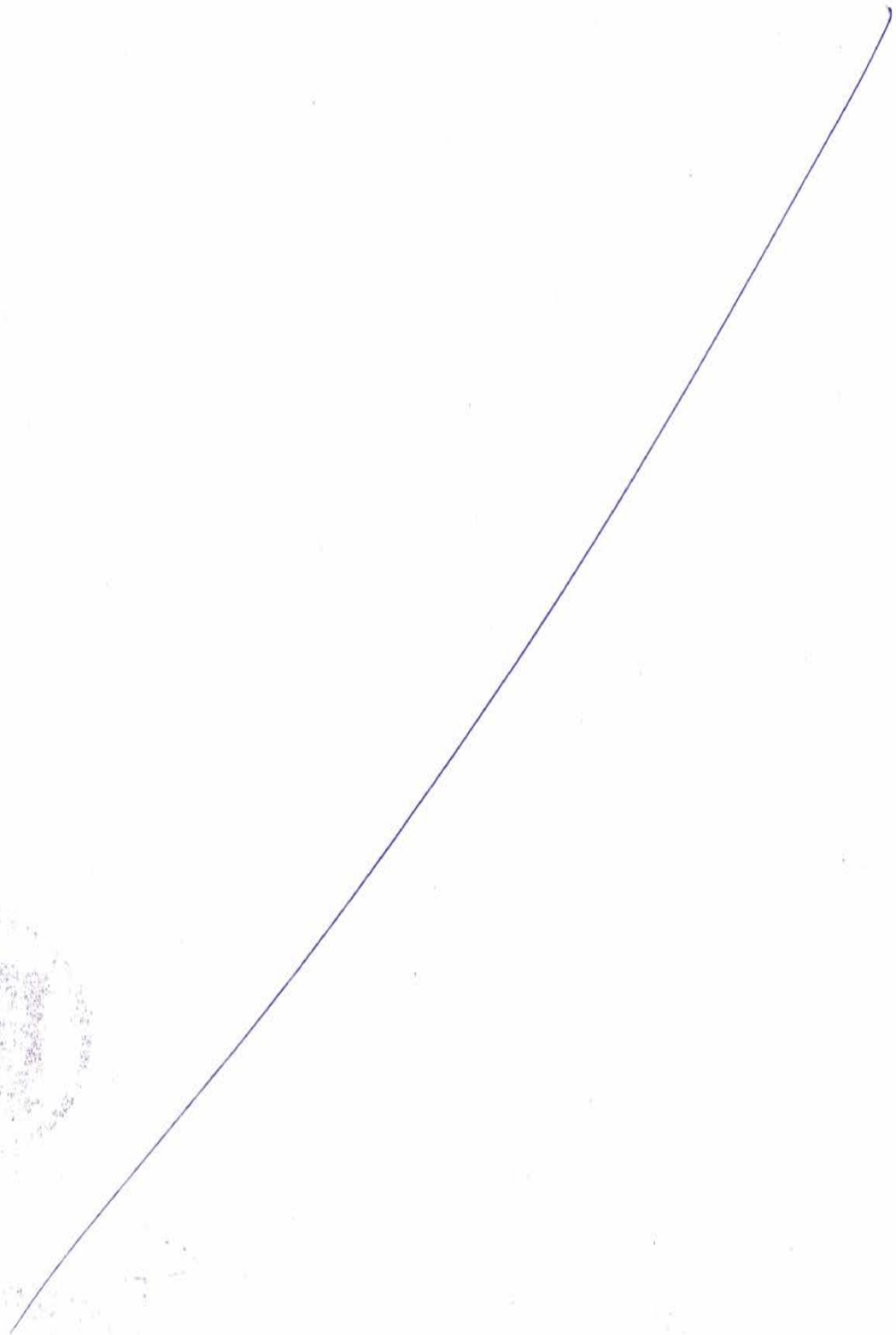




**URBANISATION,
GLOBALISATION,
AND CLIMATE CHANGE
REPRESENT THREE
OF THE BIGGEST GLOBAL
CHALLENGES AND
MEGATRENDS - AND THEY
ALL HAVE A PROFOUND
EFFECT ON THE
INFRASTRUCTURE AND
TRANSPORT AREA**

1950

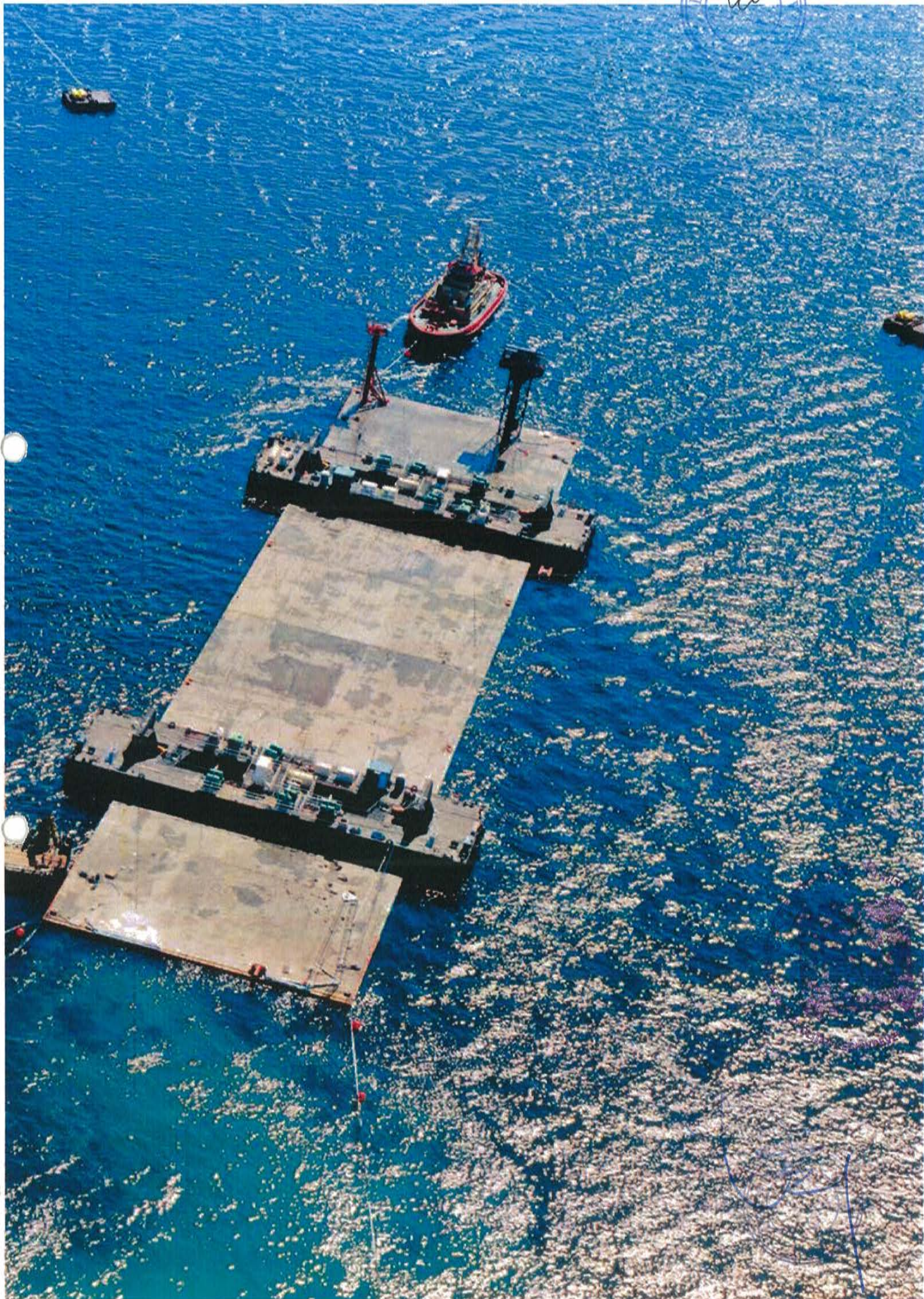
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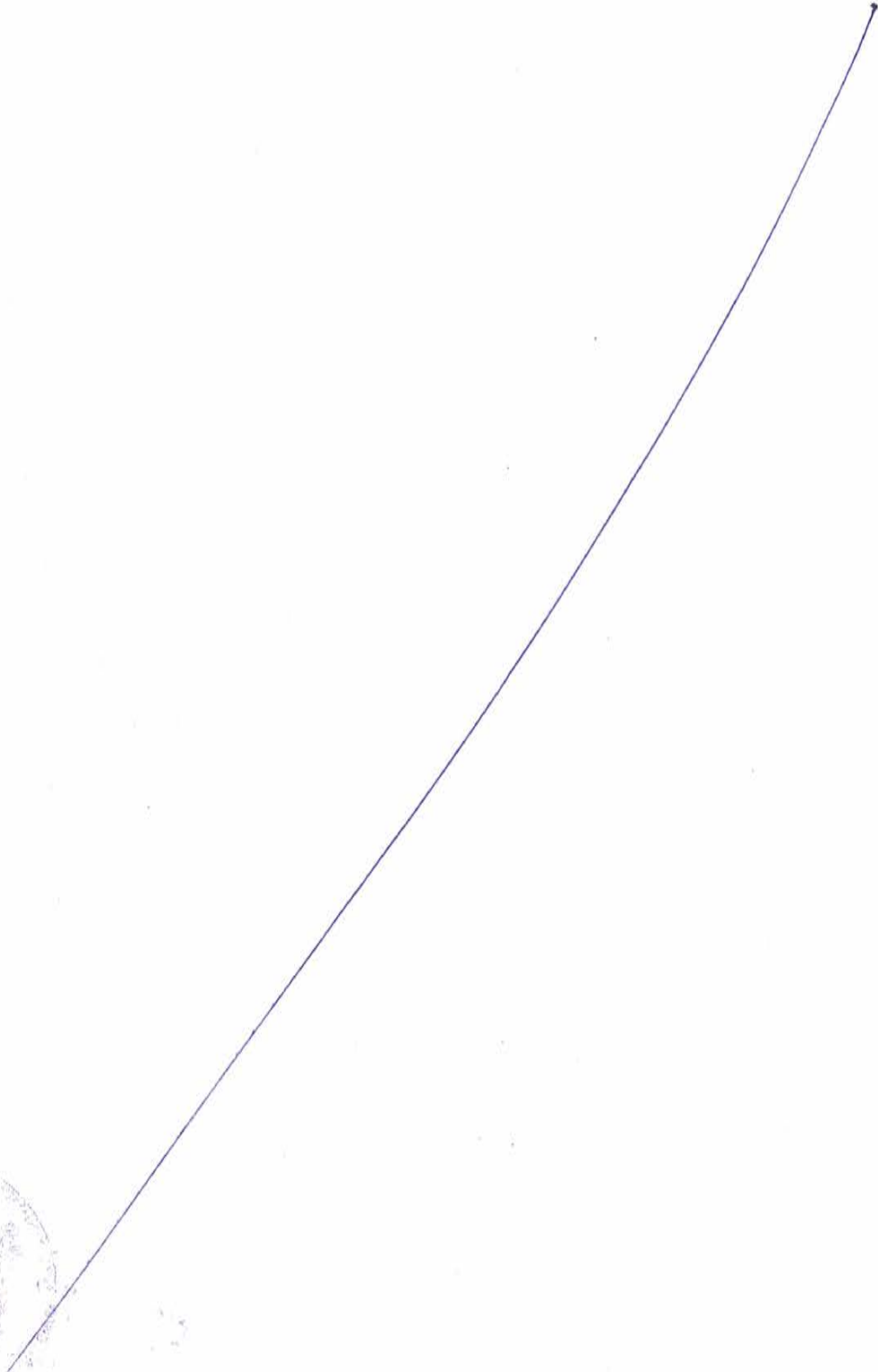


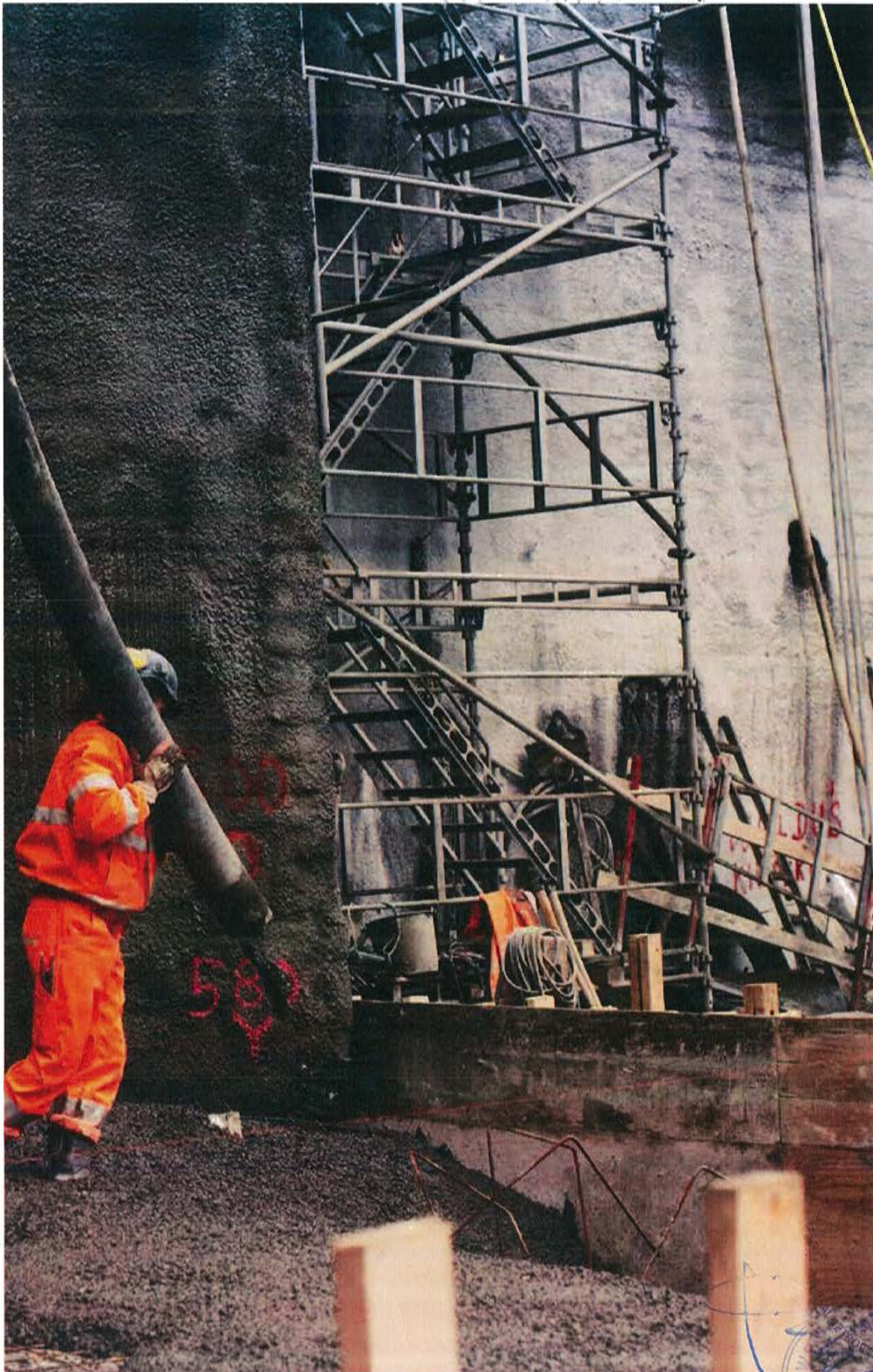
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PROPERTY LIBRARY

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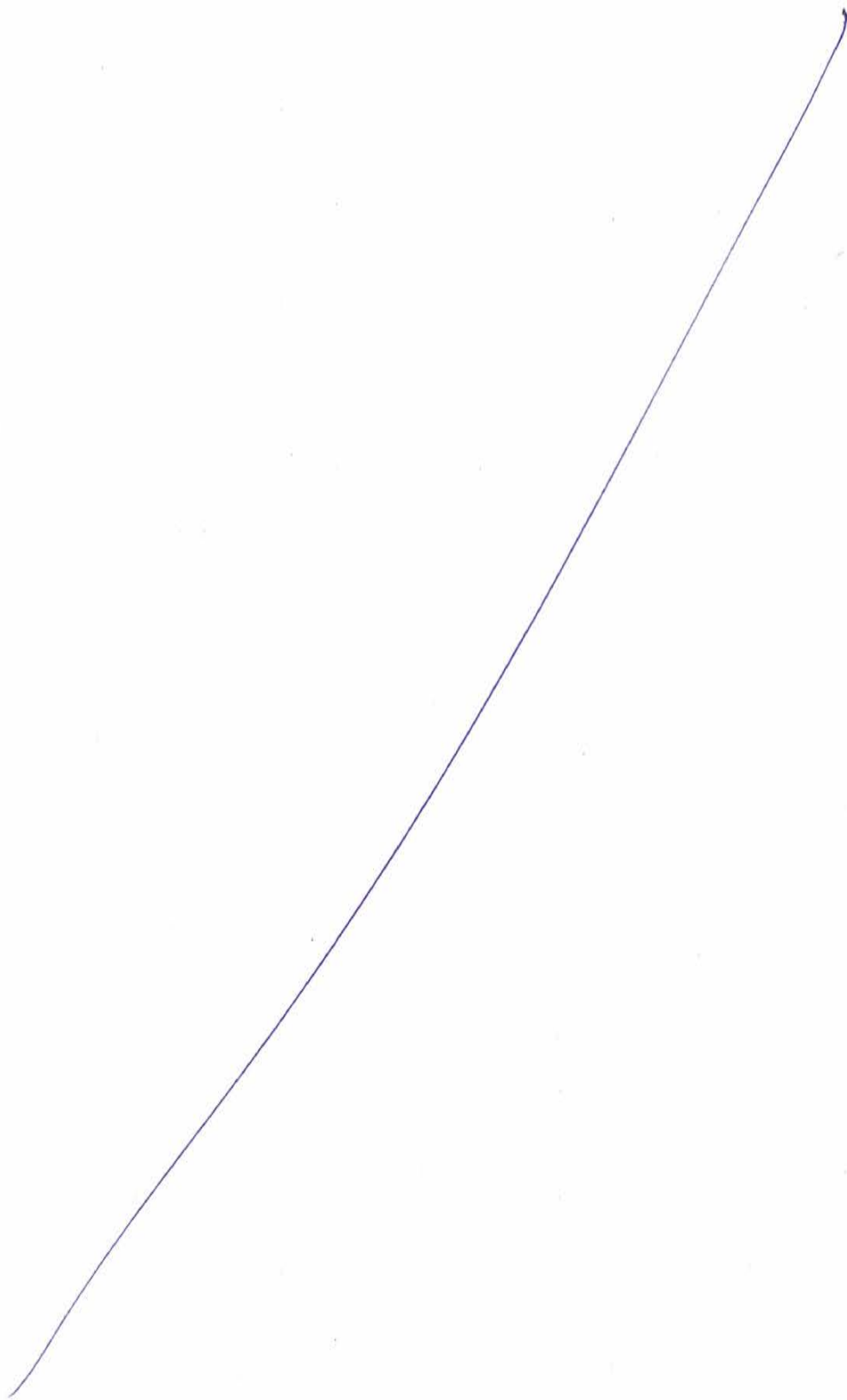


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GROUND ENGINEERING



01



02

Proper ground engineering is a prerequisite for improving the performance of designed structures - including roads, railways, bridges, and tunnels - and can significantly reduce life-cycle costs by making use of the latest technology and methods.

Ramboll's ground engineering comprises a comprehensive range of investigations and design services related to the subsurface. We have extensive experience from working in more than 70 countries, and we are able to handle any soil condition anywhere in the world providing the technology and methods needed.

Our services cover all project phases from site investigations, laboratory and in situ testing to advanced numerical modelling, project implementation, inspection, and supervision.

Geotechnics

Ramboll's services cover every aspect of geotechnics and foundation engineering, including:

- The planning and interpretation of geotechnical investigations
- Marine structures
- Soil-structure interaction
- Advanced modelling
- International geotechnics
- Construction and infrastructure projects
- Foundation design
- Foundation reinforcement and renovation
- Construction pits and retaining walls
- Tieback anchors
- Pile foundations and analyses
- Slope stability and stability analyses
- Earthquake engineering
- Geotechnical drilling and in-situ testing.

Environmentally sustainable solutions

We also work on research and development projects that focus on environmentally sustainable solutions. These include:

- Geotechnical, environmental and geo-radar tests in situ and in the laboratory
- Stabilisation testing of soft materials (peat, mud, silt, clay, sediment)
- Recipe development and R&D into new binder materials from industrial by-products
- Renovating and improving road structures using recycled industrial by-products
- Landfill construction and groundwater protection (built by using recycled industrial by-products)
- References from over 250 R&D projects on deep, mass and layer stabilisation.

Our geotechnical design services combine technical skills, environmental considerations, and economy. We have extensive experience in the geotechnical aspects of remediation and new construction, both in national and in international projects.

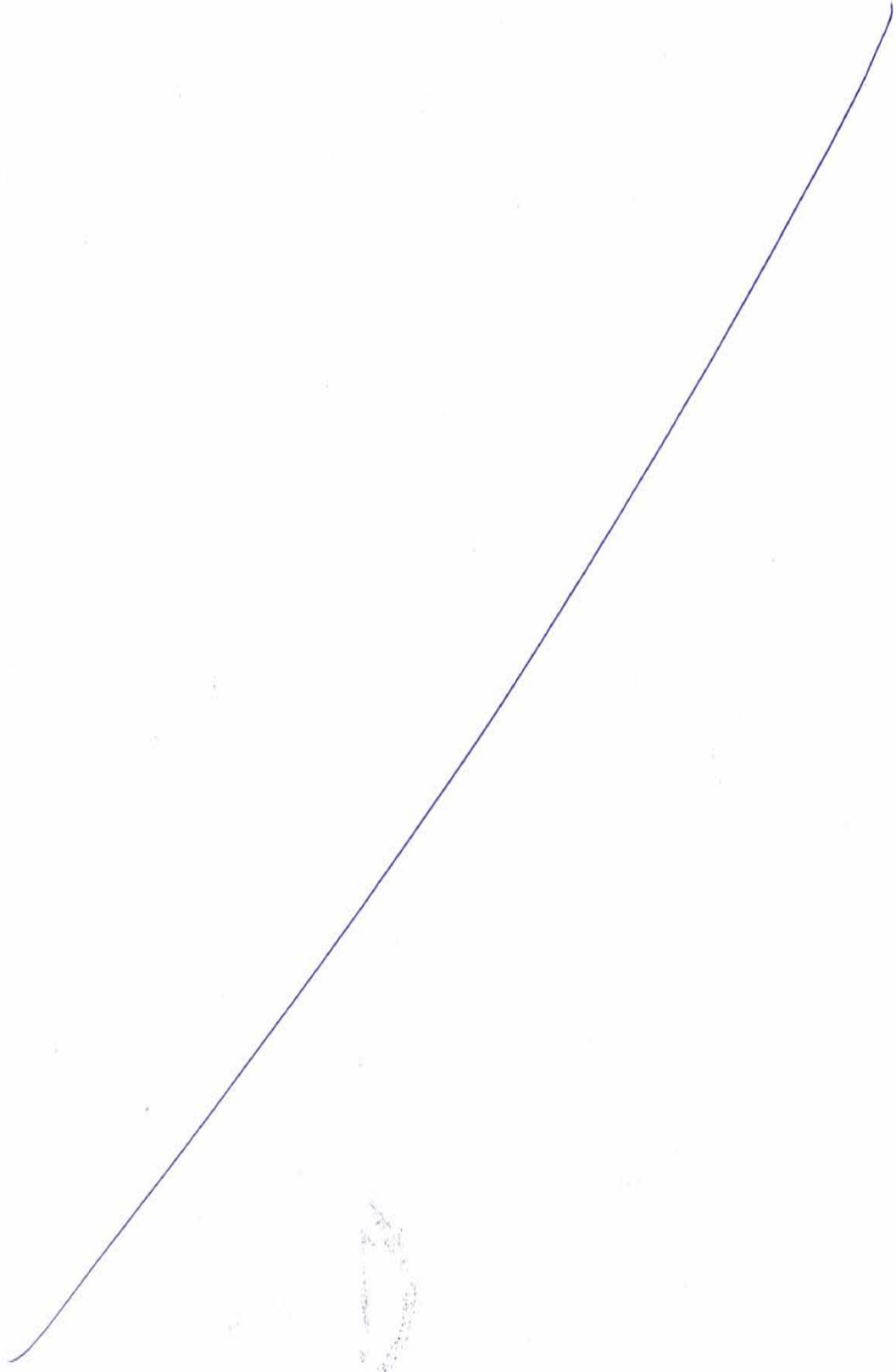
In our planning, we make use of new materials and techniques. Our thorough research into geotechnical materials has secured a pioneering role in geotechnical engineering.



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→ **Geophysical services**

Geophysics deals with the physical properties of the earth – and the atmosphere. Ramboll's geophysics services apply scientific analysis and measures to buildings, groundwater protection, and marine constructions.

Furthermore, we have extensive experience in the use of geophysical methods in geotechnical engineering as a main part of the pre-investigations for foundations, tunnelling, and highways.

Using our large selection of instruments, we can carry out virtually any kind of geophysical investigation. In particular, we focus on:

- Seismic investigations - of any kind
- Borehole logging
- Marine investigations
- Electric and electromagnetic investigations
- Ground Penetrating Radar (GPR)
- Geodesy and geographical coordinate systems.

We use state-of-the-art equipment and perform advanced data analyses and processing to meet the highest standards. Our services are customized to each customer's needs and are supported by our in-house team of geologists, hydrogeologists, geophysicists, and engineers.



04

Rock engineering services

Engineering geologists interpret observed and mapped geological data. They create conceptual models that illustrate the engineering-geological classification of each rock unit. Civil engineers then use this data to make crucial building decisions.

Our engineering geologists have years of experience with this process. They understand the geological and non-geological factors that can influence rock slope stability. So even though the factors may vary considerably in a given area, you can be sure of an accurate results.

Our rock engineering services include:

- The definition of potential problems
- The quantification of input parameters
- Calculation and evaluation
- Risk assessment
- Design and analysis.



05

PROJECT REFERENCES

01 Fehmarn Belt Fixed Link - Geotechnical Services. The fixed link will connect the German island Fehmarn with the Danish island Lolland. The distance between the two coasts is approx. 19 km. The client for the project is Fehmarn A/S, part of the Sund and Belt Group. The Fixed Link is decided by the governments in the two countries, and the plan is for it to be ready for use in 2018. The services provided by a joint venture led by Ramboll cover geotechnical investigations, geophysical surveys and investigations, large scale testing, and geodetic services.

02 Nordhavnsvej Tunnel, Municipality of Copenhagen, Denmark. The construction of Nordhavnsvej is done to improve the traffic conditions in the Northern part of Copenhagen. Extensive pre-investigations have to be conducted as an integrated program with geotechnics, geohydrology and geophysics for designing the permanent and interim constructions, as well as the groundwater management.

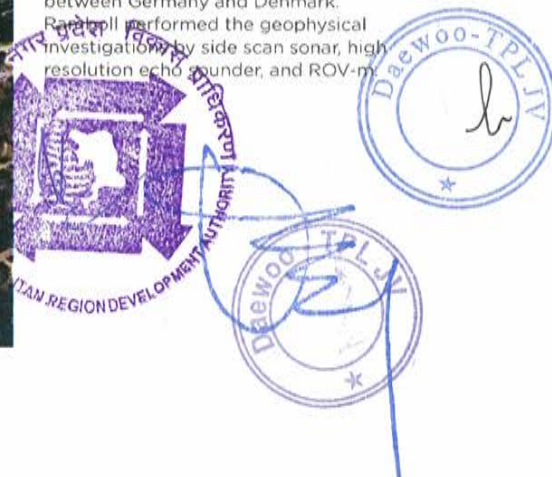
03 Malmö City Tunnel. The City Tunnel Project included a twin-tubed railway tunnel, rescue shafts, Triangeln station, a ramp, and C&C tunnel in Holma. Ramboll was responsible for designing all the groundwater lowering systems at the four construction sites.

04 Helsinki Music Centre, Finland. Ramboll did the foundation design, plans for contaminated soils management, and supervision of structural plans for the concert venue and meeting point Helsinki Music Centre. Ramboll also made the general water supply arrangements for the site.

05 Geotechnical planning for Gongqing DigiEcoCity in China.

The Absoils development project as part of the Life+ EU programme. The project consisted of converting abandoned and low-quality soils like soft clay into construction materials in Helsinki metropolitan area.

Kontek Cable Survey, Energinet. dk installed a new marine power cable as part of the modernization of the Kontek electrical connection between Germany and Denmark. Ramboll performed the geophysical investigations by side scan sonar, high resolution echo sounder, and ROV-m

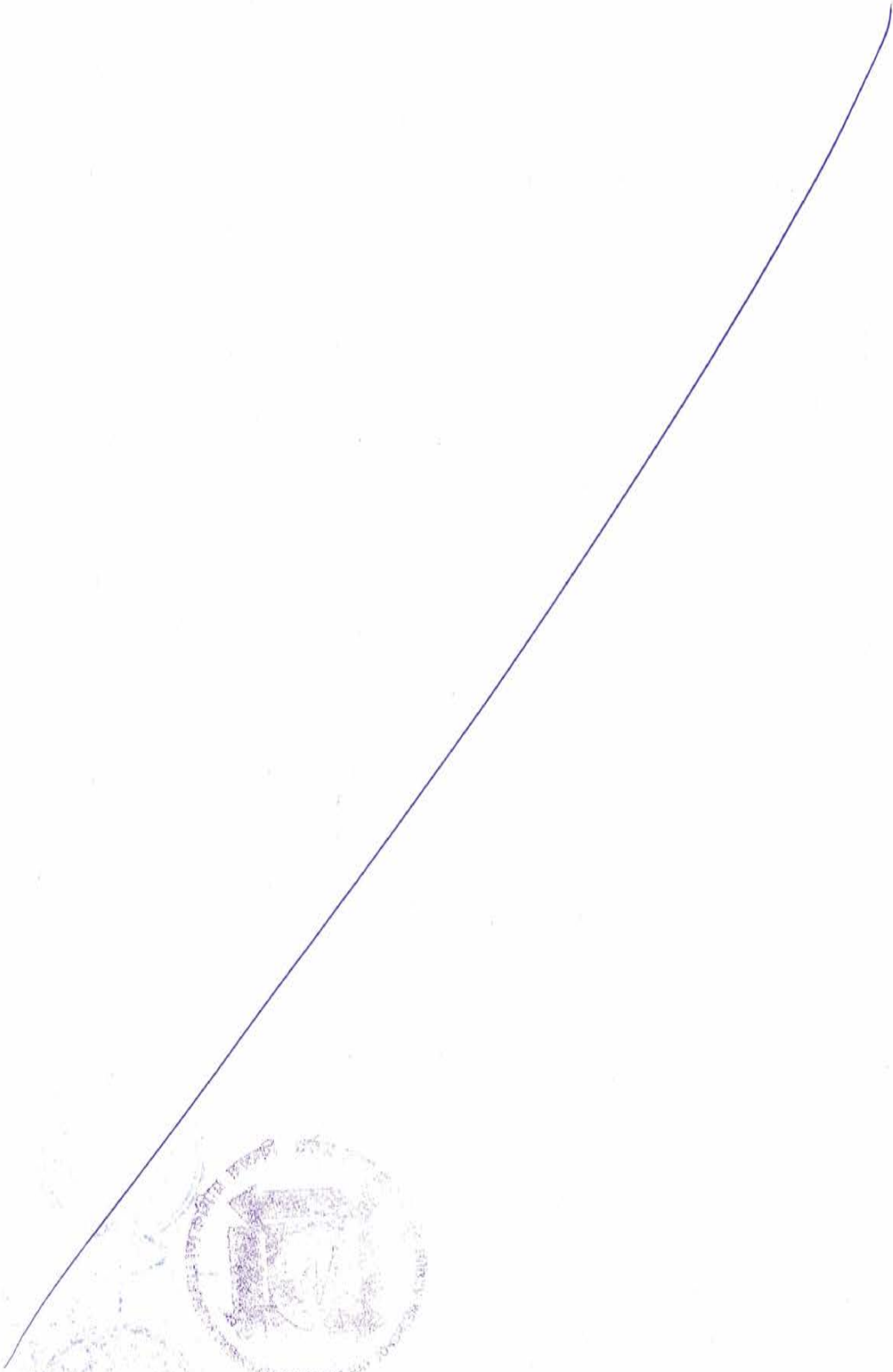


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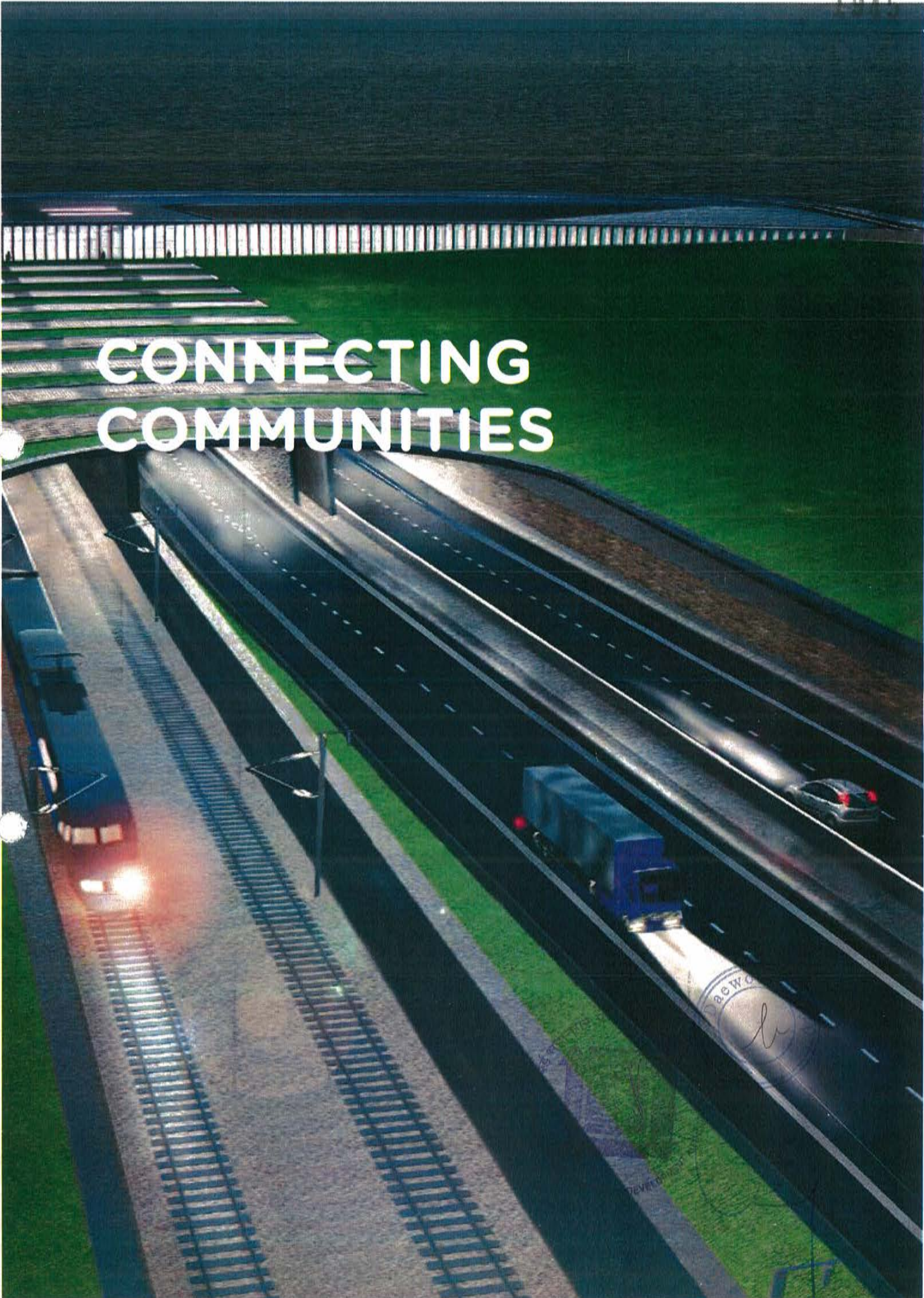
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CONNECTING COMMUNITIES



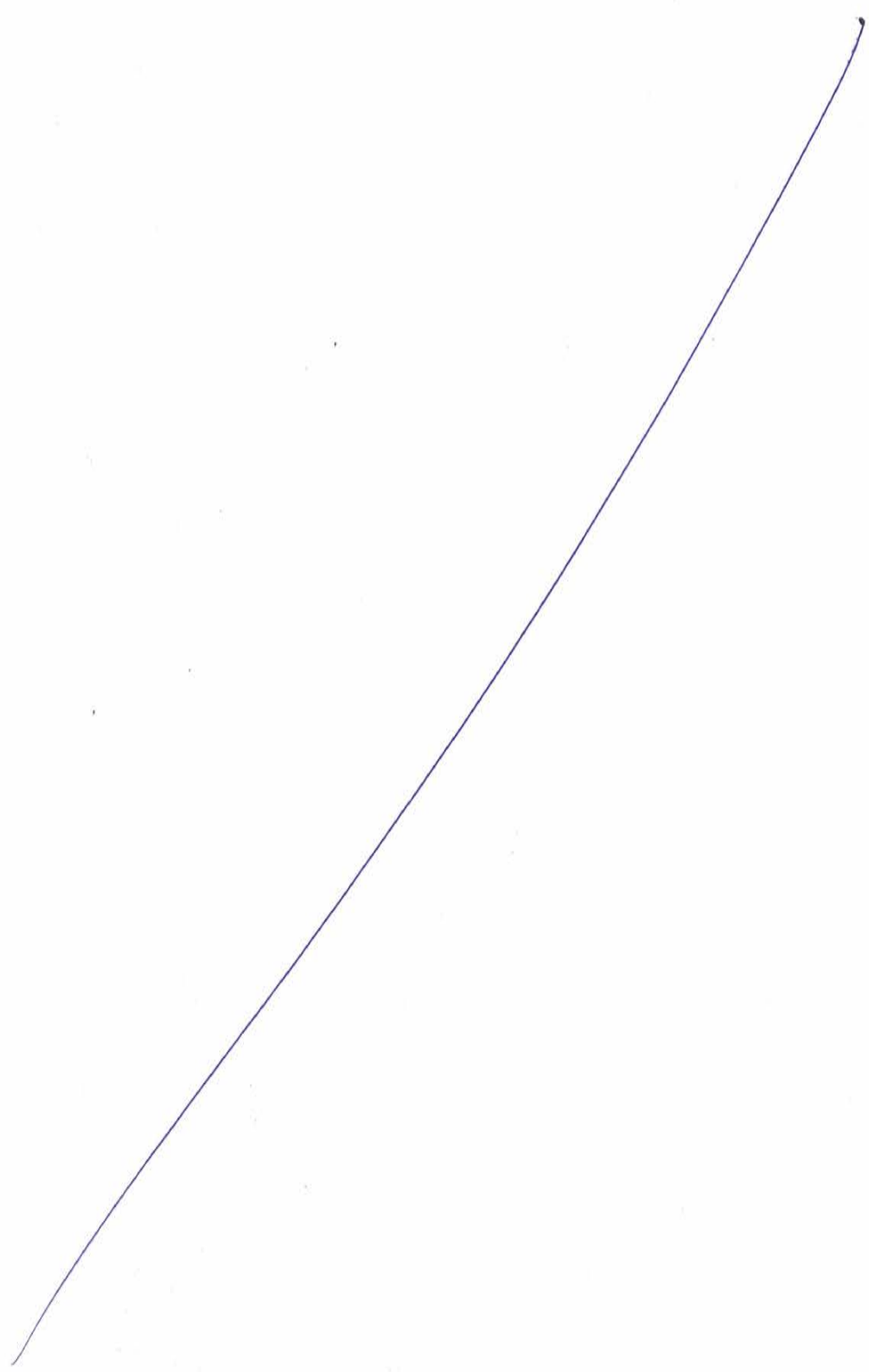
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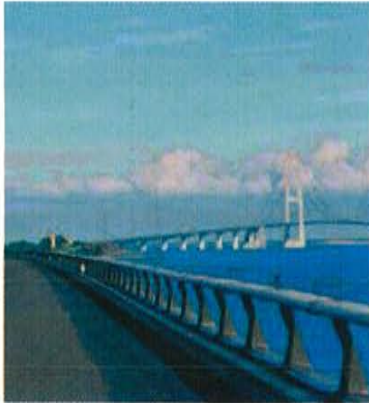
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INFRASTRUCTURE ASSET MANAGEMENT



01

Asset Management is all about keeping roads, bridges, tunnels, ports, and other infrastructure in the best possible condition. It is essential to all end users and the infrastructure owner to have a safe and reliable infrastructure system. Ramboll is recognised worldwide for our ability to facilitate this at the lowest possible life cycle cost – and we work closely with our customers to ensure that their infrastructure assets are properly maintained and benefits the end users.



02

We are market leading in asset management for roads and bridges – and experts in all areas related to condition survey, rehabilitation and maintenance planning. We perform all the necessary assessments and work according to local geography and climate.



03

We know what it takes to keep roads, bridges, tunnels, port structures, and other civil works in top condition. All outdoor structures deteriorate due to shifting environmental and mechanical conditions, and from major events such as floods and earthquakes. Ramboll is continuously working on developing new financial models, survey technologies, and effective, long-lasting procedures and methods for repairs or strengthening of damaged structures. This includes procedures for maintenance and repairs complete- or partial replacement, stabilisation of the deterioration condition, or a reduction of the current deterioration speed of the structure.

Inventories and measurements

We assess the local conditions, and we do what it takes to minimise deterioration. The critical construction parts can be monitored in order to collect the detailed knowledge about the part's condition and deterioration process. This makes it possible to significantly reduce costs by conducting major repairs at the (financially) optimal time. Our qualified staff carries out inspections and maintenance activities using the right equipment – and draws on the resources of experts and laboratory facilities whenever necessary.

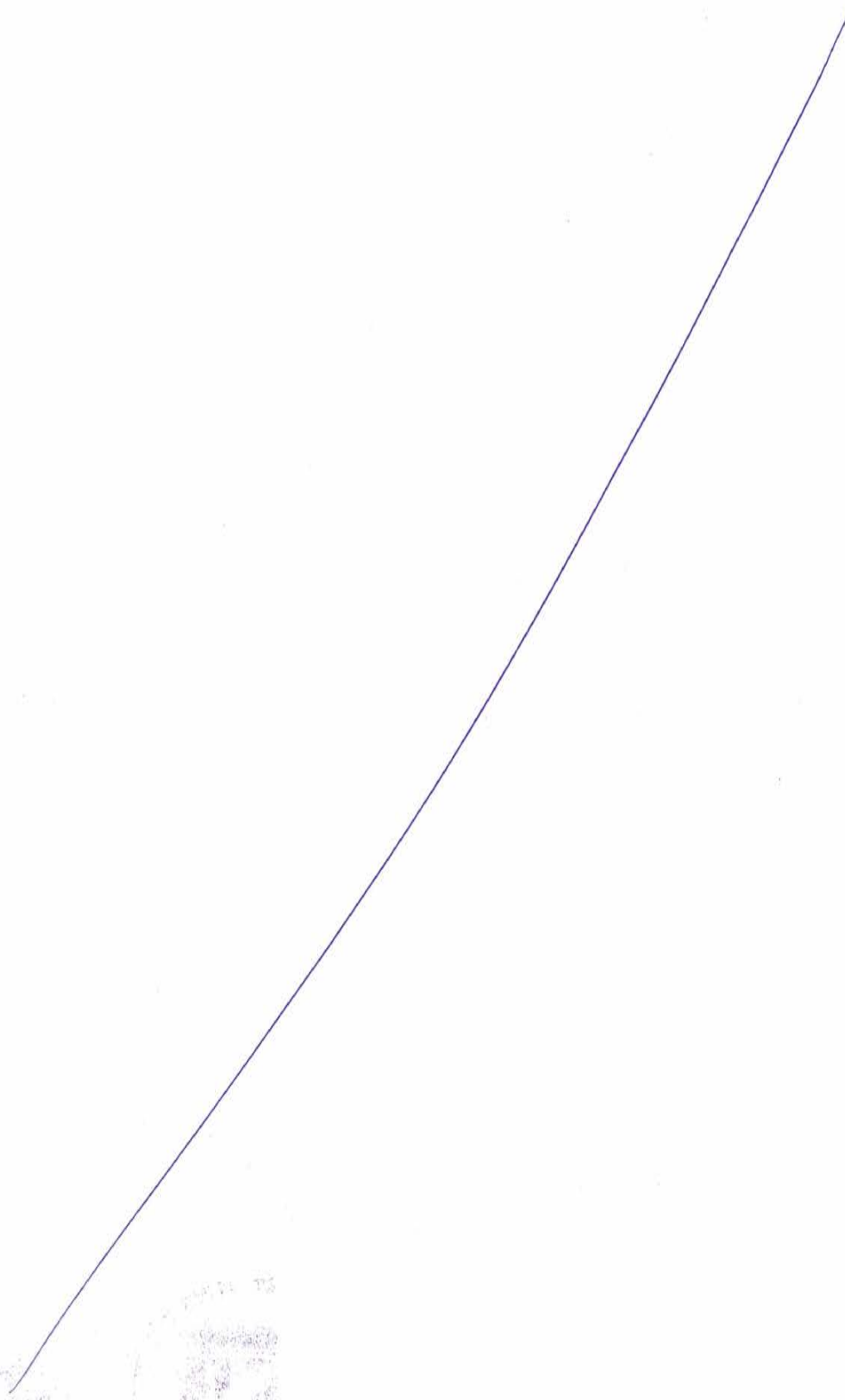
In order to plan for and execute optimal operation and maintenance for a structure, you need to know its condition. We carefully evaluate the condition through various examination activities, and by conducting routine and special inspections as needed. As a next step, in our state-of-the-art materials laboratory, we utilise equipment for the preparation and analysis of building materials. Our services cover the field of failure analysis of natural stone, concrete and other related materials – as well as in general materials characterization. We also offer expertise in other cement-based products, fibres, steel, coatings, and water proofing membranes.

Non-Destructive Testing (NDT)

Without damaging the structure, Ramboll uses NDT on-site to acquire detailed knowledge about a structure. We can screen large areas and quickly learn about the condition and remaining bearing



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capacity of the structure in its natural elements. NDT is a powerful tool used for quality assurance of asphalt, concrete, natural stones, steel, and other materials. Its use can replace traditional time-consuming destructive test methods such as drilling cores, and scrapping concrete surfaces. Ramboll both designs, uses, and sells the well-known Laser RST technology for road surveys.

Asset management as a service

Ramboll provides asset management services for all types of infrastructure. We cooperate with the asset owners and maintenance contractors by providing the expertise needed for procurement, programming, planning, or supervising phases. Ramboll can present the benefits of alternative project plans, follow the status of all planned and ongoing activities, and enable the decision makers to compare alternative outcomes. The ability to share information ensures cost-effective solutions and better cooperation among the participating organisations, and enhances the understanding of the state of the structures. Over the long term, performance based maintenance contracts (PBSC) give us the ability

to guarantee the functionality of the assets over time. Ramboll offers the expertise for planning, managing, and conducting the PBSC contract. We can also help customers developing their operations and organisation when changes are needed in their asset management.

Ramboll has developed modern and advanced IT systems to monitor and report maintenance activities dynamically on the web. These systems provide a channel for all parties involved in asset management to plan, evaluate, and follow the status of planned and ongoing works. Our Asset Management services rely on several tools and technical methods such as RST, SMART, Airpave and Web services.

International experience

Ramboll's rehabilitation and maintenance group is recognised worldwide for its asset management of roads, bridges, tunnels, and other civil works. Since 1990, we have provided professional services and training to customers in Western and Eastern Europe, the Middle East, Asia, Central America, and South America.

PROJECT REFERENCES

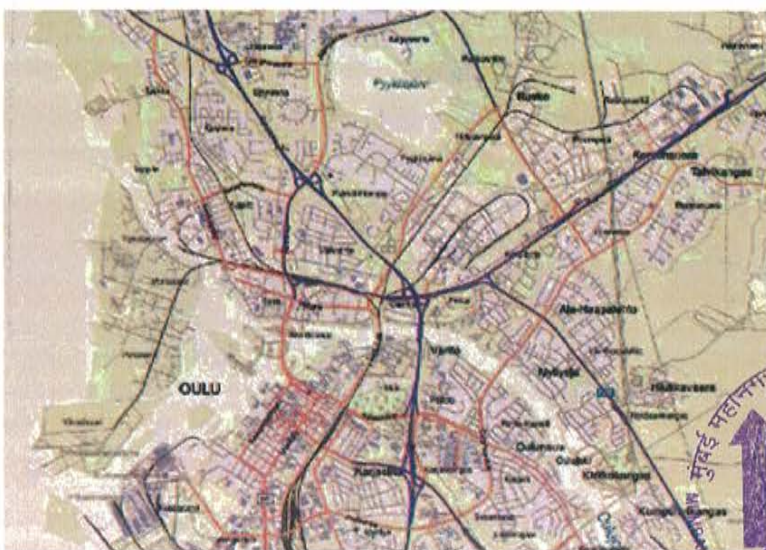
01 Great Belt bridge management, Denmark. Ramboll provided bridge maintenance services.

02 Information service for regional road authority in Kuopio, Finland.

03 Projects for contractors in Finland (Skanska).

04 Performance Based Service Contract (PBSC) for the paved roads in the Oulu region, Finland. The PBSC project covers about 1,400 km of mixed road networks.

Strategic Analysis for the Maintenance policy of NPRA paved road network, Norway.



OUR SERVICES

Our services apply to every phase of a structure's life cycle and include the following:

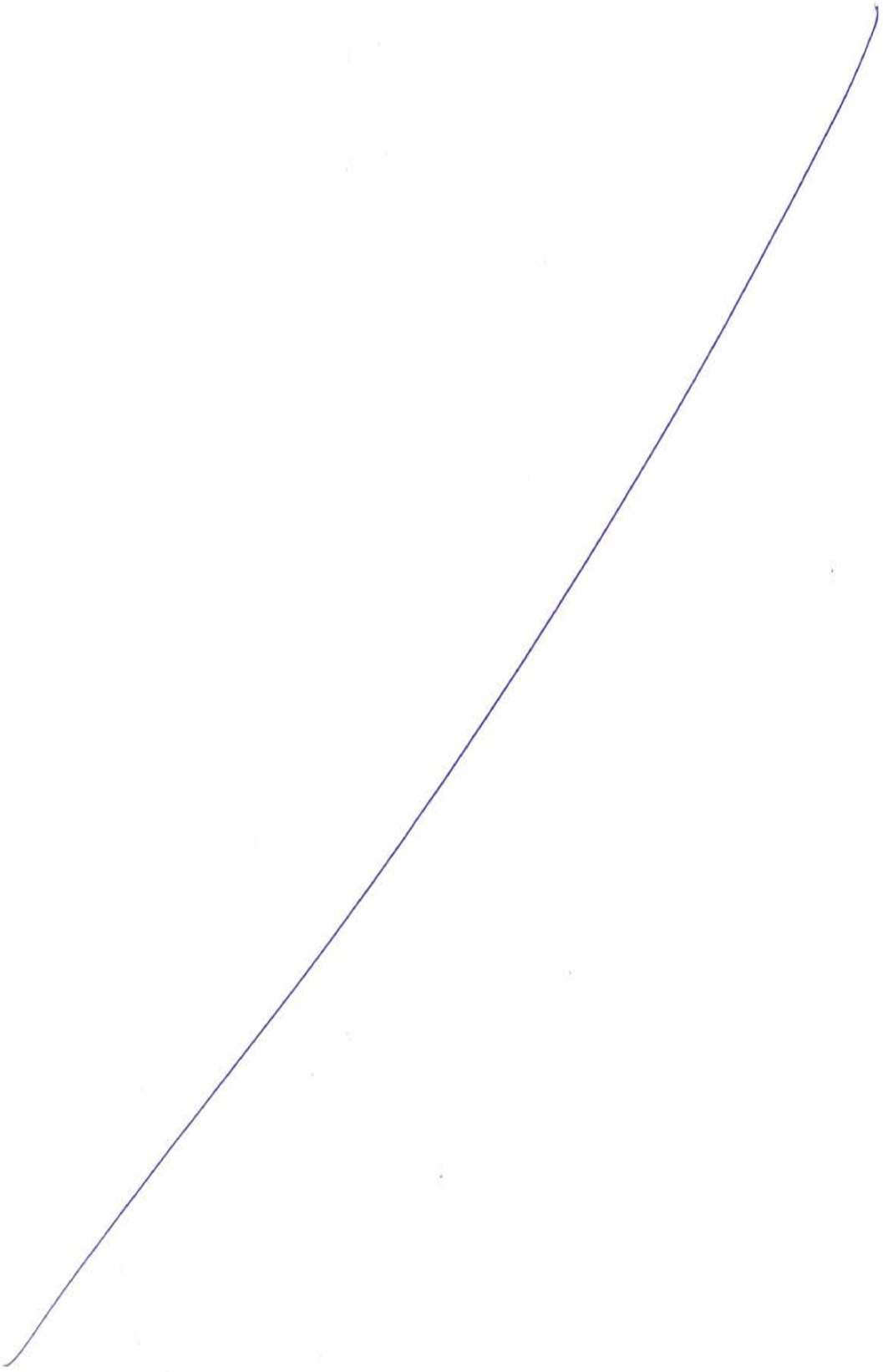
- Routine inspections, special inspections and measurements
- Materials technology
- Monitoring and management systems
- Life cycle cost and risk analysis
- Rehabilitation programming, design and supervision

Our customers include public institutions, donor organisations, private developers and contractors.



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PORTS AND MARINE



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Port and marine projects are often highly complex, and their planning and design requires a wide range of competences. Ramboll is a leading provider of independent consultancy services across the spectrum of port planning and design, marine structures, and coastal engineering.

Our dedicated staff has comprehensive experience from national as well as international projects. We undertake both large and smaller-scale projects and assist customers throughout all project phases - from the earliest planning and pre-feasibility studies to masterplan studies, design, and tendering.

Further, our services include assistance during construction, operations, maintenance, training and asset management. We work closely with local companies and hire local manpower. We benefit greatly from their knowledge and use it to shape projects according to local conditions and economies.

Our customers include port authorities and operators, private investors and developers, investment banks, and international financing institutions.

Our services

Ramboll undertakes both large and smaller-scale projects. Our services extend into all stages of planning, design, construction, operation, maintenance, and training.

Feasibility studies

Based on the elaboration of consistent development scenarios, we prepare feasibility studies and provide expert consultancy in port

master planning. The feasibility study typically includes technical investigations, traffic analyses, financial analyses and environmental impact analyses. Further, Ramboll will assist with conceptual and preliminary designs, authority management, and development policy.

Port planning

When port authorities consider expanding and upgrading port facilities to accommodate new or larger vessels, a number of facilities may need to be reconfigured. This includes berths, land storage areas, mooring systems, and scour protection. The first step is to evaluate and analyse the facilities, and Ramboll will assist port authorities with doing so.

Port design

Ramboll has been involved with many new port projects around the world, and we can assist port authorities and municipalities with all design aspects from planning and conceptual design through detailed design and supervision. Ramboll has experience within all types of marine works, from small marinas to large ports.

Rehabilitation services

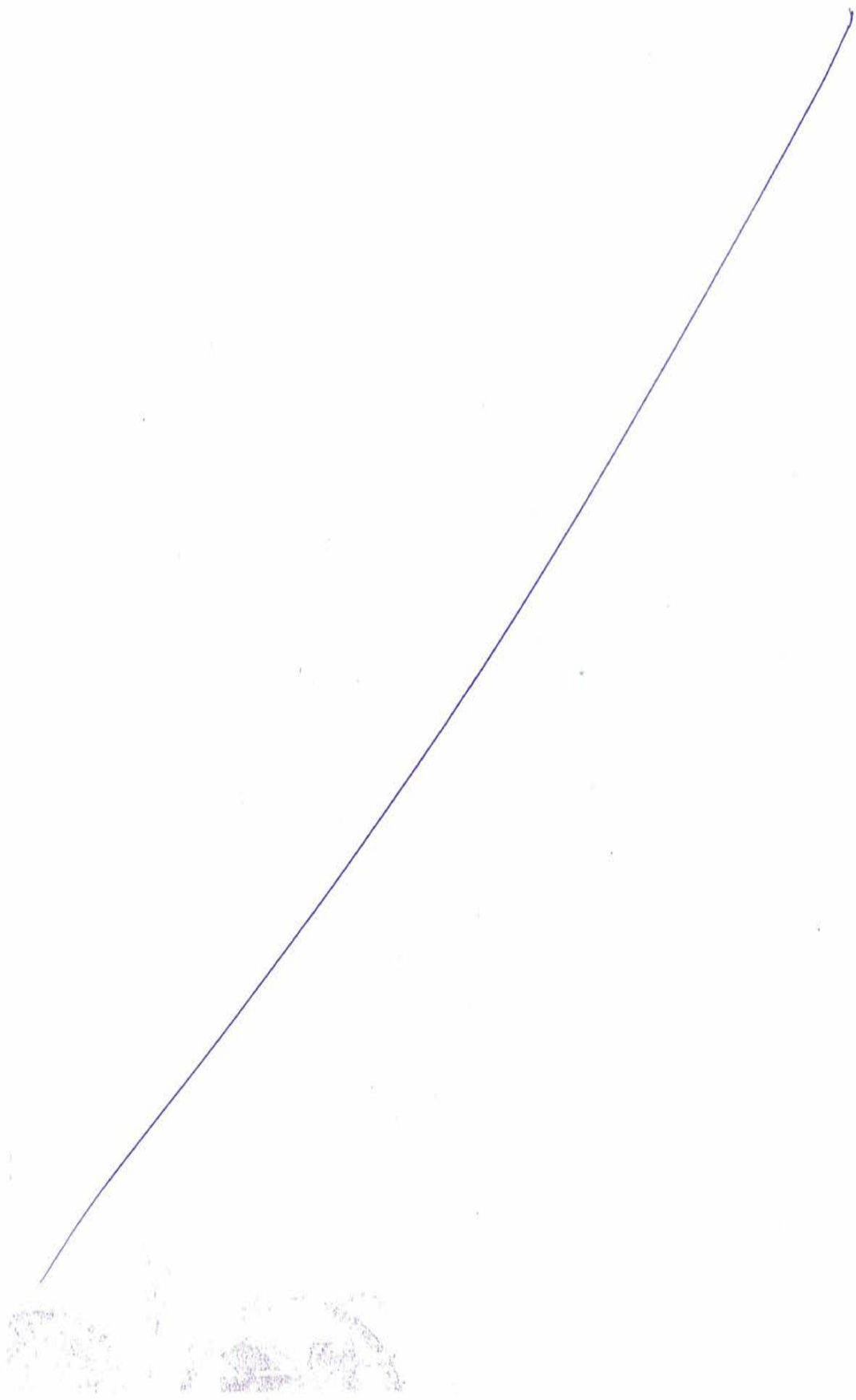
The life span of existing structures can be prolonged at a reasonable cost, if rehabilitation work is initiated in time. If not, rehabilitation may become both extensive and expensive, often requiring the replacement of entire structures.



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OUR SERVICES

Ramboll undertakes both large and smaller-scale projects. Our services extend into all stages of planning, construction, operation, maintenance, and training.

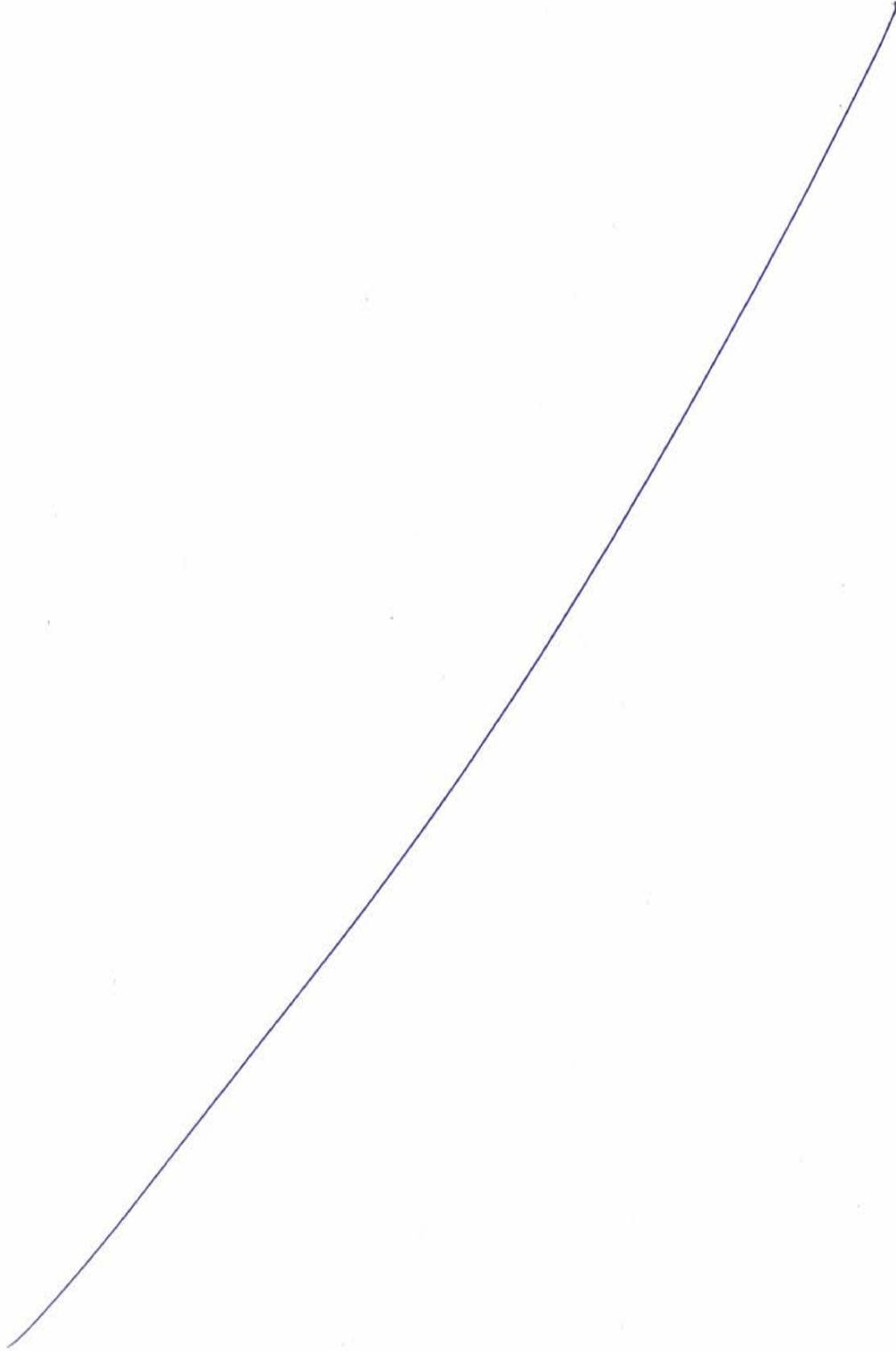
Our services include:

- Feasibility studies
- Field investigations
- Coastal hydraulic assessments
- Shoreline Management
- Port master planning
- Port planning
- Port terminal planning
- Port infrastructure planning
- Environmental Impact Assessments
- Risk assessments
- Port design projects
- Port extension projects
- Port rehabilitation projects
- Marina projects
- Dredging and fairway projects
- Port maintenance.



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→ **Environmental impact assessments**

Today, environmental considerations are integrated into the decision process of most construction projects in coastal zones. It is therefore often necessary to conduct an environmental impact study, in the form of an Environmental Impact Assessment (EIA).

Shoreline management

New developments of coastal zones and more extreme variability in the oceanographic and meteorological conditions impact on existing assets and set new demands. Ramboll conducts planning and design of coastal protection solutions, and provides expert consultancy for shoreline management.

Asset management

Proper port asset management is highly complex and requires the integration of several disciplines and services. However, by streamlining the procedures and

utilising known and tested methods from other fields, it is possible to keep it simple and stay within budget. This approach will also allow for forecasting of future costs, increase safety, and minimize the risk of unexpected break-downs.

Local partnerships

Ramboll partners with local firms, and takes advantage of local knowledge and manpower. Through these partnerships, global know-how and technology is transferred to local partners, and projects are always conducted in accordance with local conditions and economy.

Whenever necessary, Ramboll also partners with universities and specialised institutes for technical assistance to ensure the optimal project result/outcome.

PROJECT REFERENCES

01 Hambantota, Sri Lanka. Detailed feasibility study for new greenfield port.

02 Port of Gothenburg, Sweden. Port modernisation projects.

03 London River Park, UK. The park will utilise cutting edge design to create a floating walkway almost 1 km in length on the north bank of the River Thames. Ramboll was appointed lead environmental consultant on the project.

04 Vuosaari Harbour, Port of Helsinki, Finland. Design of the new port.

05 Lome Container Terminal, Togo, Africa. Port rehabilitation and design projects in Africa - Zanzibar and Togo.

06 Malmö, Norra Hamnen. Design of the new Ro-Ro Terminal.



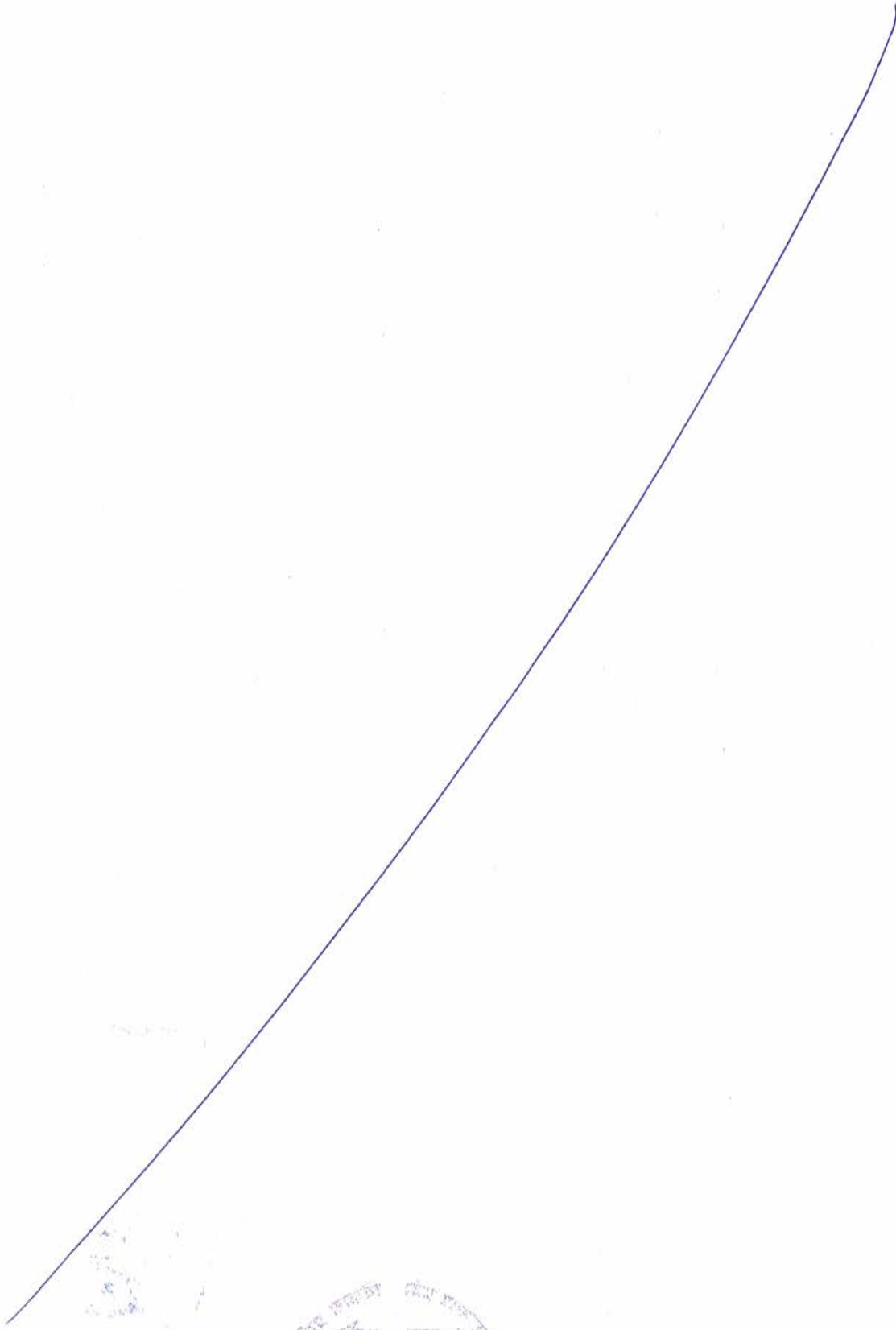
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THE UNIVERSITY OF CHICAGO

PROJECT AND CONSTRUCTION MANAGEMENT

All projects require a certain amount of supervision and quality control to ensure an optimal end result. Ramboll is a leading provider of infrastructure engineering consulting for the construction phase, and we provide project and construction management services to civil engineering and construction projects.

We offer multi-disciplinary expertise within the following areas:

- Planning
- Investigation
- Programmes
- Design management
- Procurement and purchasing
- Quality control and assurance.

As a result of our involvement with large international infrastructure projects, we have extensive experience with managing the interaction between the many different parties with an interest in the projects. Stakeholders include other consultants, contractors, authorities, utility owners, interest groups, and local residents.

Knowledge and experience

We offer the skills and experience to meet all project phase requirements, no matter how varied or complex the project. With the help of our well-equipped IT toolbox, our skilled engineers are able to provide top-notch project and construction management.

OUR SERVICES

- Project management
- Contract management
- Project planning and cost control
- Risk management
- Construction management
- Claims management
- Health and safety coordination
- Assistance in connection with preparation of FIDIC tender documents
- Handling of prequalification, tender process, and contract.



PROJECT REFERENCES

01 Supervision of tunnel works for Länsimetro, Finland. The new metro extension from Helsinki to Espoo.

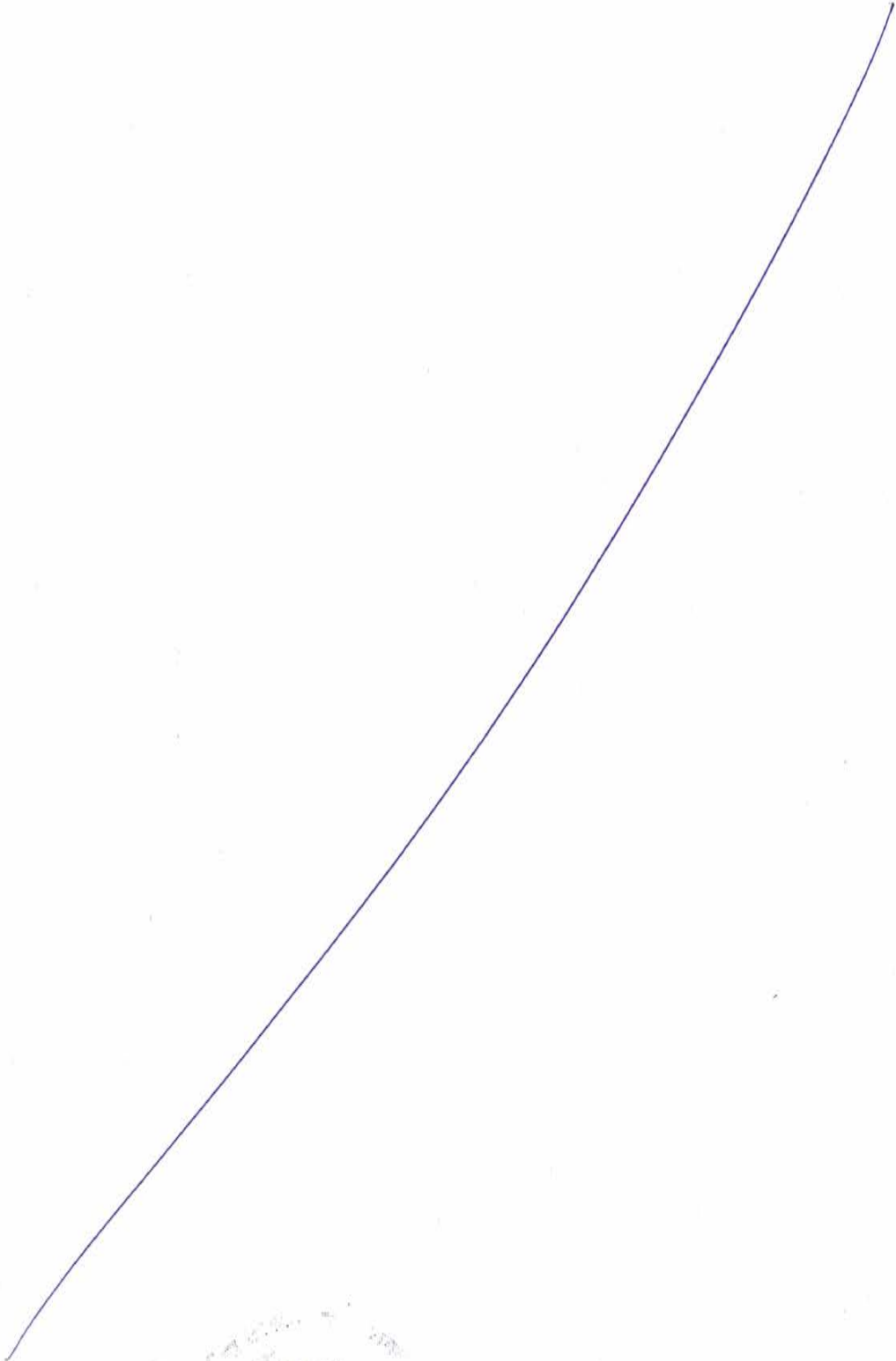


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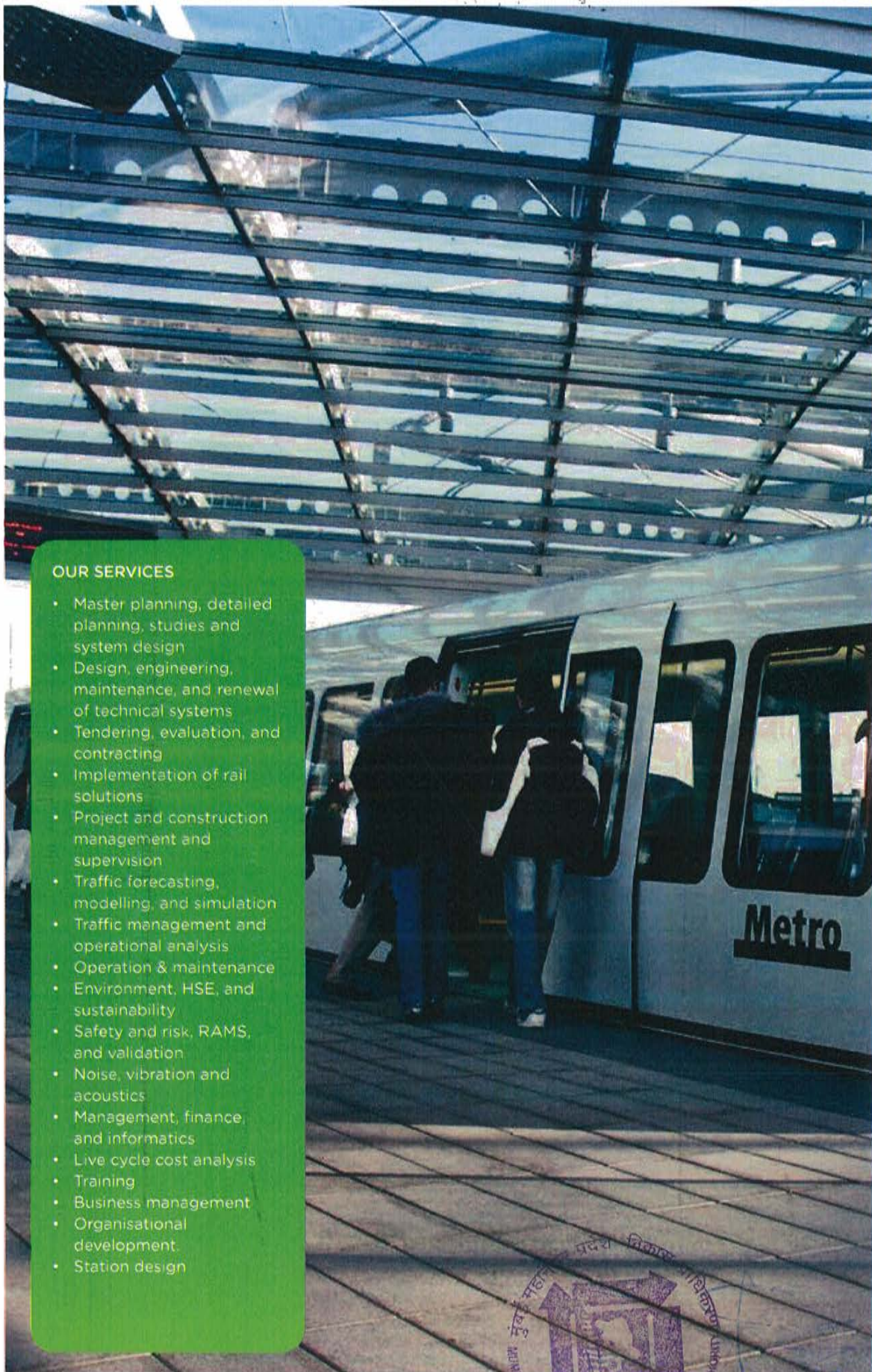
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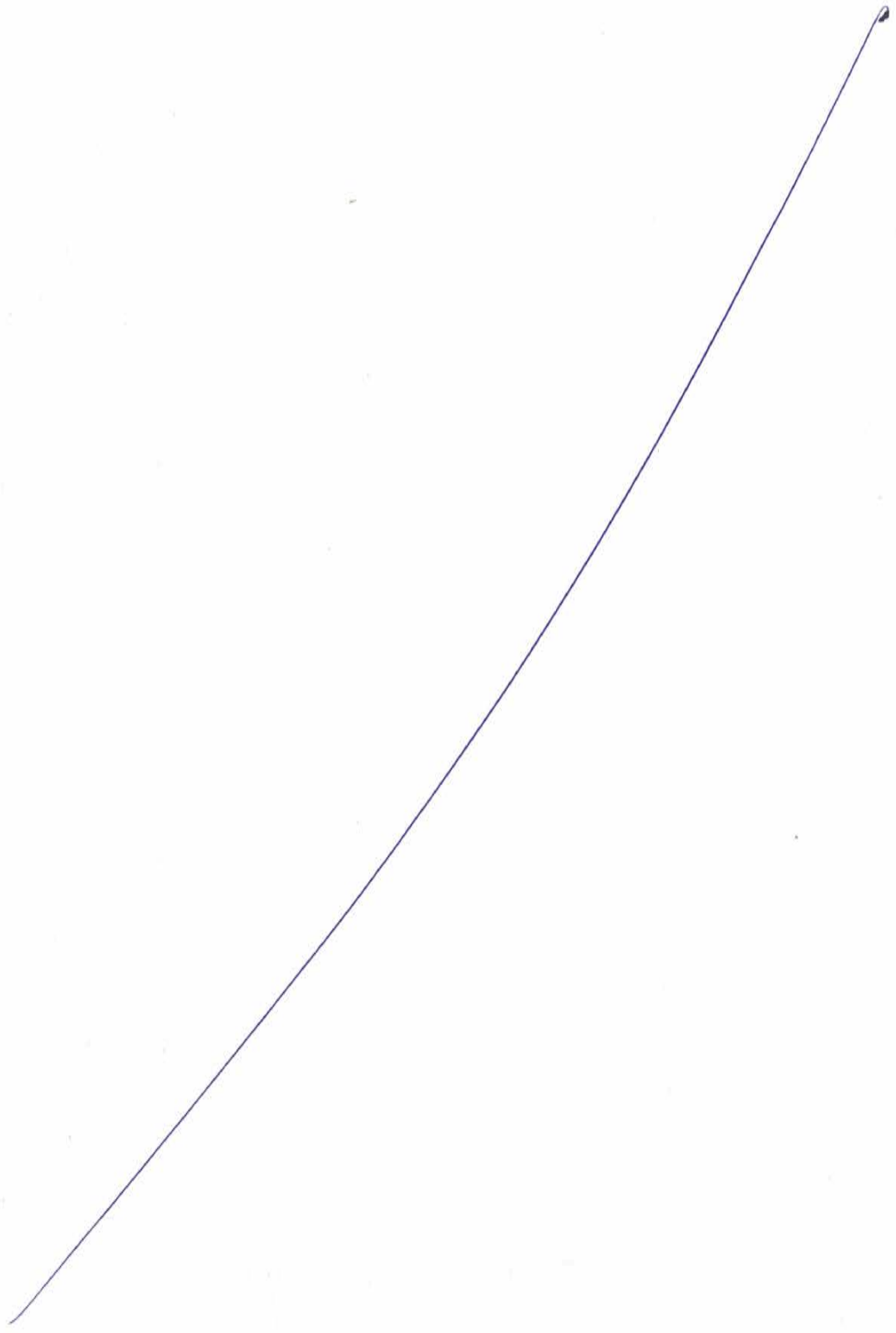
- OUR SERVICES**
- Master planning, detailed planning, studies and system design
 - Design, engineering, maintenance, and renewal of technical systems
 - Tendering, evaluation, and contracting
 - Implementation of rail solutions
 - Project and construction management and supervision
 - Traffic forecasting, modelling, and simulation
 - Traffic management and operational analysis
 - Operation & maintenance
 - Environment, HSE, and sustainability
 - Safety and risk, RAMS, and validation
 - Noise, vibration and acoustics
 - Management, finance, and informatics
 - Live cycle cost analysis
 - Training
 - Business management
 - Organisational development
 - Station design



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RAIL ENGINEERING



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A sustainable transport system is essential for a well functioning society. Increased urbanisation and road congestion, and a focus on the environment and energy consumption make railways a strong alternative to road transport for people and freight. Because of this, construction and upgrading of railways is rapidly increasing all over the world. Ramboll provides professional consultancy services within railways and other public transport - including a complete range of rail-based systems, from high-speed railways to urban transport systems, such as metro and light rail.

Our technical expertise within rail consultancy comprises permanent way, traction power, and overhead catenaries system, interlocking systems, signalling, traffic management, telecoms and rolling stock. We combine this expertise with all of our other services - allowing us to deliver fully integrated transport solutions. With extensive expertise within railway and urban transport services, we offer planning, design, approval, operational, and commissioning services.

Our customers

We render services to both the public and the private sector, and our customers cover all major stakeholders in the railway market. By having such diverse customers, we have acquired a unique understanding of the different stakeholder needs. It also gives us a valuable background for finding solutions suitable for all parties involved.

Our customers include:

- Ministries
- Railway authorities
- Railway infrastructure agencies
- Operators
- Municipalities
- Contractors
- Suppliers
- Rolling stock owners and investors
- Private investors, banks, and financial institutions.

Ramboll covers the whole project cycle from inception to ex-post evaluation. We also have experience with investor-grade assessment of markets and service propositions.

We maintain a strong focus on the customer's needs and expectations through all stages of our projects - and ensure proper risk management at all times.

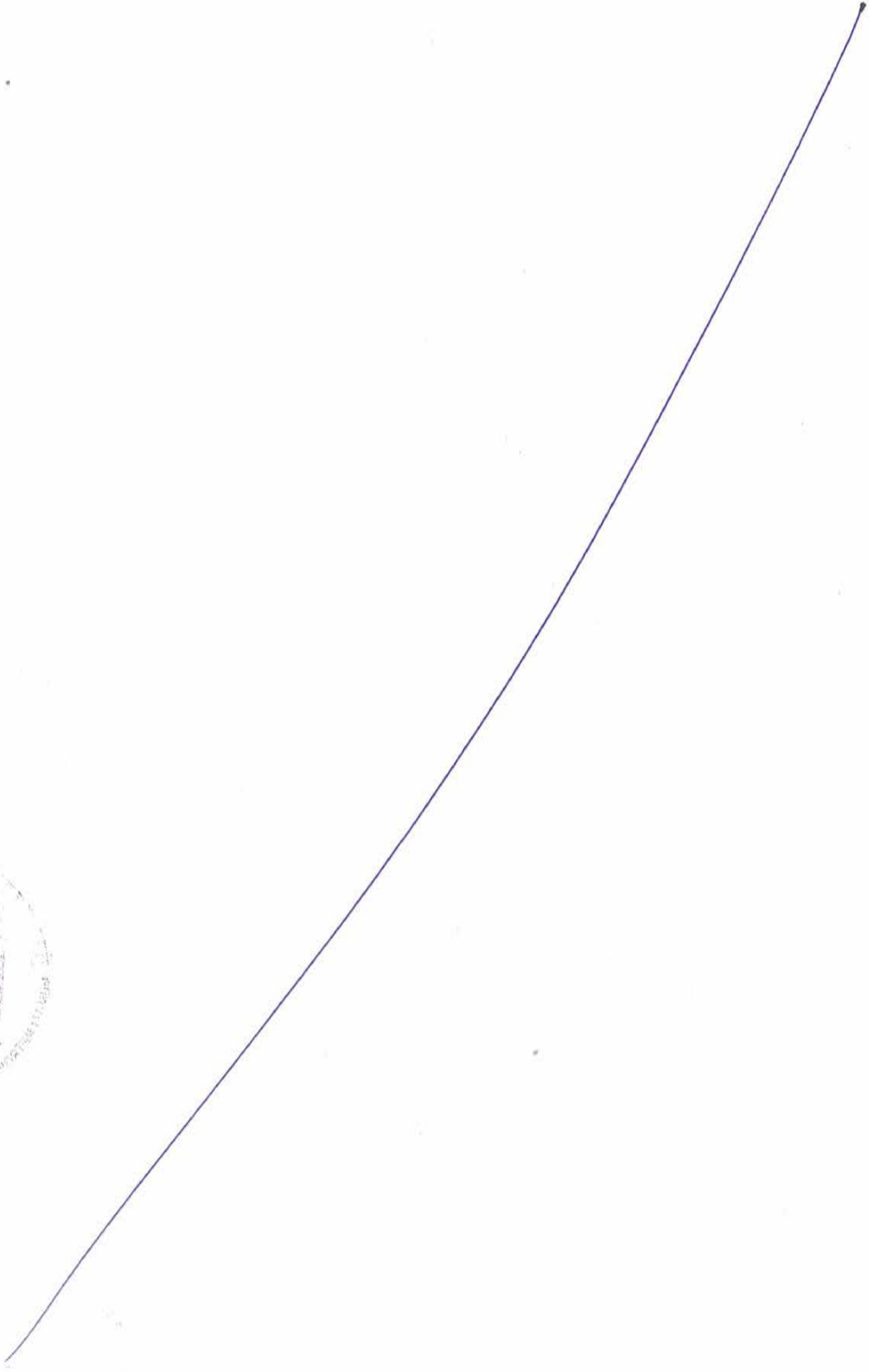
We differentiate ourselves by providing expertise and experience at all project stages, a truly multidisciplinary approach, and global knowledge coupled with an understanding of the local context. We adopt the latest technological innovations from around the world, integrate them into the local transport infrastructure and make sure they meet all local regulations and standards.

Wide-ranging expertise

Our rail experts have diverse backgrounds, including infrastructure and business management, finance, traffic and project management, engineering, safety and risk management. Their expertise, combined with the



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→ experience we have gained over more than 30 years as consultants in the railway business, provides us with a deep technical knowledge, as well as strong networks in the market.

Unique approach

Our assignments often require that we combine our railway know-how with our expertise in other civil engineering fields, such as management, construction, and ground engineering.

We have experience working with international and national codes and standards (EN and UIC), and we actively participate in workshops and group forums to help set new standards and drive innovation in the rail industry.

We have a consistent approach to quality and safety. This means that we are as keen on getting the small details right, as we are keen on developing the best overall concept.

PROJECT REFERENCES

01 Copenhagen Metro Circle Line. The new system will carry upwards of 275,000 passengers per day. This is the largest ever rail project in Denmark.

02 The Danish Signalling Programme. Denmark will upgrade its entire signalling system to a common European Rail Traffic Management System (ERTMS). Ramboll is spearheading the consortium design and national rollout of the new system.

03 Citybanan in Stockholm, Sweden. Citybanan is a double track railway tunnel. Alignment of the tunnel will be below the central part of Stockholm City. It is expected to open in 2011.

04 Tampere city tram, Finland. Ramboll did the preliminary master plan.

05 Paddington Station, UK. The first of seven major new underground stations in central London, Paddington is part of the £15bn Crossrail project. Ramboll's work on it includes top-down construction utilising diaphragm walling, ground and heritage monitoring, urban realm and highway design, and facade and secondary steelwork design.

06 Götalandsbanan, Sweden. Ramboll conducted all investigations and assessments and did conceptual design for the high speed line under Landvetter airport outside Gothenburg. This project is an important part of the new high speed line between Stockholm and Gothenburg.

07 High speed assessments. Phase 3 between Oslo and Trondheim, Norway.

08 Docklands Light Railway Three Car Enhancement, UK. To meet passenger demand during and beyond the 2012 London Olympic Games, DLR upgraded and expanded its network to carry three car trains. Ramboll worked with partners on the design of supporting structures and stations.

09 Seinäjoki-Oulu railway section refurbishment, Finland.



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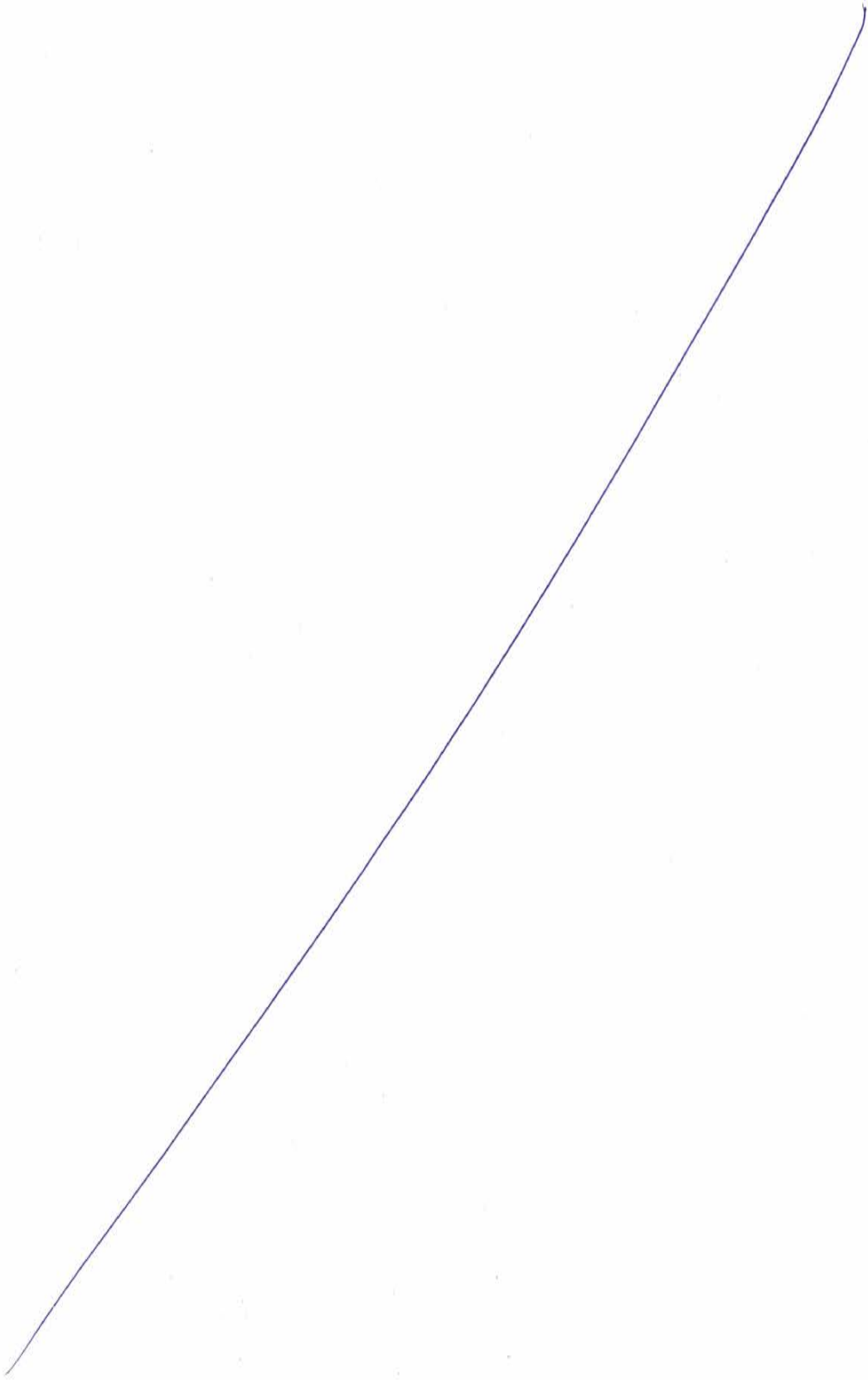
UNLOCKING THE URBAN ENVIRONMENT



STREET SITE
DEPARTMENT AUTHORITY



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ROAD AND MOTORWAY ENGINEERING

Roads and motorways are essential to ensure mobility of people and goods, and new road infrastructure is needed on an ongoing basis. More importantly, existing roads need refurbishment or upgrading. By using technology, such as Intelligent Transport System (ITS), it is possible to postpone major new investments in a safe and responsible way.

Ramboll offers a wide range of services within the area of road and motorway engineering - ranging from strategic assessments and analyses to detailed construction and as-built documents.

We also have extensive experience in all the different phases and do everything from concept development to operations and asset management.

Modern society depends on a well-functioning traffic and transportation system. To improve the quality of roads and motorways, Ramboll's transportation and traffic engineers offer expert advice on the planning and design of them, as well as advanced support and asset management.

For decades, we have worked on projects for public authorities and contractors, so we understand budget and time constraints, and we know how to handle the political interest associated with these type of projects.

Multidisciplinary services

Over the past decades, road and motorway consultancy has become more multidisciplinary, and the breadth of Ramboll's services reflects this development.

In addition to the traditional services outlined in road consultancy and design, we also offer a number of other related and integrated services:

- Environmental evaluation
- Geotechnical and geological investigations and foundation of bridges
- Architectural design
- Hydraulic analysis
- Traffic studies
- Transport economic studies
- Risk analysis
- Integration with squares and roads
- Railway technique
- Design of hydraulic and mechanical systems for moveable bridges
- Construction management.

Solutions for city streets and squares

Our road and motorway team also plans and designs city streets and squares. They focus on traffic safety and the creation of a good environment for different types of traffic, including pedestrians, cyclists and vehicles.

One very important aspect of street and square projects - and one that typically represents a bit of a challenge - is the selection of visually appealing and durable pavement materials. Over the years, we have come up with many excellent pavement solutions, often utilising natural stones to ensure both longevity and sustainability.

Motorways and main roads

Ramboll has worked on road projects all over the world. Our experience ranges from

motorway solutions in heavily populated areas to gravel roads in developing countries.

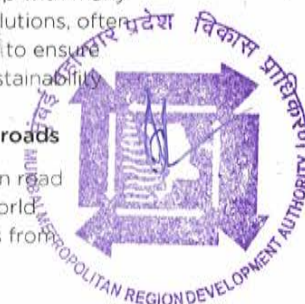
In addition to regular detailed design services for motorways and main roads, we also offer specialised services - for instance, to widen existing motorway sections through open land or highly complex town sections. We know how to navigate the challenges posed by limited space, noise, and existing structures.

We also have the in-house capability to undertake geometric and pavement design for all types of road networks (including local roads, collector roads, arterials and expressways), and we use state-of-the-art design software.

Asset management

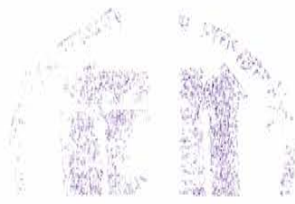
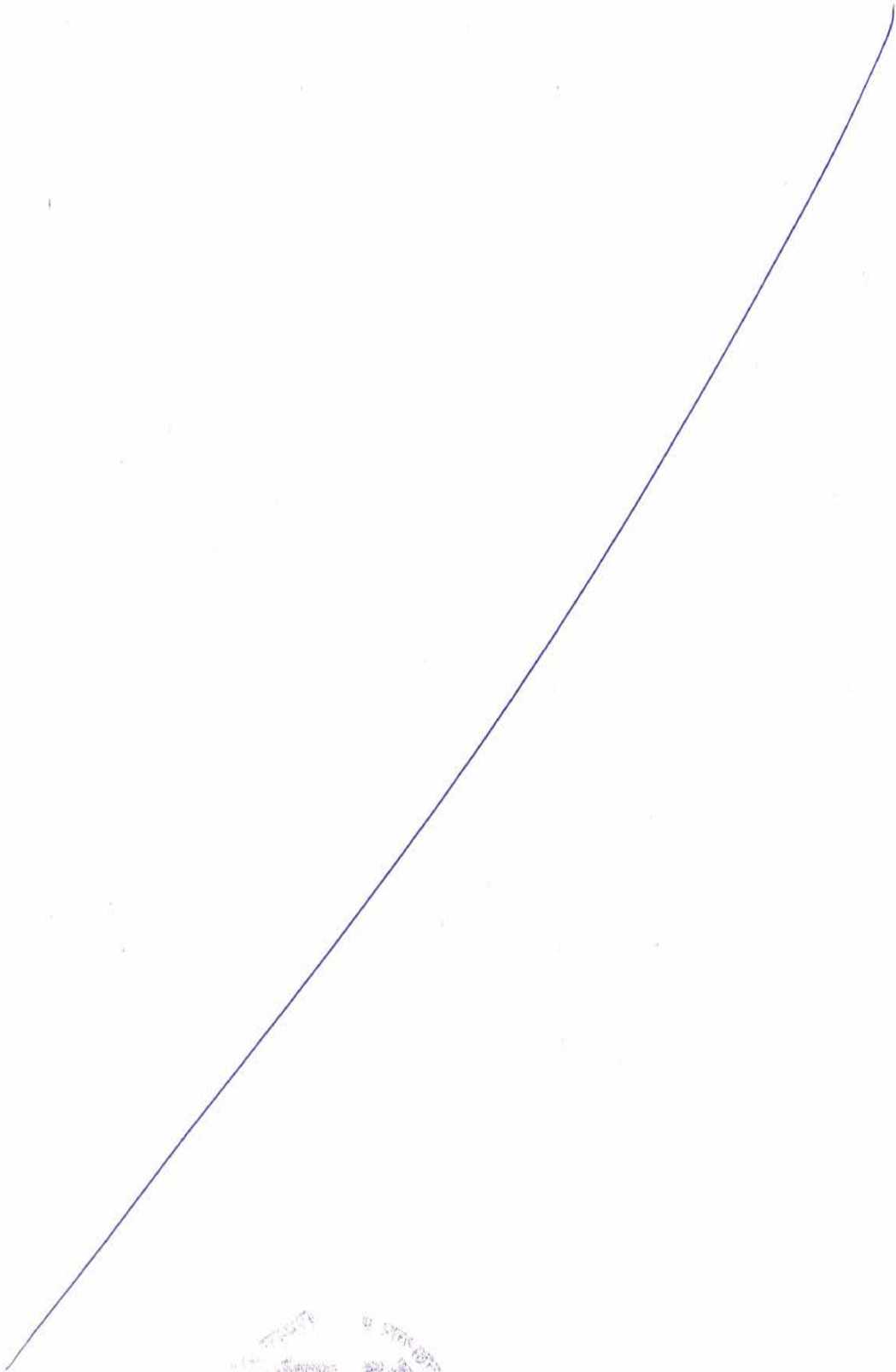
Ramboll has combined its expertise in the areas of road and bridge design asset management with advanced testing methods and IT to offer complete solutions for asset management.

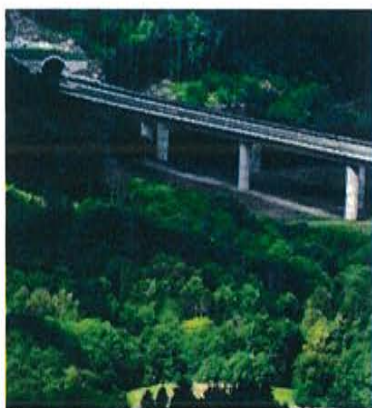
Ramboll RST is the leading provider of consulting services and equipment for efficient pavement management. We use our expertise and proven analytical methods to optimise road asset management and bring the greatest benefits to road authorities, contractors, and end users.



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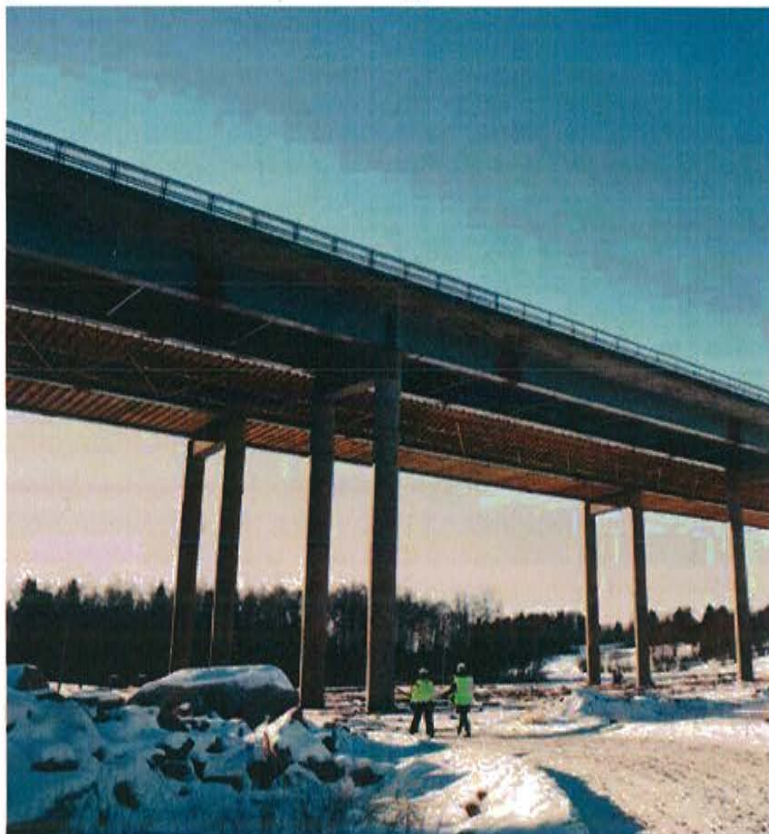




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PROJECT REFERENCES

01 The E18 PPP project in Norway. 38,3 km of four-lane highway, 80 larger and smaller structures; bridges, culverts, retaining walls, and tunnel portals in addition to 40 km of side roads.

02 M1 Junctions 25-28, Nottinghamshire, UK. Ramboll, with partners, acted as designer on this £324m ECI scheme which widened the motorway from three to four lanes over a length of 25 km. This was the first project of its kind to be constructed without contra flow.

03 E18 motorway, Southern Finland. Ramboll did road, bridge and geotechnical design for different parts of the E18 motorway.

04 E6 Tanum, Sweden. Ramboll solved the difficult task of aligning the road crossing at the world heritage area in Tanum, Sweden.

Highway 14 in Savonlinna. Ramboll proposed the building of a two-lane highway with at-grade intersections instead of a four-lane highway with interchanges (which was initially planned). Effectively reducing the number of accidents, the Savonlinna project has become known as one of Finland's most profitable infrastructure investments.

The Marieholm Tunnel together with the Partihall Connection are parts of the planned Marieholm Connection, Sweden.

Køge Bugt Motorway, South of Copenhagen, Denmark. The project includes widening from 8 to 10 lanes of a 5 km section. Ramboll provided project coordination services during the design and construction phase.

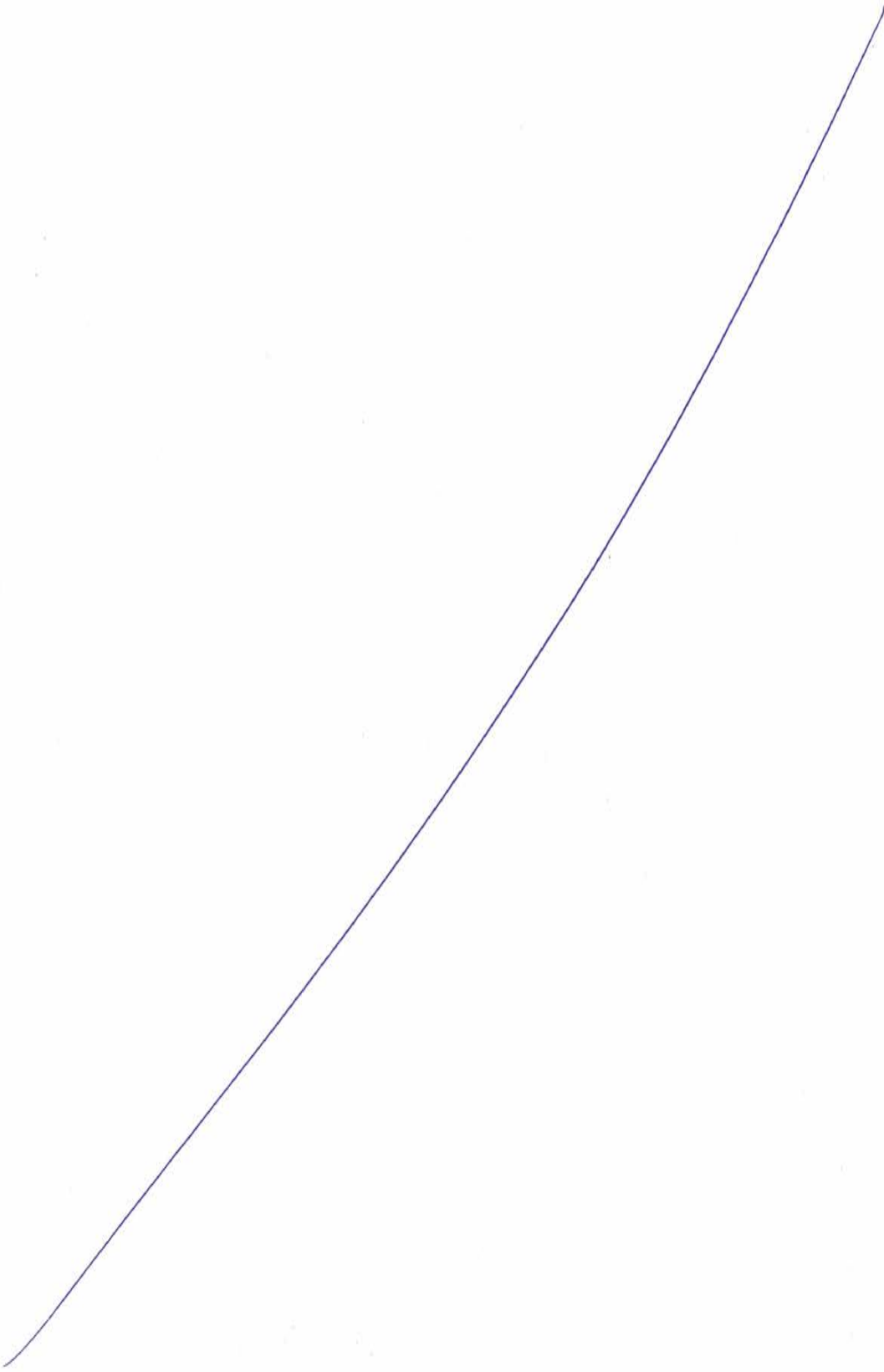


OUR SERVICES

- Road engineering
- Motorway engineering
- Civil engineering
- Transport
- Urban planning
- Landscape architecture
- Structural engineering
- Environmental engineering
- Ground engineering
- Water and sewage engineering
- Project management
- Construction management and monitoring
- Road asset management
- Motorway widening



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TRANSPORT PLANNING, TRAFFIC ENGINEERING AND TRAFFIC SAFETY



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As urbanisation becomes more pronounced, traffic management becomes more challenging. This applies to both urban and rural areas, as people and goods need to be transported over longer distances. We help our customers meet today's high demands for improved transportation systems and increased mobility by navigating the complex challenges associated with the planning and design of cities and transport systems.

Whether we're working on small-scale traffic projects or extensive national and international planning projects, our number one priority is to create safe and flexible infrastructure and transport systems. To achieve this, we focus on creating the right balance between heavy and light road users. We also build many types of models - from complicated transport models to 3D visualisations of a simple junction - to ensure that solutions are as effective as possible. Throughout the process, we work hard to improve the visual environment in both urban and rural environments.

Traffic and community planning and strategies

Transport planning can be key to unlocking the value of a site. Our specialists have a clear understanding of the interplay between public policy and project needs. We work with planners, developers, architects and operators, as well as multidisciplinary engineering teams, to develop and negotiate the right solutions. Ramboll has the expertise and software for carrying out

impact studies, and traffic simulations for road, rail, and pedestrian traffic, regardless of the country and location. Our planning services include:

- City-wide transport plans
- Parking lots
- Bicycle route planning
- Travel habit studies
- Pre-studies for transport investments
- Evaluations of transport measures
- Transport strategies on local and regional levels
- Public transport
- Urban logistics.

Traffic safety plans

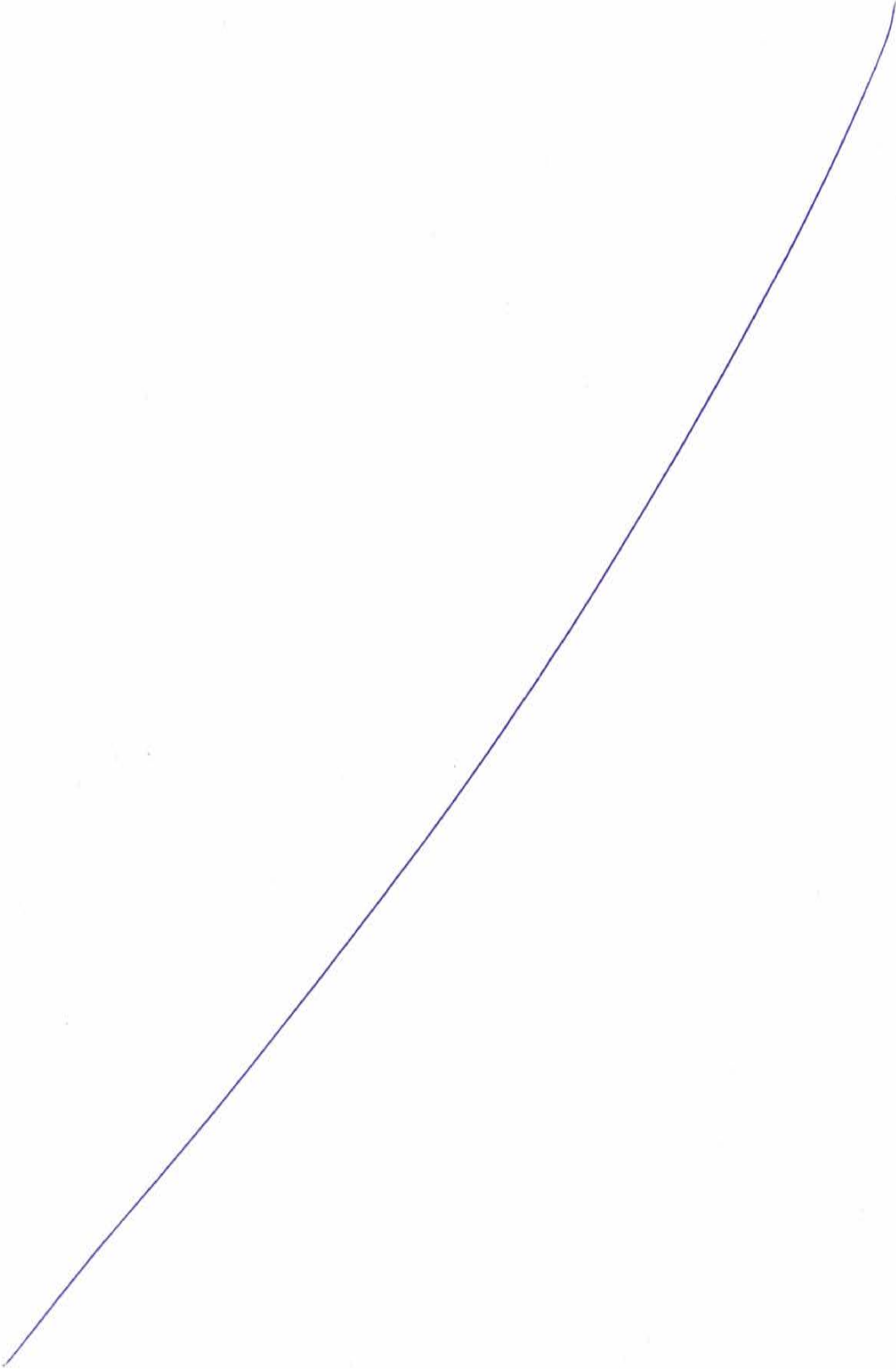
Ramboll excels at creating comprehensive traffic safety plans at the community and municipality level. To facilitate the making of traffic safety plans, we collect information about the present status of traffic safety and potential problems.

Registration and analysis of traffic accidents having occurred in the planning area constitute an important part of the process. These are examined with Ramboll's LITU software and based on geo-information systems. Mobility habits, detected problems, and perceived traffic safety are investigated with resident surveys.

The first phase results form the basis for the problem analysis. Based on the problem analysis, we set both quantitative and functional goals for traffic safety and mobility management. Additionally, we define the focus areas of traffic safety work. These constitute the starting point for developing solutions to improve traffic safety.



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The overall planning work typically focuses on the following:

- The analysis of the correlation between road accidents and road/traffic conditions
- The analysis of the interplay between drivers, vehicles, the surroundings, and other factors pertinent to road safety
- Measures to reduce the accident risk in road traffic
- The formulation of road safety aims and visions
- The registration and analysis of road accidents.

Sustainable transportation & environment

- Analysis of environmental consequences
- Analysis of socioeconomic factors.

Traffic analysis and geographic information systems (GIS)

- Road Informatics - Intelligent Traffic Systems (ITS)
- Geographic information systems (GIS)
- Traffic simulation with micro, meso, and macro simulation
- Traffic operation (signals, control systems, etc.)
- Surveys
- Demand and impact analyses.

Research and development

- Guidelines
- Model development
- Research projects.

PROJECT REFERENCES

01 Kivistö Station in Vantaa, Finland. Simulation of bicycle and pedestrian traffic and linked trips.

02 Ring Road III (E18) telematics in Helsinki, Finland.

03 Urban South Hampshire DaSTS Study, UK. The Delivering a Sustainable Transport System (DaSTS) report signalled a major revision in UK transport policy. Ramboll's specialist input helped to put the Urban South Hants DaSTS study ahead of others in evolving methodology and creating innovative strategies which influenced the overall report.

04 Realtime information system for public transport in Oslo (SIS), Norway.

Baltic Transport Outlook (BTO) 2030.

Traffic management in Røde port, Roskilde, Denmark.

Southern Finland Rail Network
Ramboll conducted development scenarios, traffic forecasts, and economic and social impact assessments for the development of freight traffic.



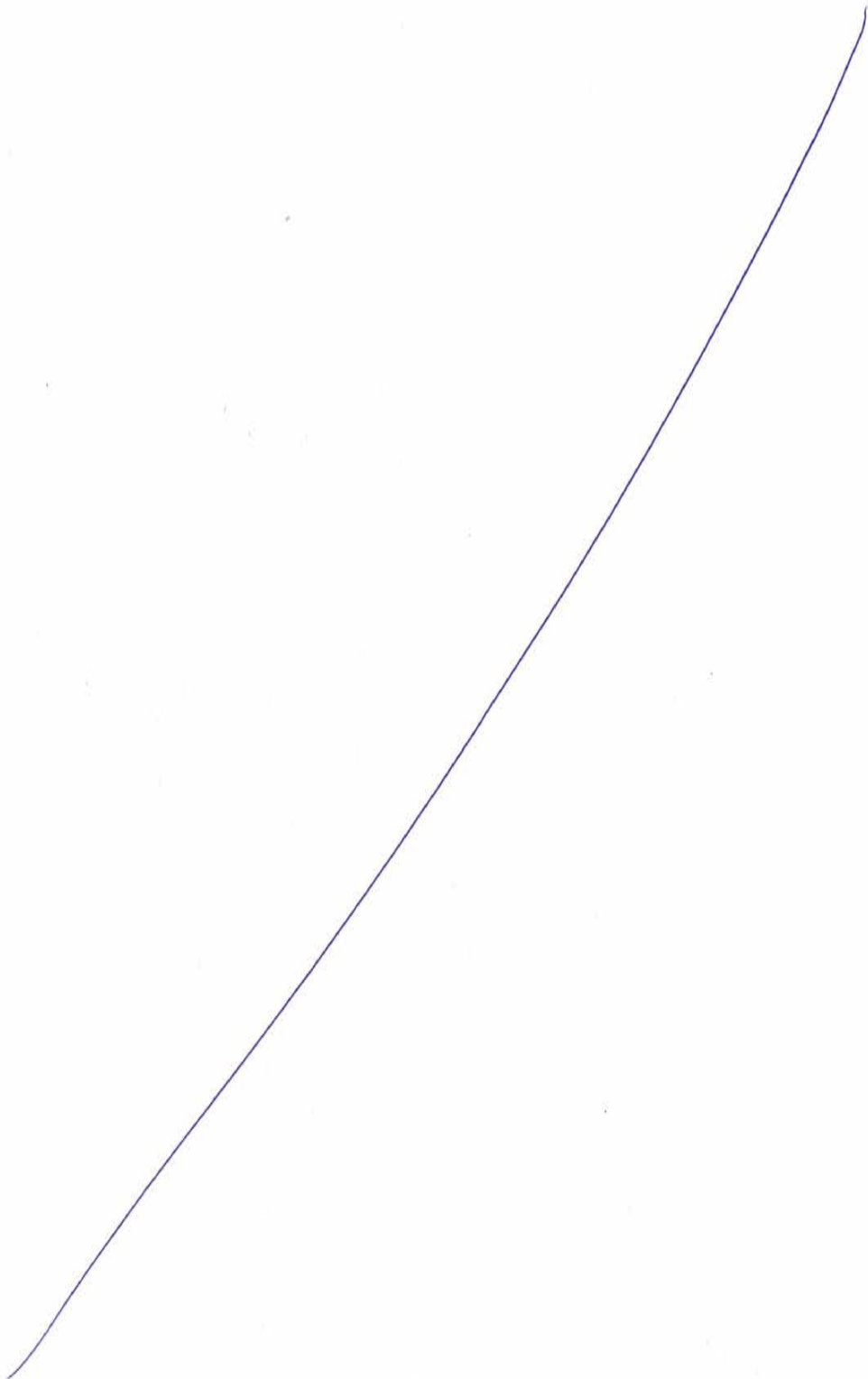
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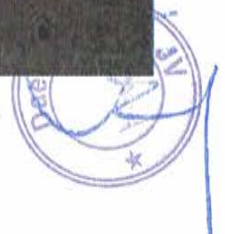
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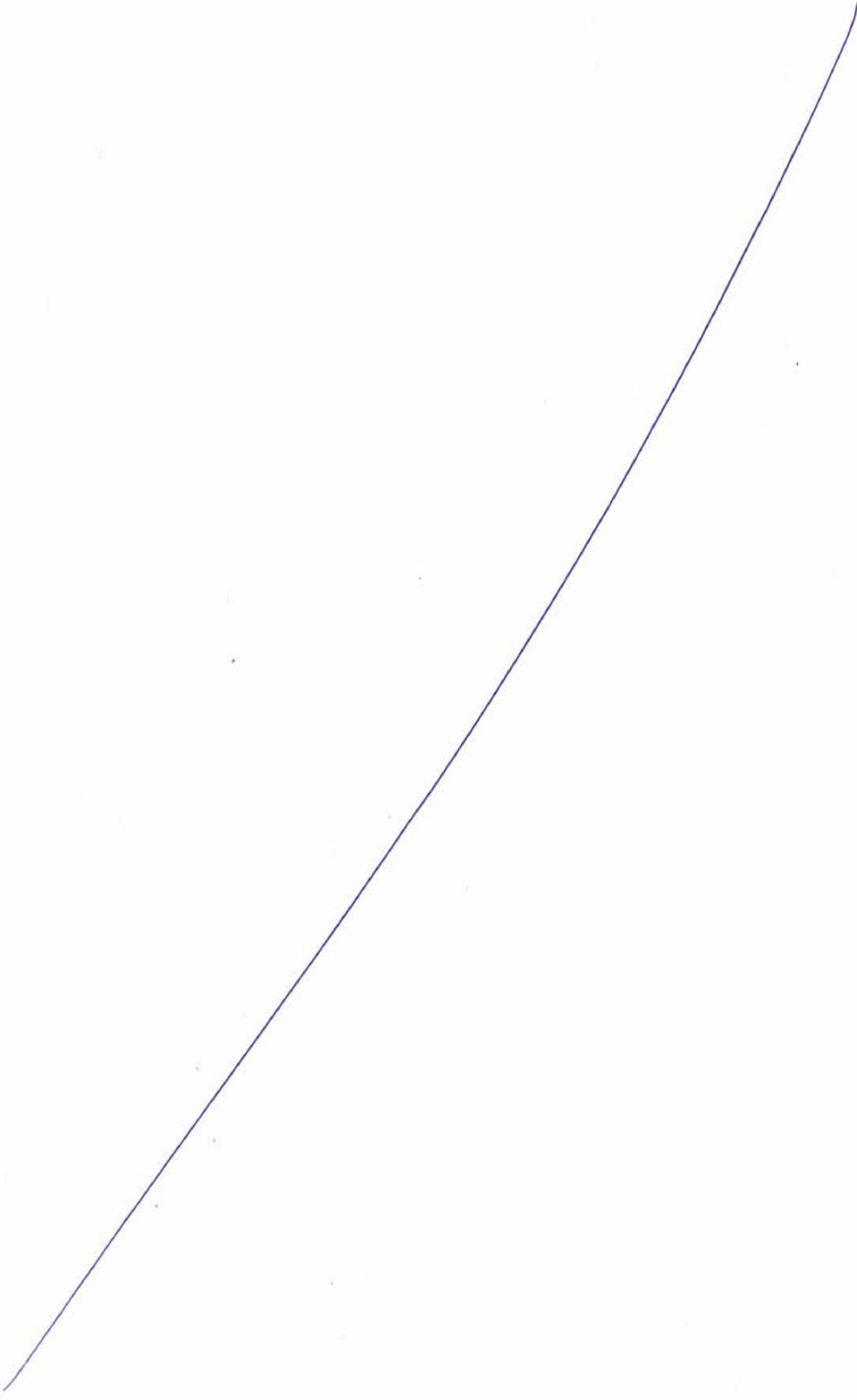




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TUNNEL ENGINEERING



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The use of tunnels to connect people and places is becoming more widespread as environmental issues arise in cities and in the countryside. Ramboll offers a full range of engineering services for tunnels and underground structures. Our expertise includes railway tunnels, road tunnels, cyclists and pedestrian tunnels, and tunnels for all types of utility systems.

We cover all project phases such as feasibility studies, conceptual design, preliminary design, detailed design, tendering and contract, supervision, and operation and maintenance.

Our design processes are lead by experienced project managers to ensure an optimum implementation of the projects. We work closely with our customers, neighbouring project owners, consultants and external specialists, local authorities, and utility owners.

Our expertise

Ramboll covers the following areas:

- Tunnel design
- Rock mechanical calculations
- Geotechnical investigations and evaluations
- Groundwater handling
- Environmental investigations
- Ventilation design
- Fire design
- Mechanical and electrical installations
- SCADA
- Risk management
- Supervision
- Operations and maintenance management.

Solutions in tunnel engineering

Ramboll provides high standard, multidisciplinary solutions for all types of underground structures including cut and cover, immersed, jacked, bored, NATM, and hard rock tunnels. Furthermore, we are experienced in special disciplines, such as tunnelling under and close to existing structures, permanent diaphragm walls, top-down methods, etc.

The preliminary investigations involve a range of different disciplines; frequently, a thorough preliminary investigation is key to a successful project. Our tunnel engineering work covers investigation, preconstruction, and construction phase investigations. These stages include primary site exploration, detailed surface investigations, detailed sub-surface investigations, and tunnel mapping.

General tunnel engineering

We cover all types of tunnel engineering, including:

- Cut and Cover tunnels
- Immersed tunnels
- Bored tunnels with TBM
- The New Austrian Tunnelling Method (NATM) tunnels
- Rock tunnels.

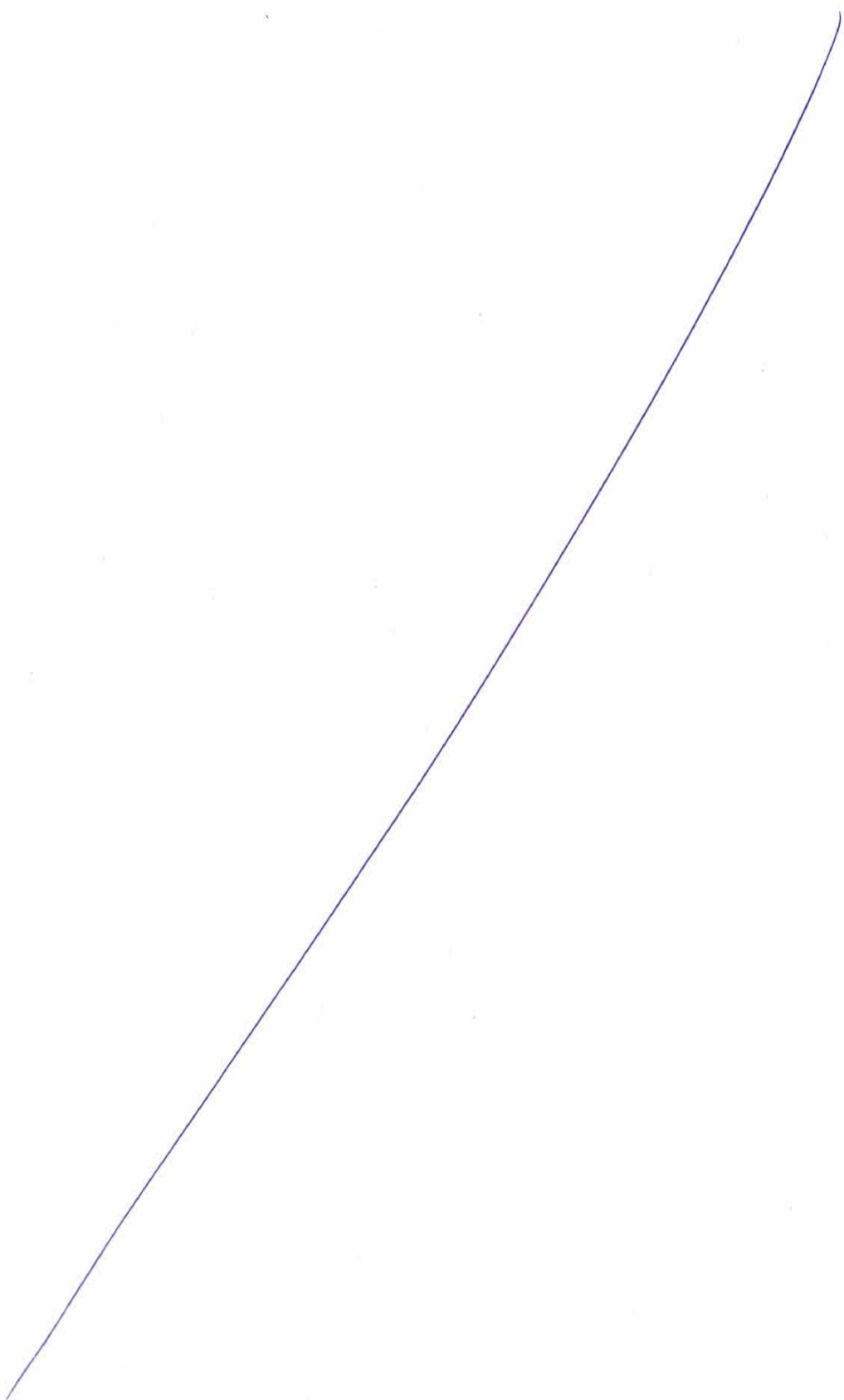
We have extensive experience with land tunnel and sub-sea tunnel projects, and we work on all phases of tunnels and large cavern engineering projects:

- Primary site exploration
- Detailed surface investigations
- Detailed sub-surface investigations and tunnel mapping
- Preliminary field investigations
- Risk investigations.



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- • Tunnel mapping based on Q-method
- Rock-support
- Grouting
- Problems caused by water
- Ventilation design.

Tunnels in soft soils

For tunnels and other underground structures in soft soils, we use different types of retaining and stabilising methods, including:

- Secant pile walls
- Diaphragm walls
- Sheet pile walls
- Ground anchors
- Reinforced soil
- Driven piles.

Tunnel safety

In recent years, there has been increased focus on tunnel safety, and international standards are currently under development.

Ramboll carefully keeps track of these standards, and we continuously upgrade our services to provide the latest knowledge in tunnel safety within the following areas:

- Ventilation requirements for air quality and safety
- Fire fighting access analysis. Evaluation of the fire fighting access for tunnels. This includes simulations of the conditions that can be expected during a fire.
- Fire and smoke spread analysis. Evaluation of the conditions within a tunnel during a fire, Used in conjunction with the Evacuation Analysis. Serves as input for the Risk Analysis.
- Evacuation modelling.

PROJECT REFERENCES

01 Fehmarn Belt. A 19 kilometer long immersed tunnel across the Fehmarn Belt between Germany and Denmark. This tunnel will be more than three times as long as any existing immersed tunnel. It will also be the longest tunnel yet to be designed in accordance with EU Directive 2004/54/EC on road tunnel safety and will set new standards for modern tunnel design.

02 Øresund Link between Denmark and Sweden: The 4,050 m immersed tunnel (for a dual-track railway and a four-lane motorway from Copenhagen to an artificial island) was the longest immersed tunnel in the world at its inauguration in 2000.

03 Södra Länken, Sweden. A new ring road in Stockholm, where 4.6 km is a rock tunnel. The tunnel is Sweden's longest road tunnel.

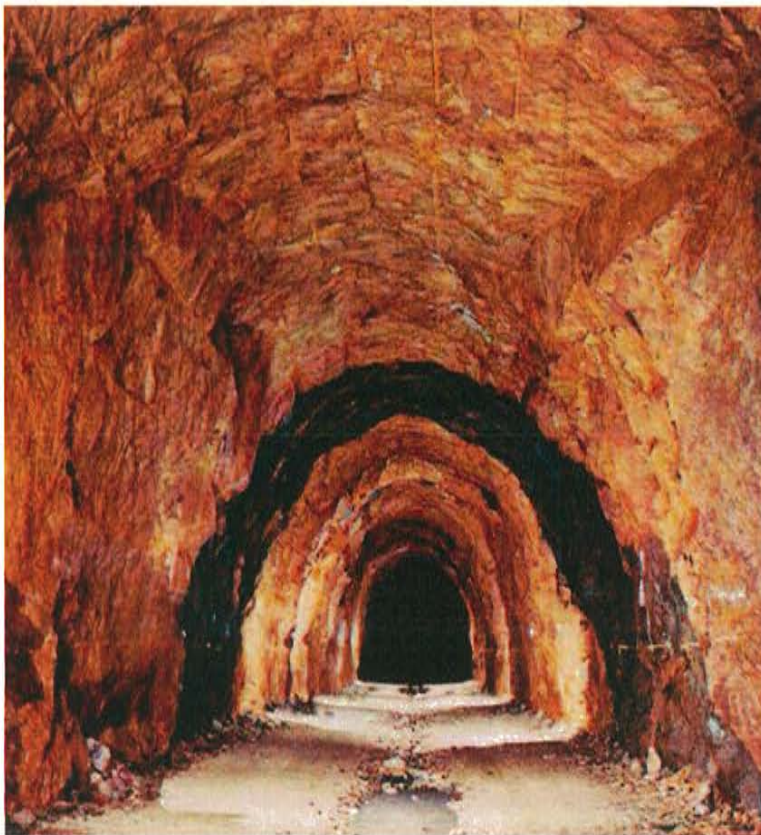
04 Management and supervision of the 120 km long Päijännetunnel, which provides Helsinki and the surrounding cities with pure water from Lake Päijänne in central Finland.

The Steinberg tunnel in Trondheim, Norway.

City Tunneln rail tunnel in Malmö, Sweden. Management and supervision of the tunnel on the Swedish side of the Øresund connection between Sweden and Denmark for increased capacity on the rail network.

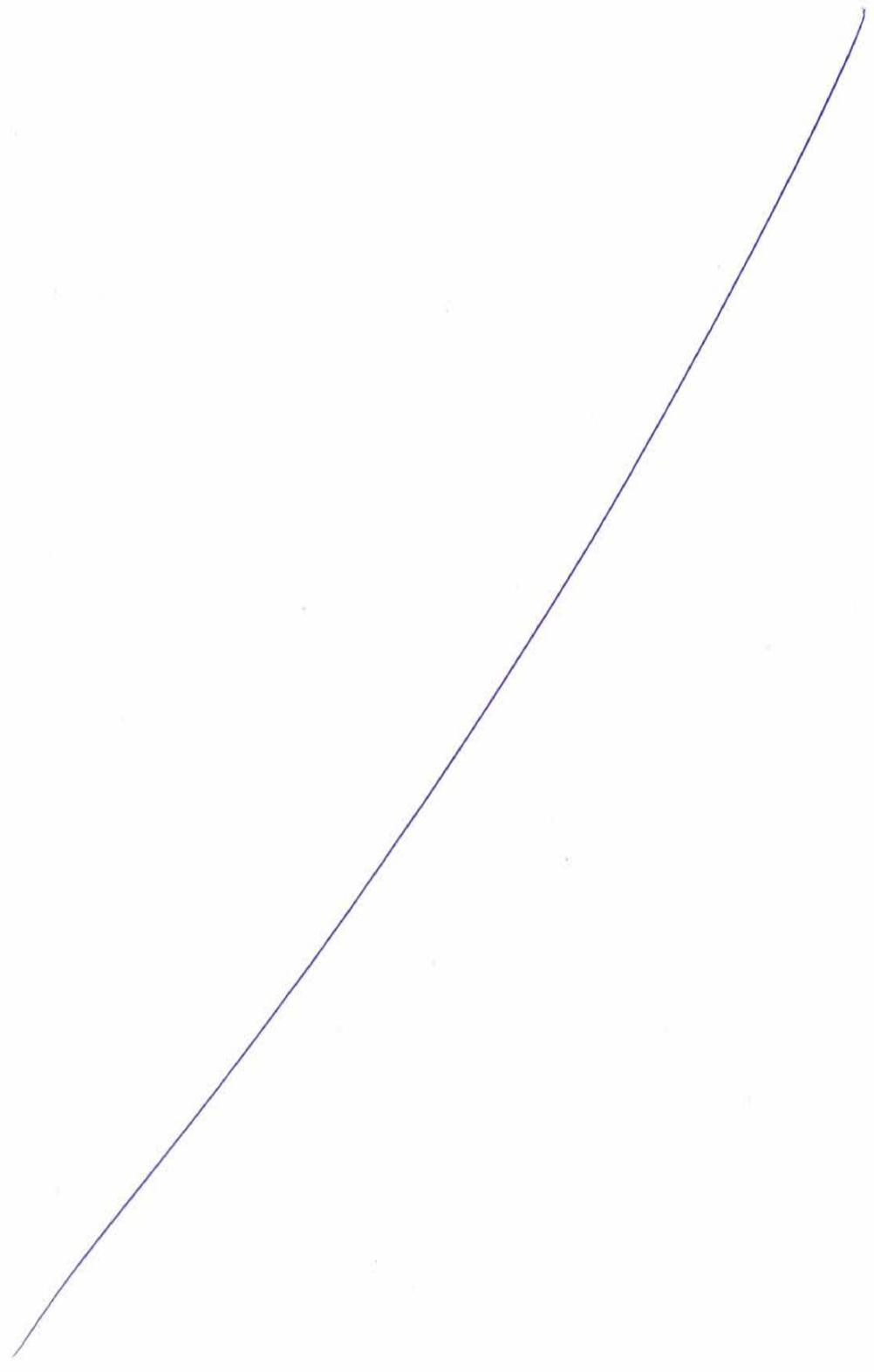
The Marselis tunnel in Aarhus and the Nordhavnsvej tunnel in Copenhagen are the first Danish Cut & Cover tunnels to be designed in accordance with the EU Directive 2004/54/EC on road tunnel safety.

Royal Clarence Yard, Gosport, Hampshire involved the restoration of listed buildings and the erection of retail, commercial and residential property. Ramboll was responsible for engineering investigation, strategic planning, detailed design, and environmental assessment.



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URBAN DEVELOPMENT AND MASTER PLANNING



01

The need for smart sustainable urban solutions has never been greater than it is today. Ramboll's master planning services focus on developing healthy, safe places in which people can thrive, communities can evolve, and the environment can flourish.

Realising complex urban solutions

Coordination and understanding of a wide range of disciplines is critical to successful master planning, which is why our ability to integrate our areas of expertise is crucial to our success.



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We help customers realise their development potential, particularly when it comes to complex urban concepts. We identify key risks and suggest solutions. We provide the spectrum of knowledge required for the development of all kinds of urban, suburban, former industrial, and green field areas. The realities of commercial feasibility remain central to our consultancy.

Close coordination from concept to completion

We have a thorough understanding of all project stages involved from concept to completion — from architectural and infrastructure design, environmental and geotechnical assessment, legislative requirements, sustainable energy, transport planning and socio-economic implications, to planning strategy, phasing, and delivery.



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Depending on the requirements of the project, we bring together the relevant specialists to work with an experienced master planning project manager. The project manager takes responsibility for internal communications and

functions as the primary point of contact for the team. Our approach has proved successful when coordinating very specific types of expertise to provide a cohesive and comprehensive service.

Our usage of advanced modelling software and geographic information systems (GIS) supports the analysis of options available and the subsequent communication of results.

Master planning experience

We have the ability to carry out any combination of master planning services from our multi-disciplinary profile. Our experience includes sustainable master plans for regeneration of city centre areas, hospitals, colleges, airports, ports, golf courses, and luxury resorts - in both national and international settings.

In keeping with our philosophy, our master planning teams encourage the exchange of ideas between all disciplines involved to reach the most streamlined, cost-effective result, enabling us to meet the social, technical, environmental, and financial requirements of any project.

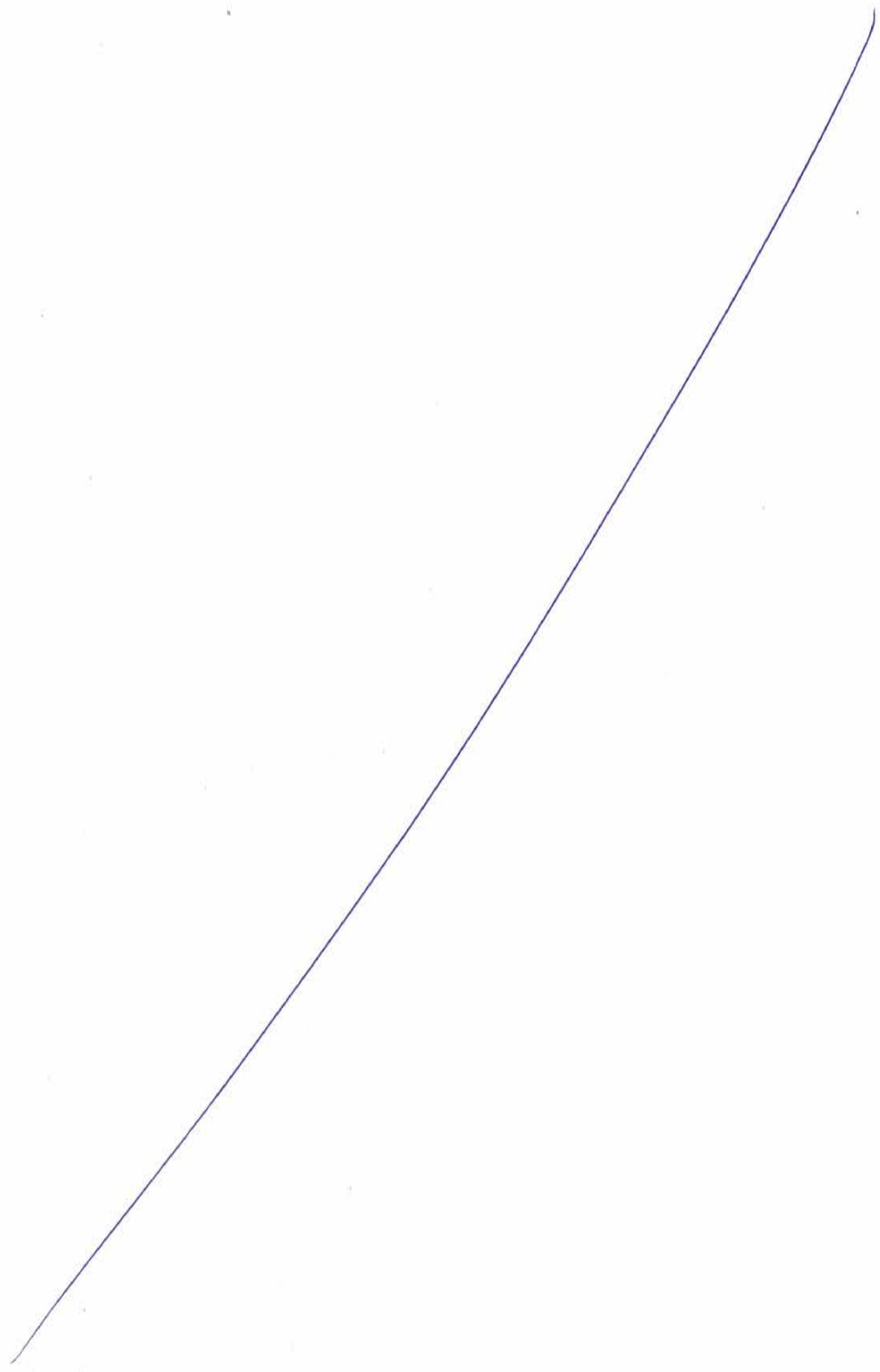
Sustainable approach to urban development and master planning

Sustainable development requires a fresh approach to master planning. This is achieved by removing existing preconceptions and redefining the design process to combine innovative, practical and sustainable drivers for development. From the project inception through design development, we identify and develop key



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→ sustainability considerations in an interactive process with customers and design teams.

We deliver solutions based on a clear understanding of core facts, including customer aspirations, site opportunities and constraints, economic thresholds, and the evolution of policies and regulations against the project time table.

Our approach to sustainable master planning promotes multidisciplinary work and close collaboration with specialist groups within Ramboll. This results in integrated strategies which respond to site opportunities, and offer innovation and exemplary sustainable design.

Our input is applied and developed throughout the life cycle of the project. We aim at achieving

truly sustainable development by promoting education and awareness alongside design solutions, to enable environmental best practices to become an integral part of new communities.

Ramboll has over 100 employees working within urban development and master planning. The employees are located in Denmark, Finland, Sweden, the UK, India, and the Middle East.

PROJECT REFERENCES

01-02 Nordhavn, Copenhagen, Denmark.

03 Suurpelto residential area in Espoo. Ramboll did the town plan, as well as geotechnical, traffic, water supply, and street plans. Ramboll also designed bridges and noise barriers for this sustainable neighborhood.

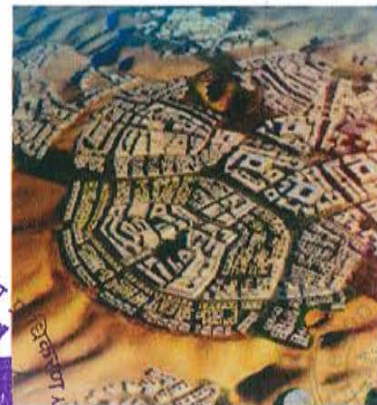
04 Alakati Nicosia.

05 Jätkäsaari area, Finland. This area was planned as an urban, densely built city district around the shoreline of Helsinki. Ramboll mapped out utilisation of contaminated soils and sediments, conducted environmental surveys, and supervised the former landfill renovation.

06 The King Abdullah City for Atomic and Renewable Energy (KA-CARE), Saudi Arabia.

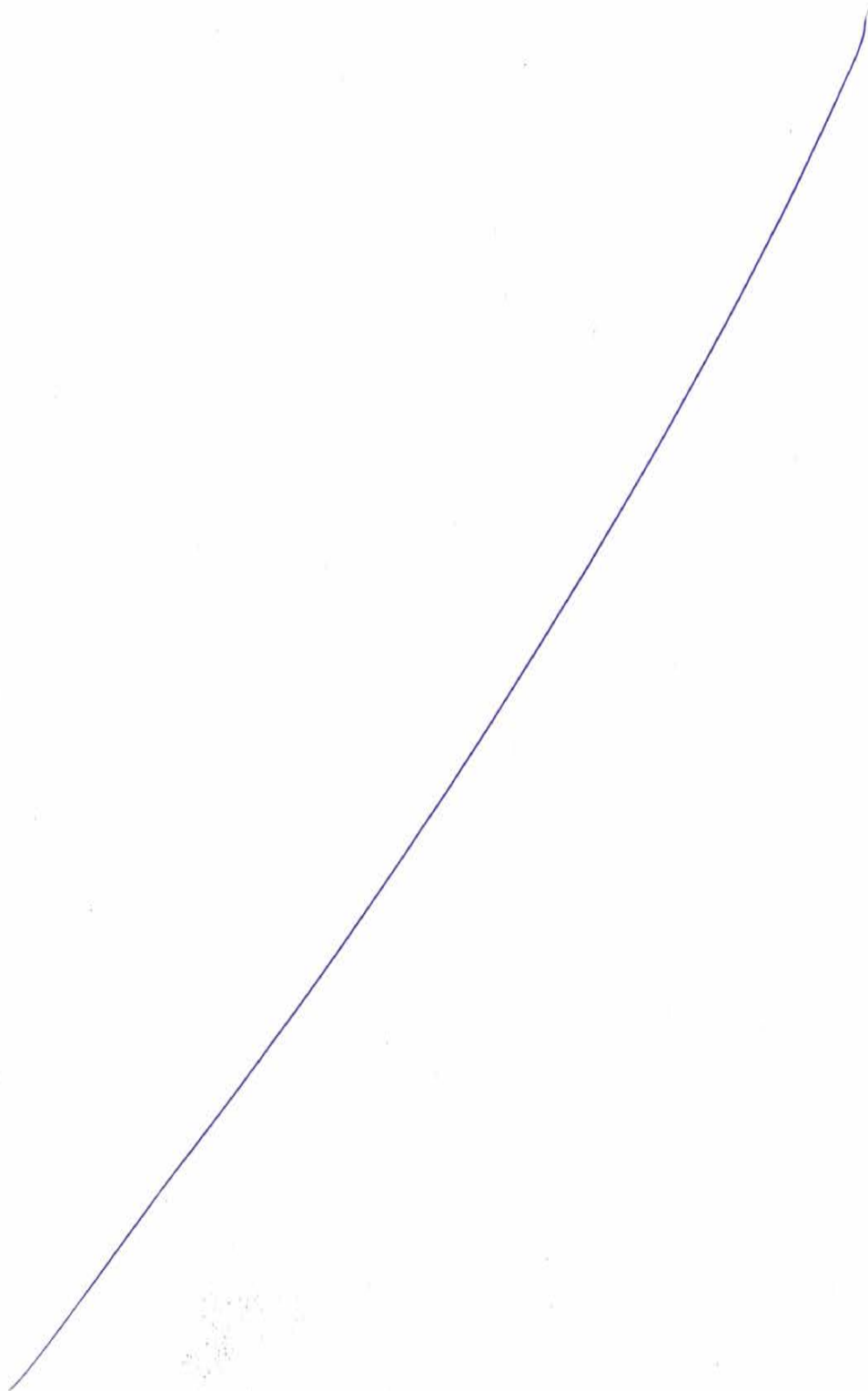
Sustainable masterplan covering 5,500Ha of desert south-west of Riyadh. Ramboll did a full multidisciplinary engineering review and design proposals, including infrastructure, services and water engineering, and transport planning services.

Railway tunnel under the municipality of Varberg. Ramboll did master planning studies of the city front for two different railway tunnels under the city of Varberg.

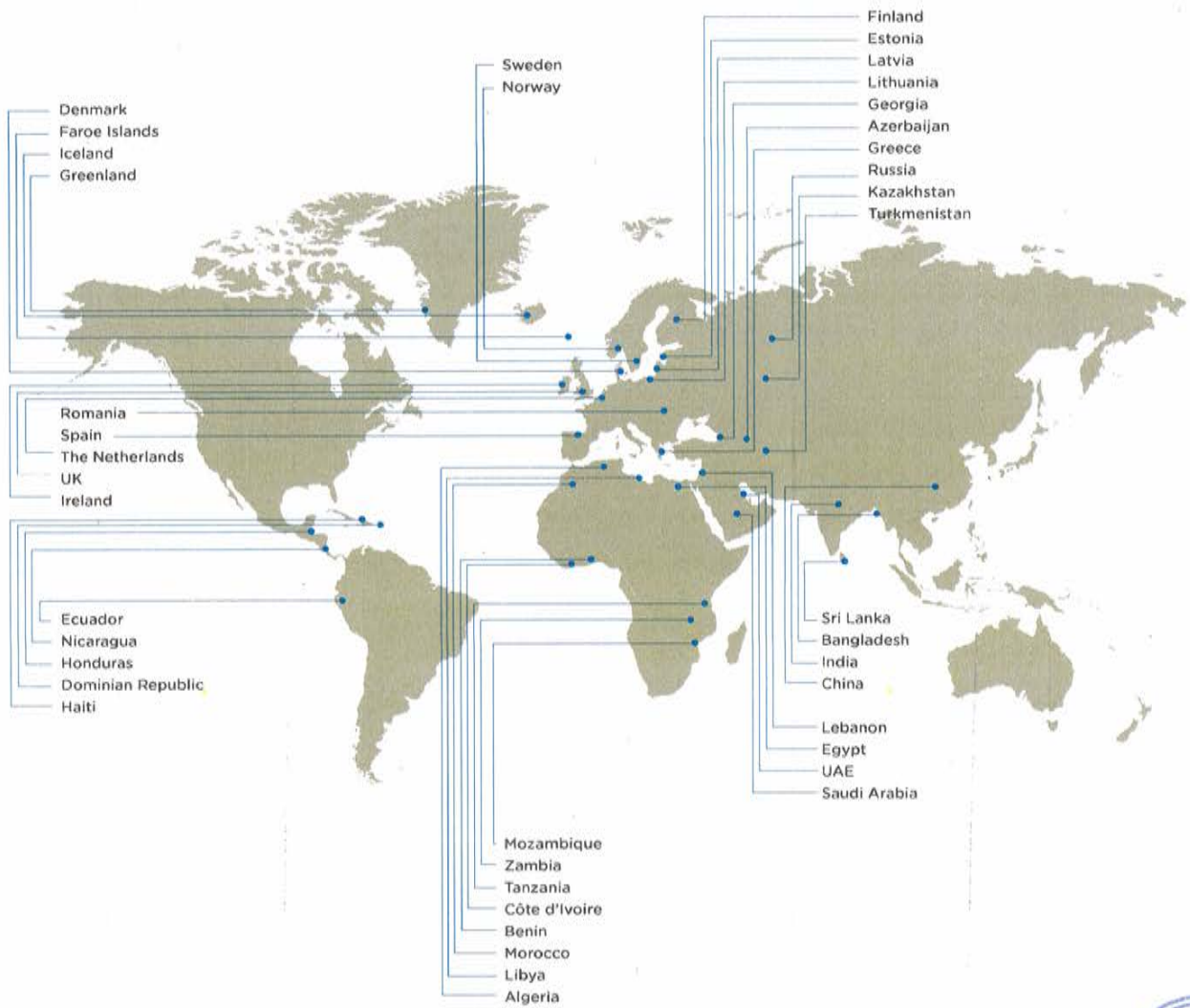


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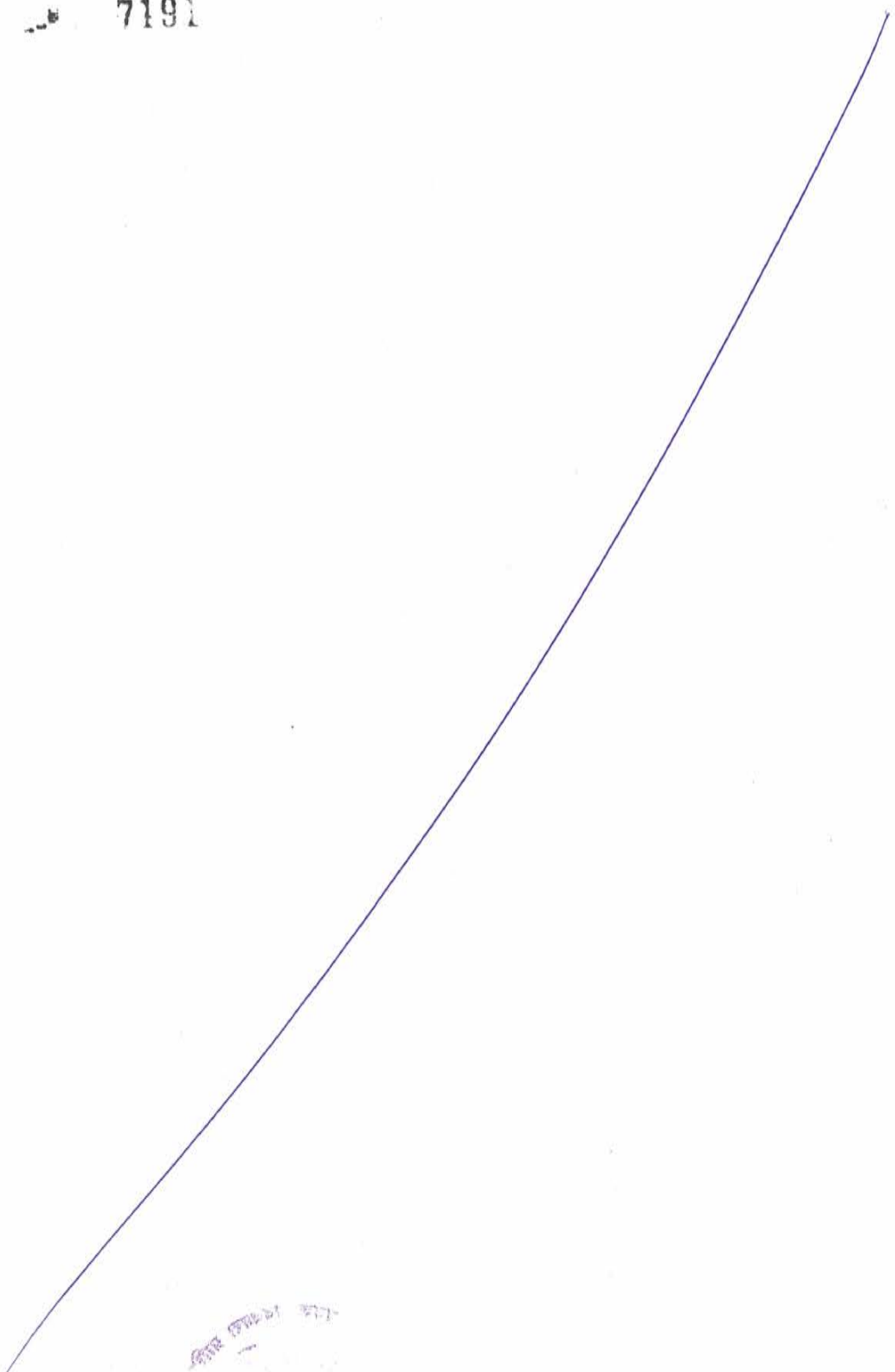
TRANSPORT PROJECT LOCATIONS



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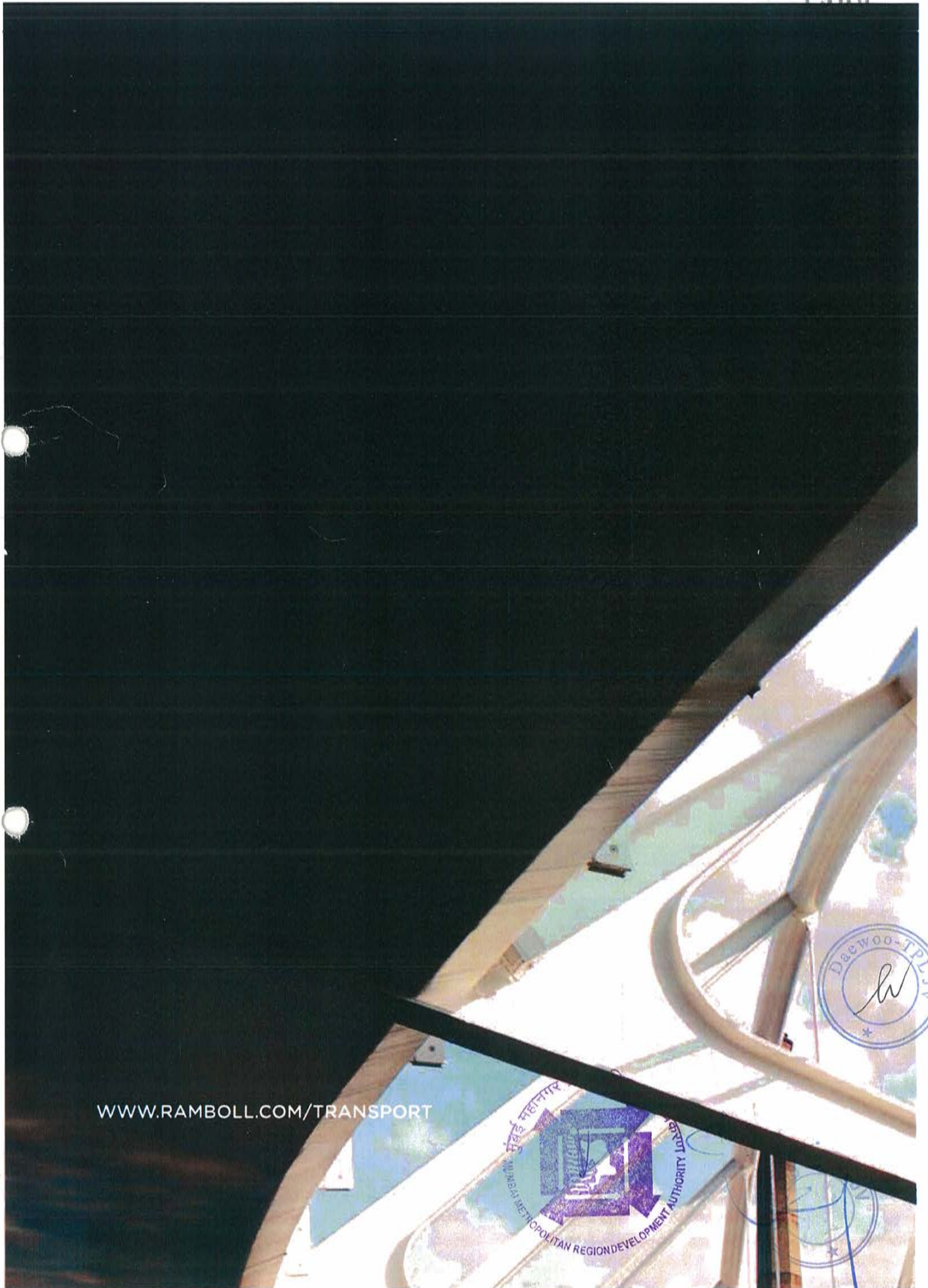
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FOR THE YEAR

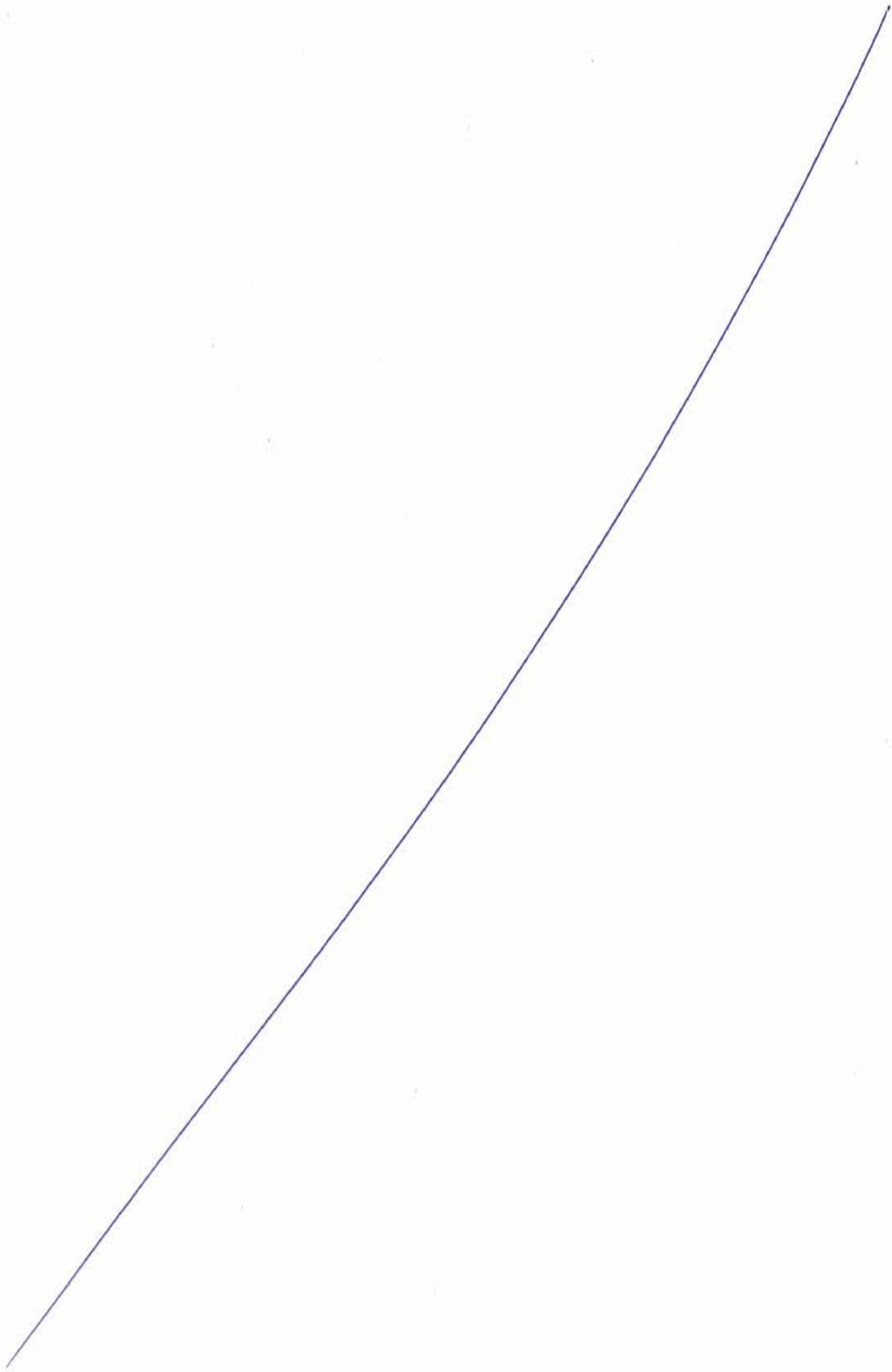




WWW.RAMBOLL.COM/TRANSPORT



7193



Major Transport Infrastructure Projects

David Climie, Project Director & Employer's Representative
Forth Replacement Crossing
 Principal Contract Project Office
 King Malcolm Drive, Rosyth KY11 2DY

Email: frcenquiries@transport.gov.scot



To whom it may concern

Your ref:

Our ref:

Date:
22 March 2016

Dear Sir/Madam

Consultancy Services for the Principal Contract on the Queensferry Crossing - Ramboll

The Queensferry Crossing is a major piece of strategic infrastructure located on the east coast of Scotland. At its center is a new iconic bridge across the Forth estuary. The bridge is approximately 2.6km long and incorporates a unique three tower cable stayed structure with overlapping stay cables with two main spans each of 650m, the longest spans in the world for a multi span cable stayed bridge.

This is to certify that Ramboll has performed the following consultancy services for the Principal Contractor in connection with the Queensferry Crossing, which is a design and build project for which Transport Scotland are the Client.

Contract Name:	Queensferry Crossing (Forth Replacement Crossing)
Construction Value:	790 million GBP (1135 million US \$)
Consultancy Fee:	20 million GBP (28.75 million US \$)
Commencement Date:	April 2011
Completion Date:	Detailed Design complete. Construction is approximately 85% complete with opening to traffic planned for the end of 2016

Scope of Works:

1. Lead consultant responsible for the design of the permanent works associated with the scheme.
2. Tender design and detail design
3. Tender design and detailed design of geological and geotechnical aspects related to the main crossing
4. Marine and hydrological studies including the assessment and design of scour protection
5. The design of the foundations comprising large diameter caissons in water approximately 23m deep and spread footings sat upon igneous intrusions within the center of the channel.

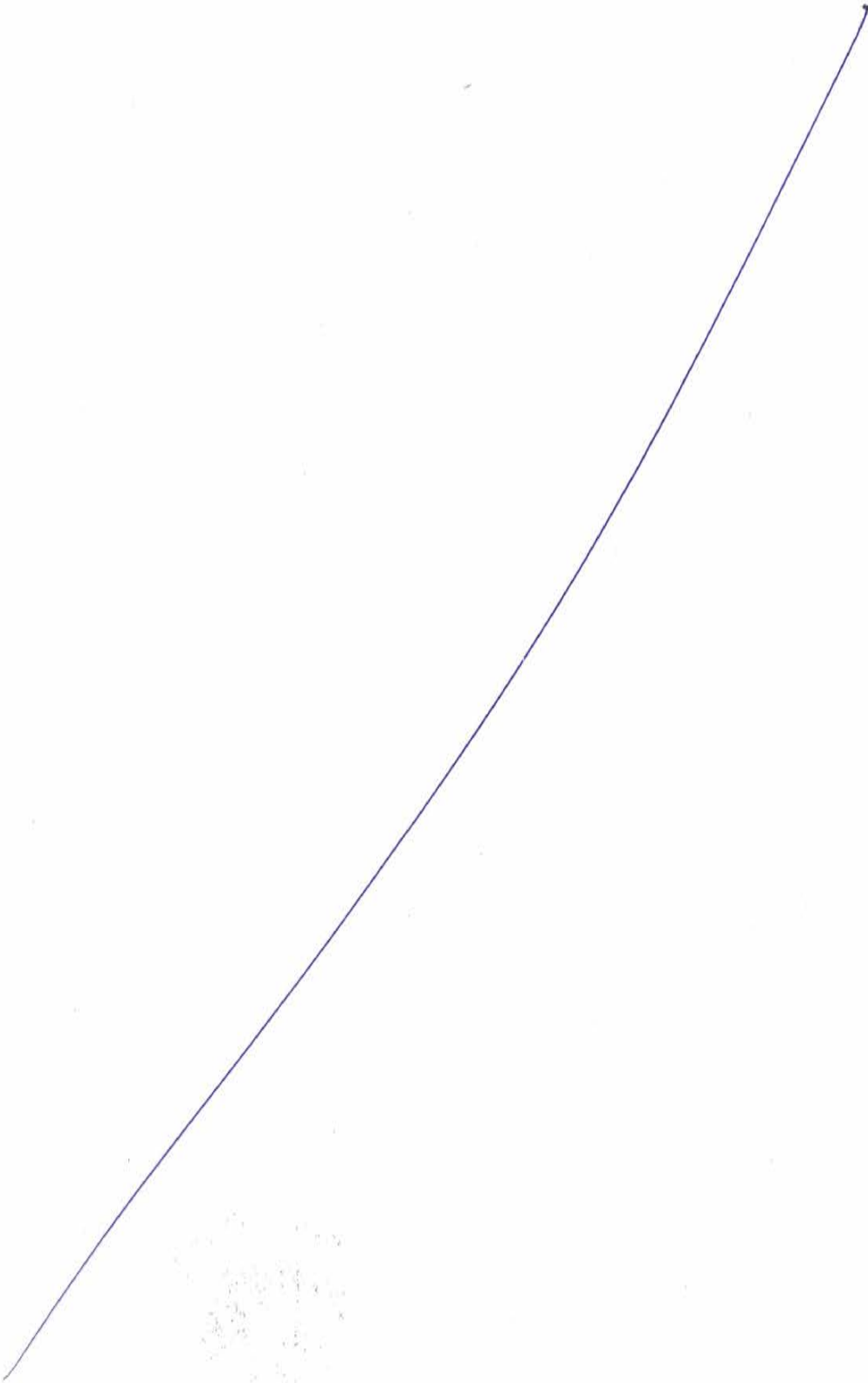
Ramboll has performed the consultancy services in a professional manner

Yours Sincerely

David Climie
Transport Scotland



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Mersey Gateway Crossings Board Ltd
 Third Floor
 Waterloo Centre
 Waterloo Road
 Widnes
 WA8 0PR

0151 495 4091
www.merseygateway.co.uk

Our Ref SN/MEK
If you telephone please ask for Your ref Steve Nicholson
 0151-495-4090
Date 15th May 2014
E-mail address steve.nicholson@halton.gov.uk

Reference No:

Date:

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ramboll** has successfully completed the project namely **“Lead Technical Consultant for Mersey Gateway”** up to contract award.

Project Description:

The £600m Mersey Gateway DBFO project comprises construction of a new 6-lane fixed-link iconic 3 tower cable stayed bridge. The total length of proposed Bridge is 1931m comprising of 1000m of Cable Stayed portion having span lengths of (185m+300m+300m+215m) and approach span in the range of 60m to 100m. There are three lanes on either side of tower including total deck width of approx 35m.

The proposed bridge is crossing over the River Mersey in Halton, North West England, together with connections into, and modifications to, the existing highway network in Widnes and Runcorn on either side of the river (a total length of over 8km) and modifications to the existing Silver Jubilee Bridge to return it to local use and to encourage sustainable transport modes. Both the new bridge and the existing crossing will be tolled, and the main contract, let to a Project Company, includes tolling operations and maintenance (excluding the maintenance of the existing crossing).



Registered Office: Municipal Buildings, Kingsway, Widnes, Cheshire WA8 7QX
 Registered in England & Wales
 Registered Number 8751307

Mersey Gateway Crossings Board Ltd is a local authority owned company controlled by Halton Borough Council

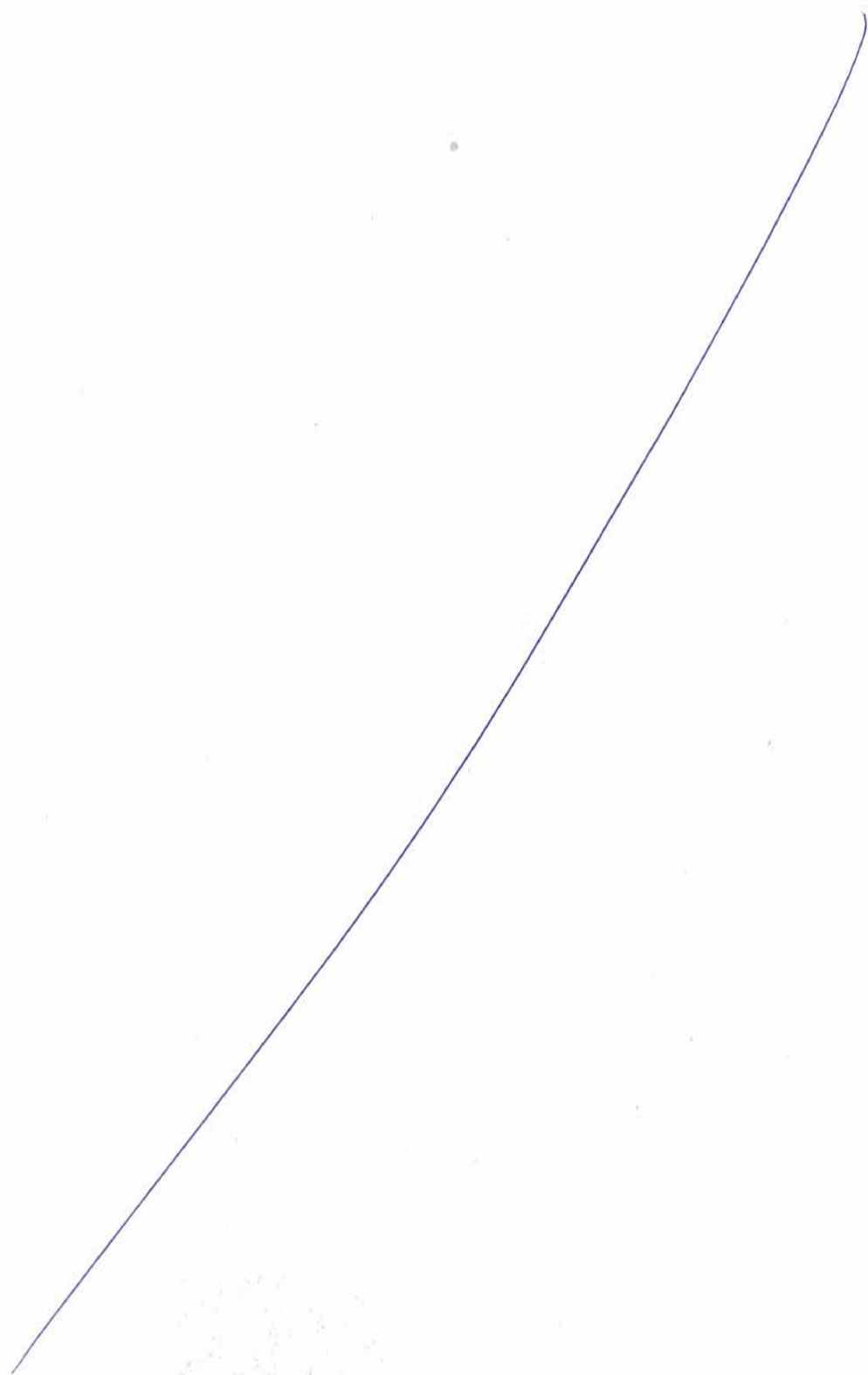
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A brief scope of work for the consultancy services completed by Ramboll is:

Ramboll were appointed as the Lead Technical Consultant to Halton Borough Council in 2001 for this prestigious project and have since provided project management services and technical advice (including structures, highways, geotechnical engineering, environment, transportation, surveying and tolling technology) for the following stages of the project:

- Desk Studies
- Feasibility studies into alternative options and Preferred Option Selection
- Major Scheme Business Case Submission
- Preparation of Orders and Applications (including the Environmental Statement)
- Public Inquiry (Including Expert Evidence)
- Outline Business Case
- Procurement (under a Competitive Dialogue Process)
- Advance Works
- Preferred Bidder stage

Start Date of Consultancy (month/ year): July 2001

Completion Date of Consultancy (month/ year): July 2014

Consultancy Fee: > £16m

Project Cost: > £600m

Contractor/Concessionaire Name with award/start date:

The Merseylink consortium was appointed as the project company to design, build, finance and operate the Mersey Gateway Project in March 2014. The sponsors are: Macquarie Capital (Australia), FCC Construcción S.A. (Spain), Bilfinger Project Investments (Germany).

The contractors are: FCC Construcción, Kier Infrastructure & Overseas Limited (England), Samsung C&T Corporation (Korea)
The toll operator is: Sanef S.A. (France)

Yours faithfully

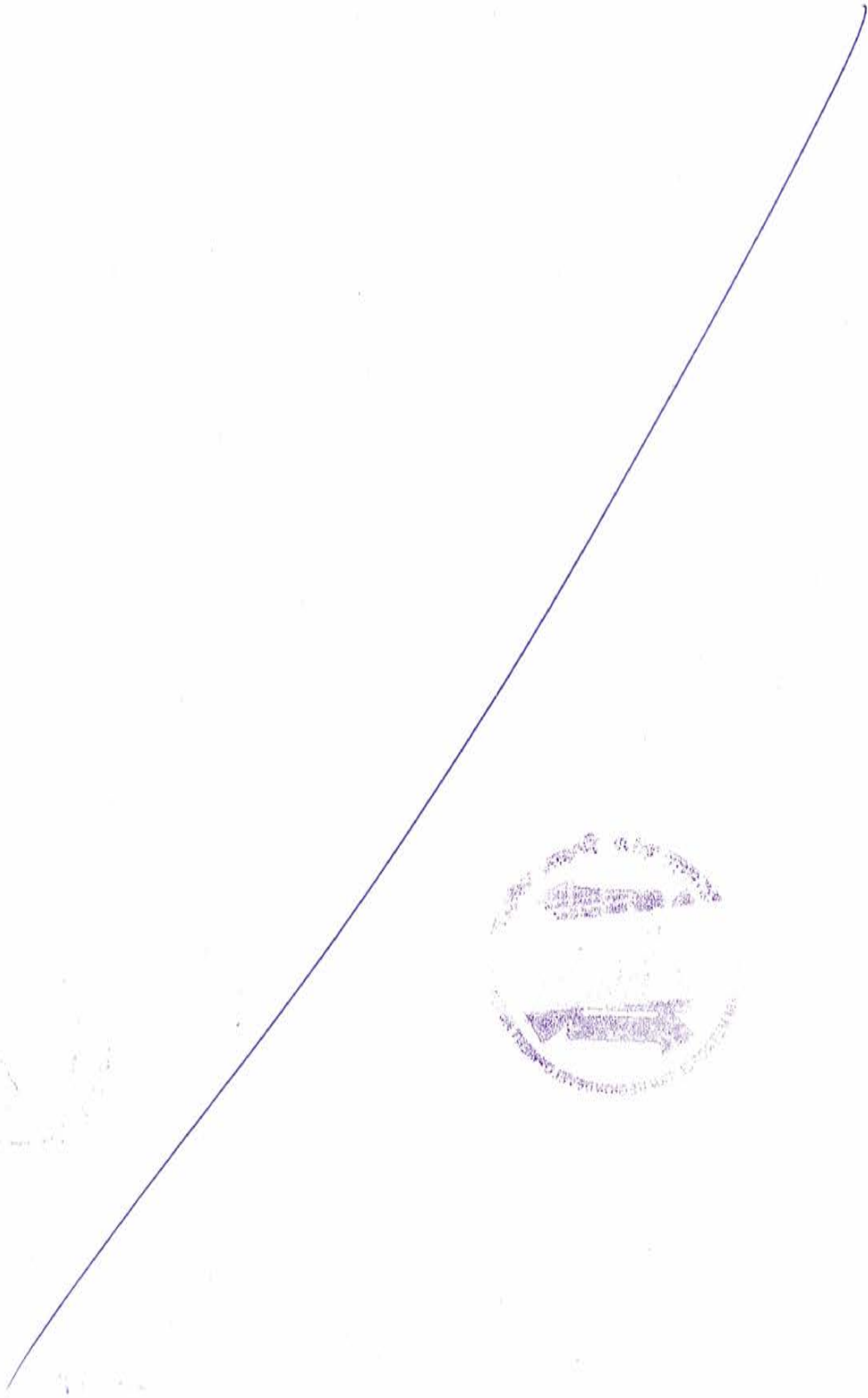


**Steve Nicholson
Chief Executive
Mersey Gateway Crossings Board**



1. 1. 1946

OFF. NO. 7199



RAMBOLL

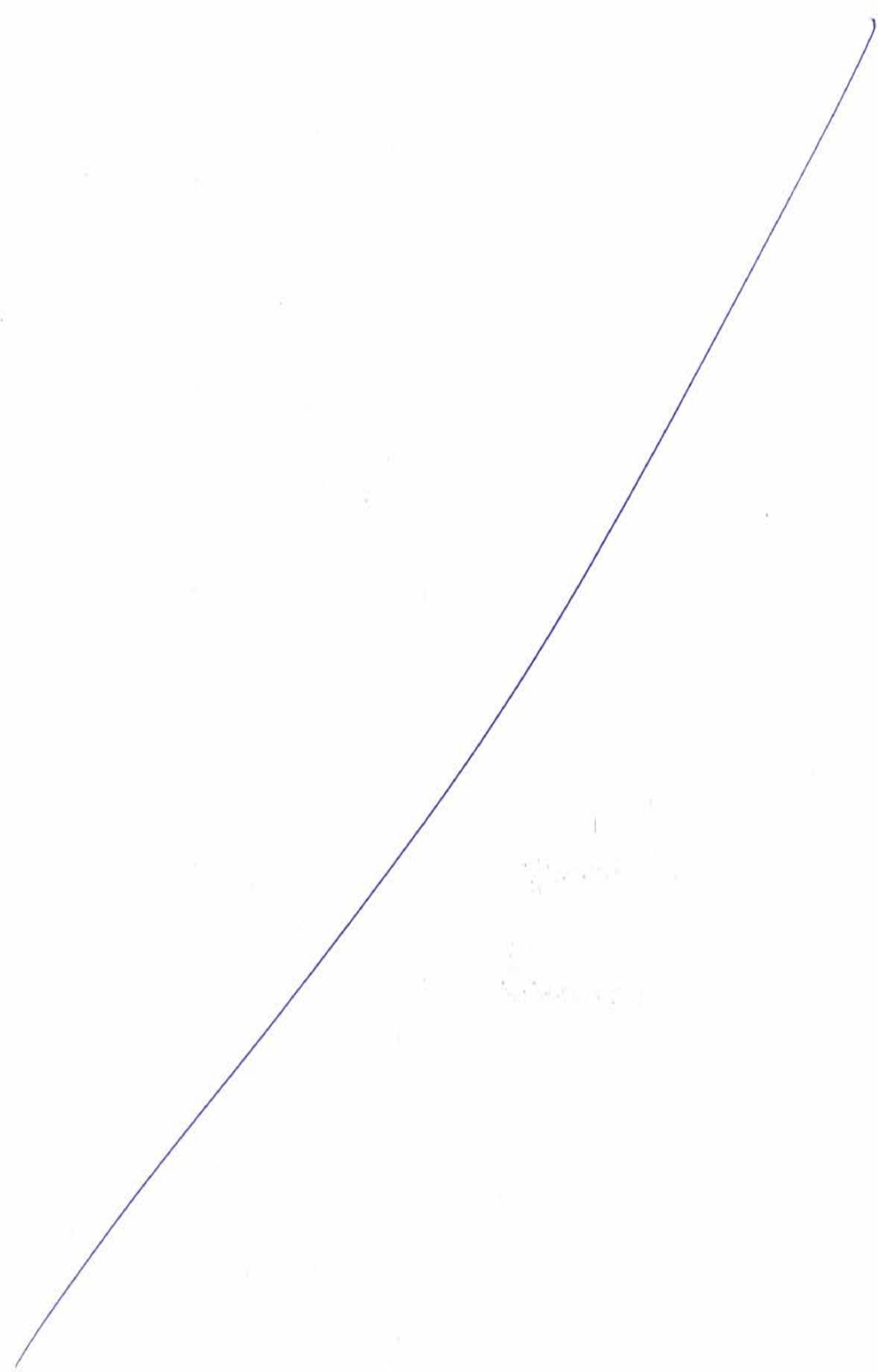
ENABLING SUSTAINABLE SOCIETIES

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CONTENT

Global challenges
require holistic solutions 2
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GLOBAL CHALLENGES REQUIRE HOLISTIC SOLUTIONS

The world today faces far-reaching challenges that affect us all. Complex megatrends such as urbanisation, climate change, and resource scarcity require holistic solutions.

As a global engineering, design and consultancy provider, Ramboll is dedicated to working with clients to meet these challenges by

combining local insights with the multidisciplinary expertise of 13,000 professionals over six continents.

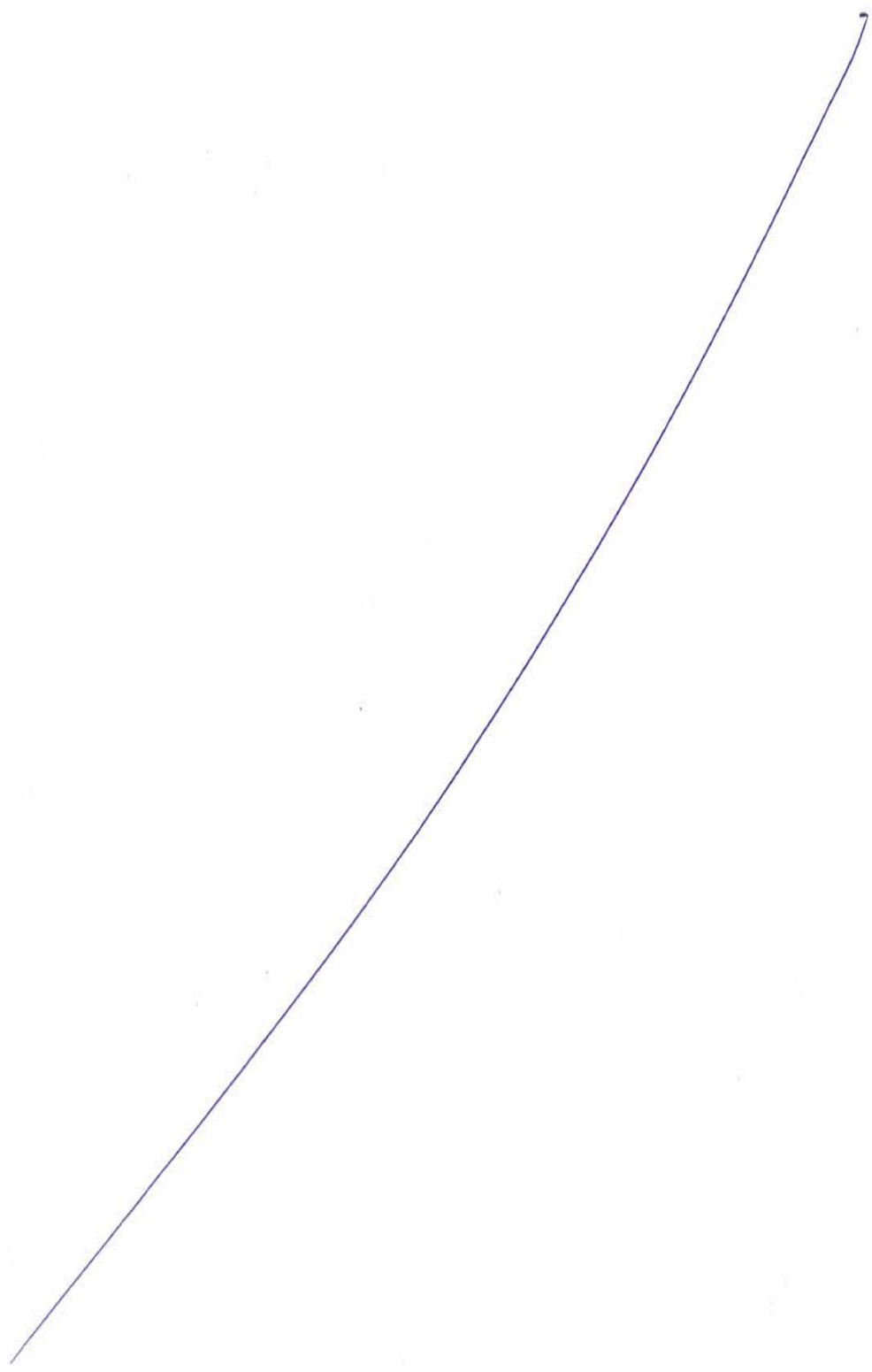
We continually strive to be at the forefront of delivering innovative, inspiring and sustainable solutions that set new standards and maximise value for our clients and society as a whole.

Ramboll today holds a leading position in the Nordic market and serves clients globally through a network of 300 offices across 35 countries.

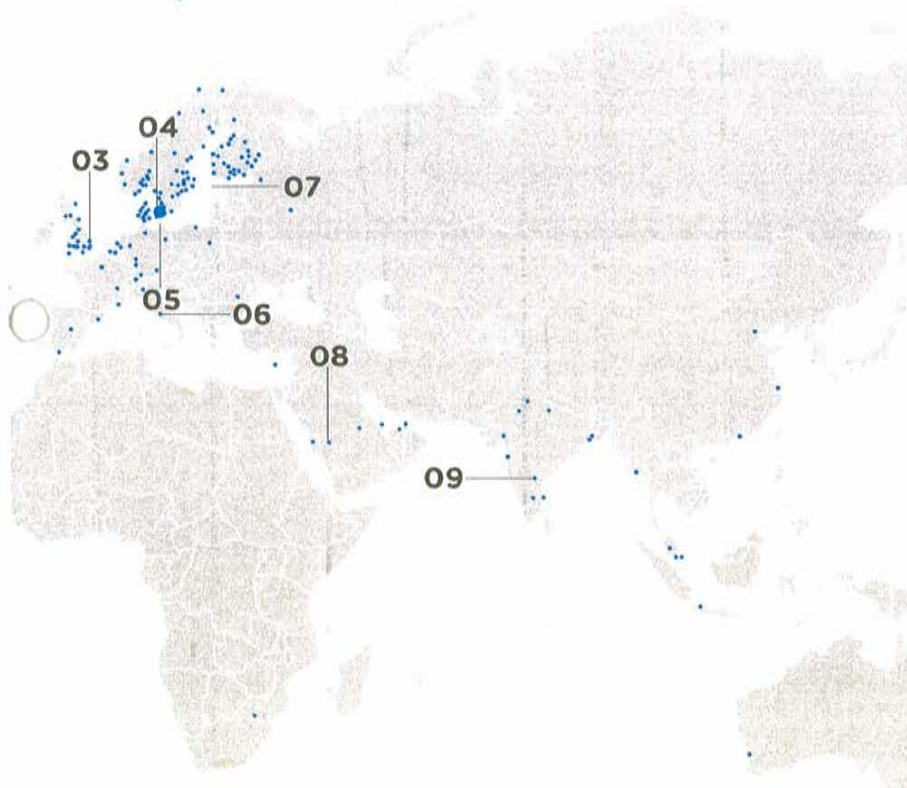
www.ramboll.com



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- Ramboll Head Office
- Ramboll office



WORLD CLASS PROJECTS

- 01 PORT OF SAN DIEGO CLIMATE ACTION PLAN**
Creating and implementing a plan to reduce greenhouse gas emissions across half a dozen targeted areas
- 02 SOCIETY BUILDING**
Helping the Greenlandic government to prioritise investment funds to areas representing the best value for society [pg 6](#)
- 03 TATE MODERN**
Engineering a landmark extension for the world's most visited modern art gallery in central London [pg 10](#)
- 04 AVEDØRE POWER PLANT**
Conversion from coal to highly efficient and low CO₂ biomass facility
- 05 FEHMARNBELT FIXED LINK**
Designing the world's longest immersed road and rail tunnel to connect Scandinavia with Central Europe [pg 11](#)
- 06 VANKE PAVILION**
Applying highly advanced digital tools and techniques to engineer the complex centrepiece for Expo Milan 2015.
- 07 NORD STREAM**
Environmental assessment of the world's longest subsea pipeline - providing gas to 20 million households
- 08 JEDDAH MASTERPLAN**
Paving the way for improved social, environmental and living conditions in Saudi Arabia's second largest city
- 09 TELECOM TOWERS FOR 4G**
Supporting the roll-out of 4G in India with our partners by providing 7,700 telecom towers to Reliance Jio

RAMBOLL AT A GLANCE

Markets

- Buildings
- Transport
- Planning & Urban Design
- Water
- Environment & Health
- Energy
- Oil & Gas
- Management Consulting

Key facts

- 13,000 professionals
- 300 offices
- 35 countries
- EUR 1.4 billion turnover



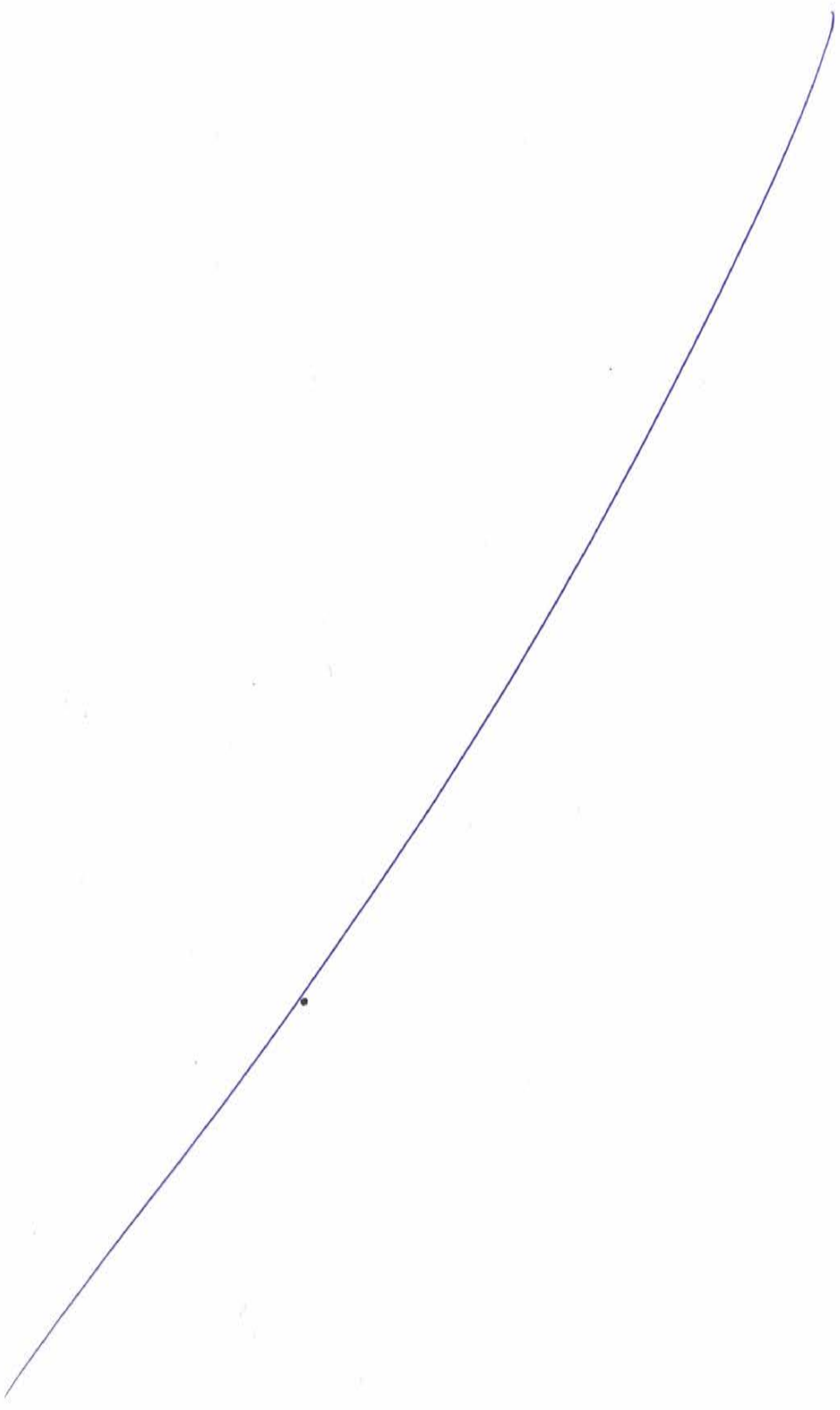
Front cover, development
Nordhavn, Scandinavia's largest urban development (Illustration: Metroselskabet, By & Havn, COBE, Polyform, Sleth and Ramboll) [pg 16](#)



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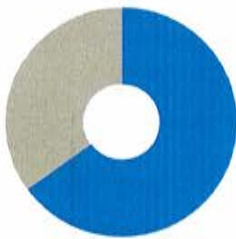
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CREATING CLIENT VALUE

Our clients are at the centre of everything we do. By placing our clients' needs first, we are fully dedicated to creating added value and delivering the very best solutions.

We provide guidance and support at every stage of the value chain, from expert advice during early stage strategy development to managing the entire project. Our aim is to delight our clients by meeting or exceeding their expectations in terms of value, quality and responsiveness. To support this, Ramboll's Project Excellence programme is devoted to maximising project benefits for clients and ensuring consistent service.



SERVICING PRIVATE AND PUBLIC SECTOR CLIENTS

- Private sector revenue (2016): 65%
- Public sector revenue (2016): 35%

CLIENT PERSPECTIVES

“Ramboll delivers proactive people who take responsibility and make a difference”

Bo L. Seligmann, Senior Manager, Novo Nordisk China

“Competent staff, good insights, good dialogue”

Jan Flyvholm, Production Superintendent, Maersk Drilling

“High level competencies, delivered on time”

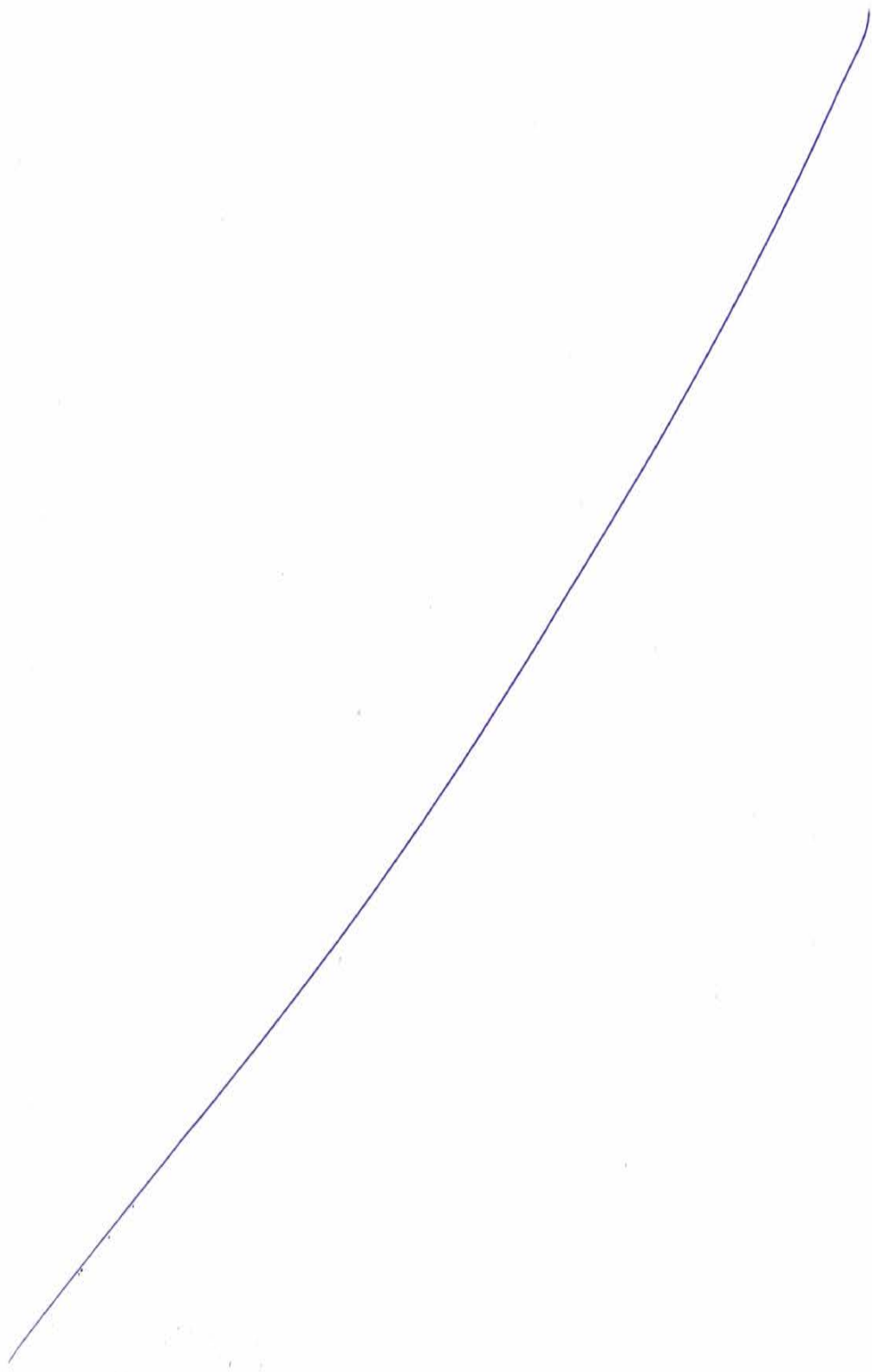
Lars Nilsson, E.ON

SOME OF OUR CLIENTS

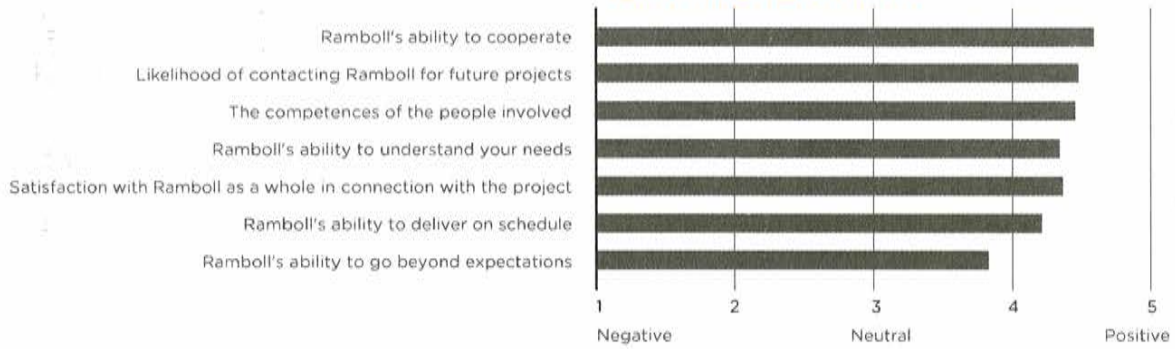


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CLIENT SATISFACTION SURVEY



Results based on 3,810 customer satisfaction survey responses from the period January - December 2016.

4.32

Ramboll overall client satisfaction score in 2016 on a scale of 1 to 5

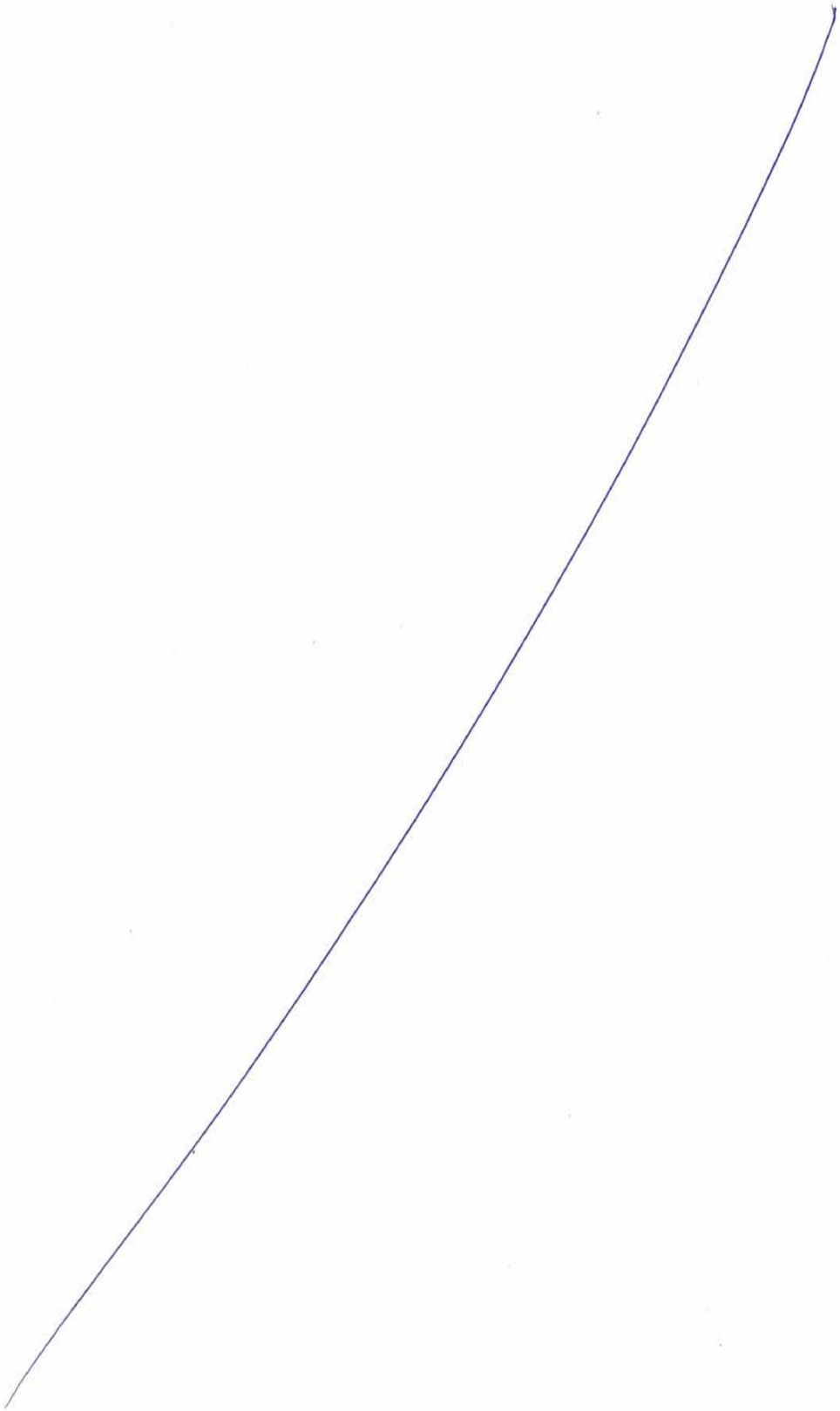


NURTURING SUCCESSFUL CLIENT RELATIONSHIPS

By drawing on our global knowledge base and local experience, we have a complete understanding of the markets in which our clients operate. We have worked with each of our top ten clients for an average of 50 years and nurture successful relationships based on mutual trust and consistent results. Our top priorities are to continuously enhance our reputation for providing the highest level engineering, design and consultancy services, and strengthen relationships with our clients.



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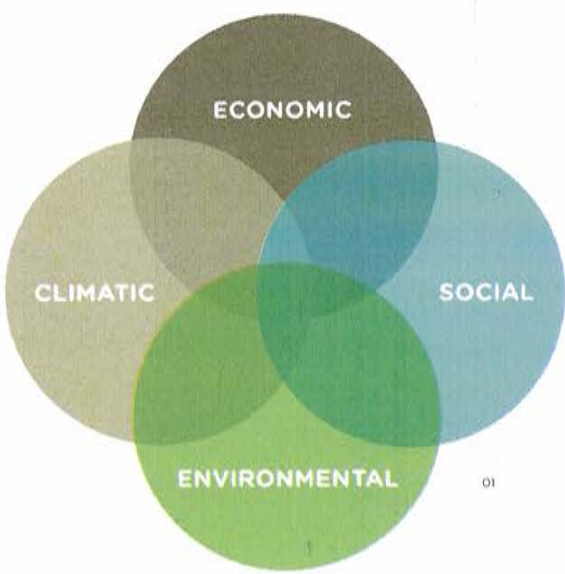
1975

"Every day we find innovative solutions to the challenges posed by the global trends of urbanisation, climate change, resource scarcity and globalisation."

Jens-Peter Saul, Ramboll Group CEO



CREATING A WORLD OF DIFFERENCE



ENABLING SUSTAINABLE SOCIETIES

Ramboll is committed to meeting today's demands without jeopardising the needs of future generations. We achieve this through a holistic and balanced approach that combines specialist knowledge of management and strategy with world class technical and scientific competences. This enables us to set the public agenda on issues affecting societal development and provide expert consultancy services to ensure long term value to both our clients and society as a whole.

www.ramboll.com/sustainablesociety

01 RAMBOLL'S SUSTAINABILITY MODEL

Ramboll understands sustainability as balancing economic, social, environmental and climatic factors.

02. SOCIETY-BUILDING, GREENLAND

To guide the Greenlandic government in prioritising the country's limited investment funds to areas that represent the best value for society, Ramboll is performing socio-economic impact assessments and cost-benefit analyses on the expansion of the container harbour in Nuuk and increasing capacity in the education sector.

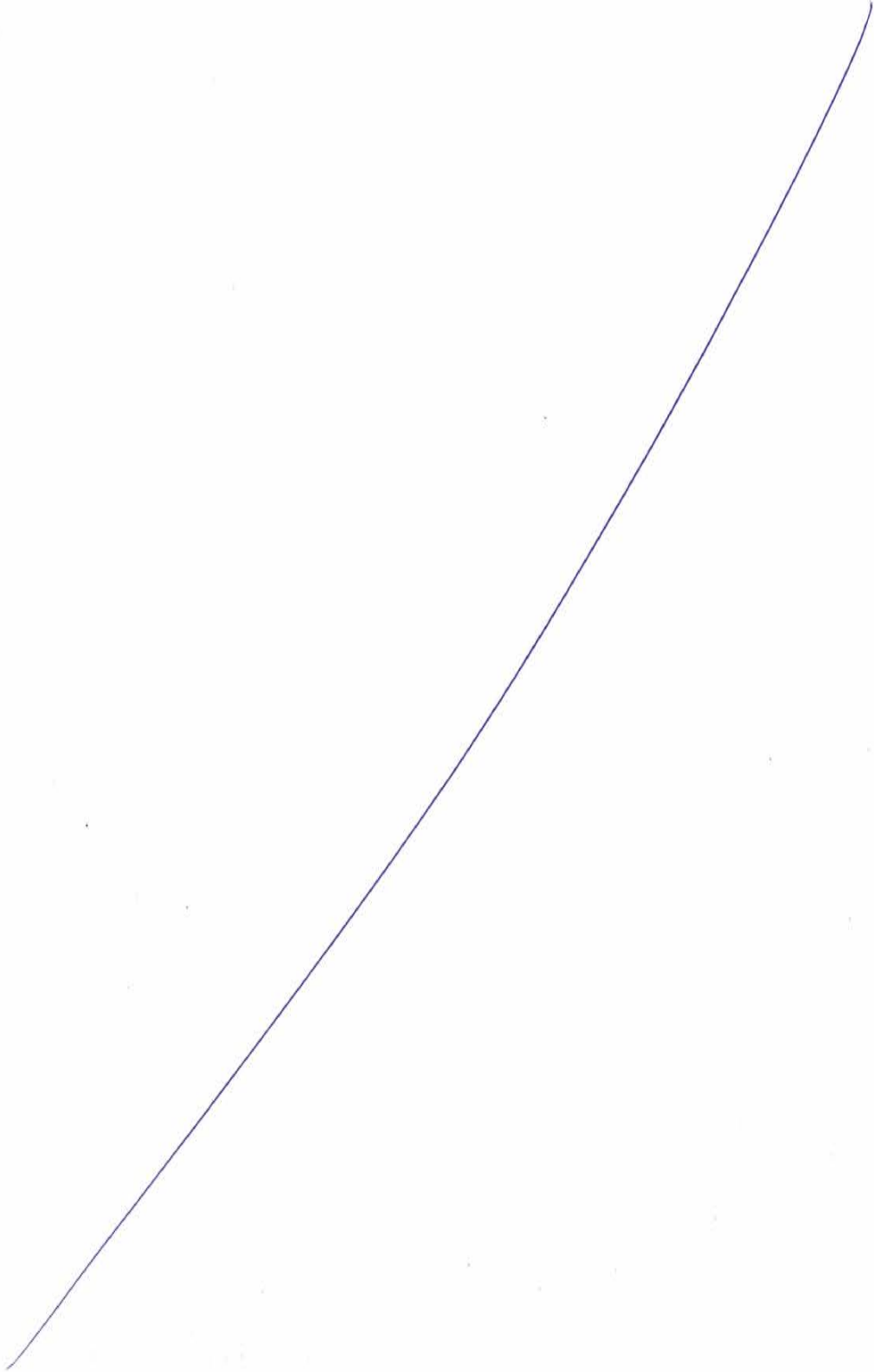
03 COPENHAGEN LIGHT RAIL, DENMARK

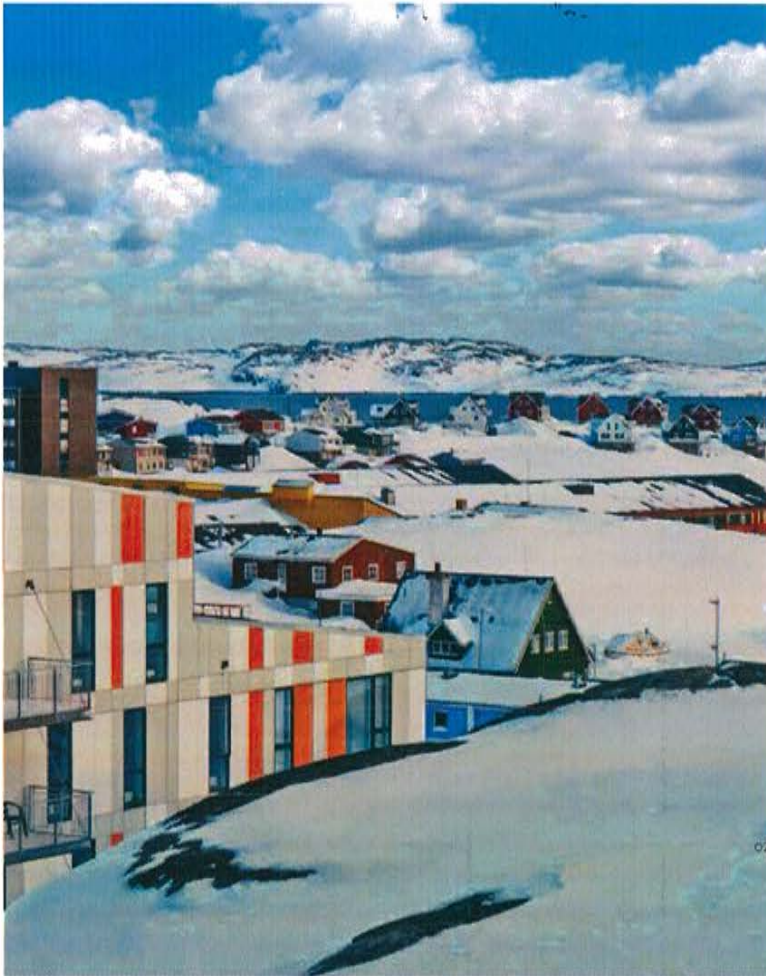
The new light rail link in the Greater Copenhagen area will not only provide better options for commuters and reduce carbon emissions, but also be a powerful enabler for urban growth in the communities that it connects. Ramboll is providing project management and rail engineering services on the project. Image: BIG Bjarke Ingels Group.



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RESPONSIBLE ARCTIC DEVELOPMENT

Falling oil and mineral commodity prices have slowed economic expansion in the Arctic. However, Arctic communities remain strongly focused on the best approaches for long-term sustainable development. Ramboll is the leading consultancy in the Arctic with over 30 years' experience designing and implementing both public and private sector projects, as well as 450 experts located across 17 offices in the region.

Working with clients on society-building, infrastructure, buildings, energy, water, waste, mining and oil & gas initiatives, Ramboll brings together Arctic experts in engineering, scientific and management services with proven experience in delivering environmentally and socially responsible solutions.

www.ramboll.com/resource-scarcity



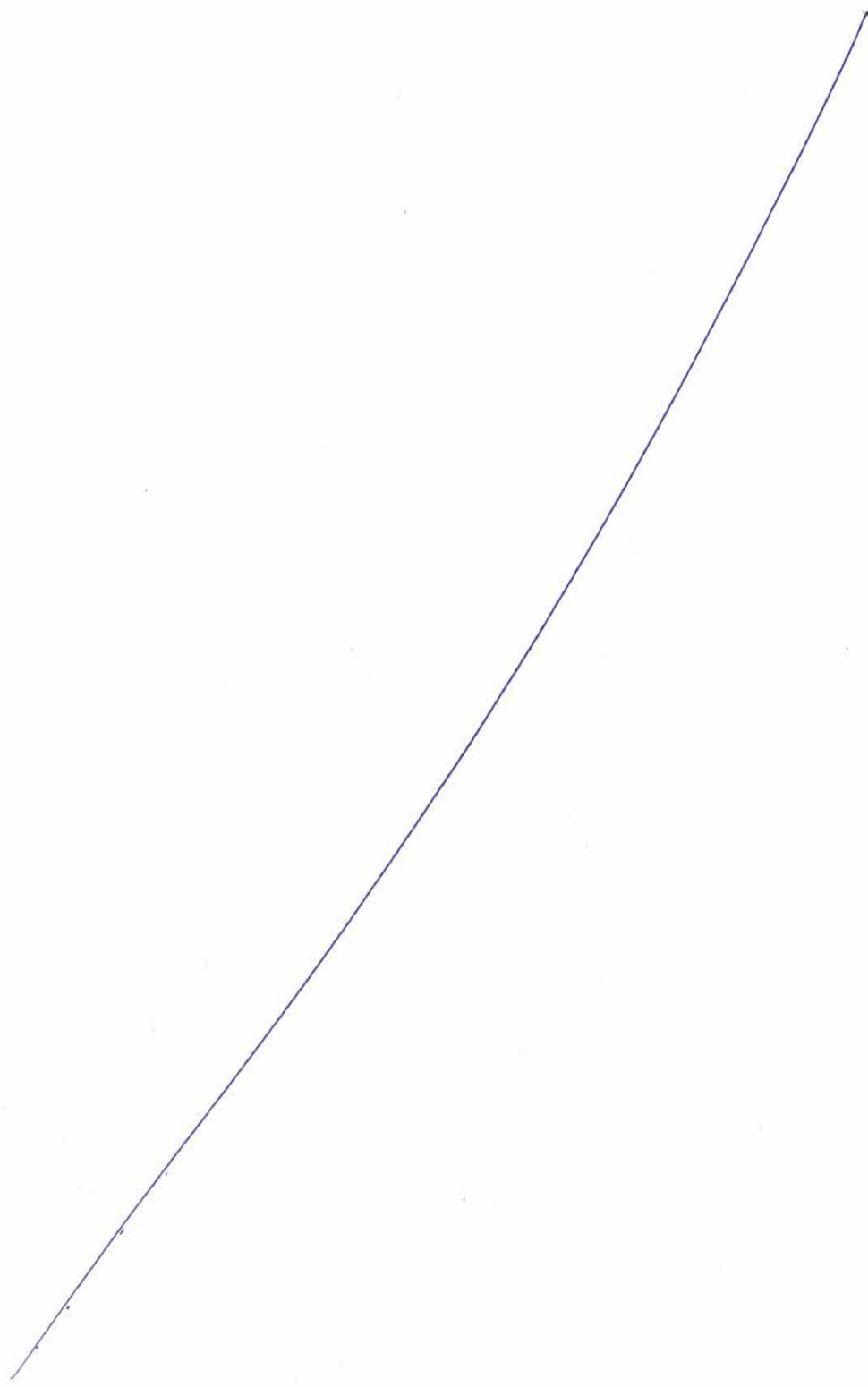
PROMOTING URBAN GREEN GROWTH

According to the World Bank, two thirds of the world's population will be city dwellers by 2050 and the global middle class is expected to grow by three billion people over the next two decades. This has led to a focus on creating liveable cityscapes in which people and businesses can thrive, communities can grow, and the environment can flourish. Ramboll has played a central role in providing strategic guidance and developing the building, transport, energy and water infrastructure for the Nordic capitals, which are internationally recognised for sustainable development. Today we work with cities worldwide to create attractive and well-planned urban environments that enable green growth and improved quality of life.

www.ramboll.com/cities



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MARKETS

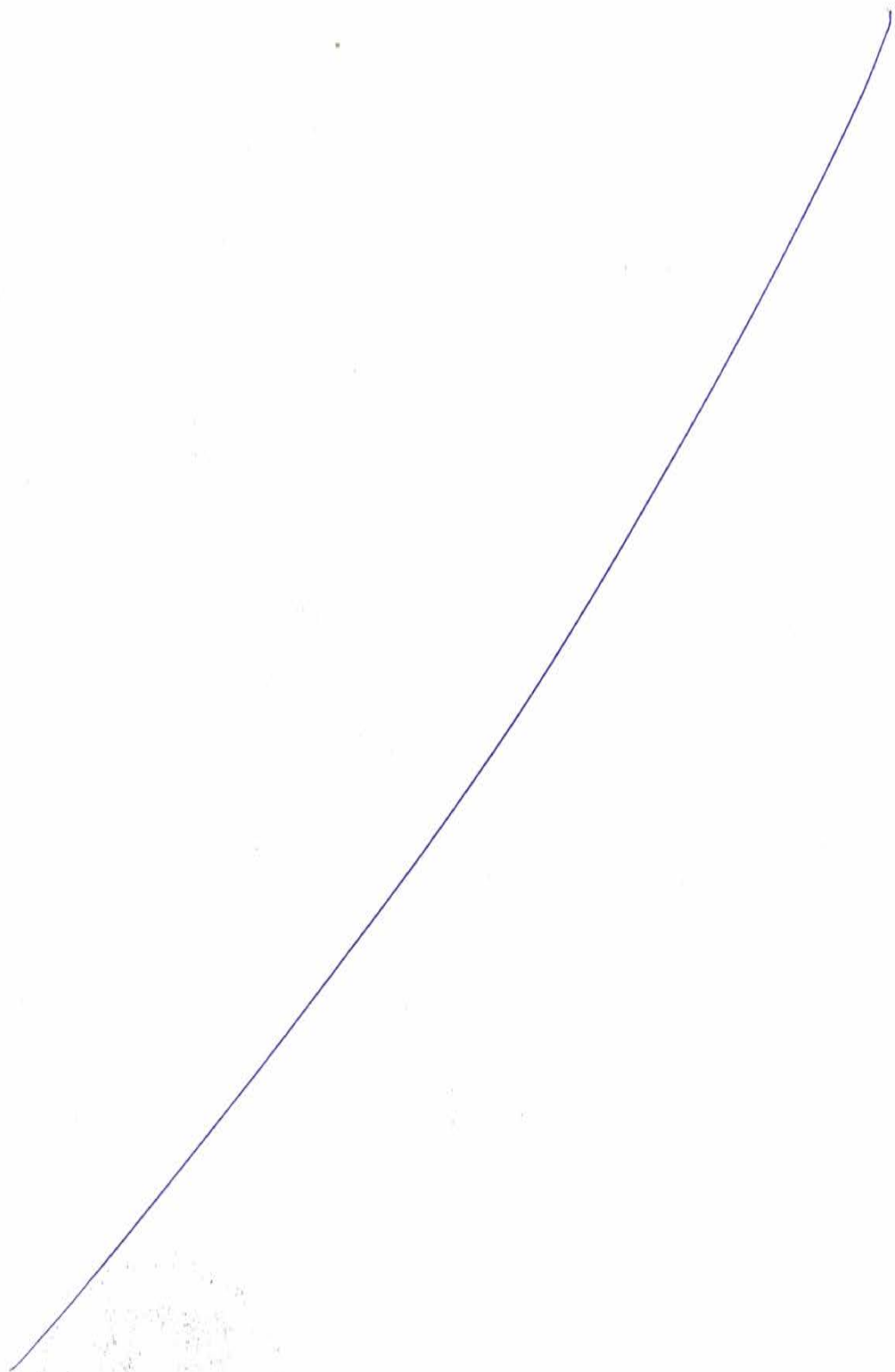
BUILDINGS
TRANSPORT
PLANNING & URBAN DESIGN
WATER
ENVIRONMENT & HEALTH
ENERGY
OIL & GAS
MANAGEMENT CONSULTING

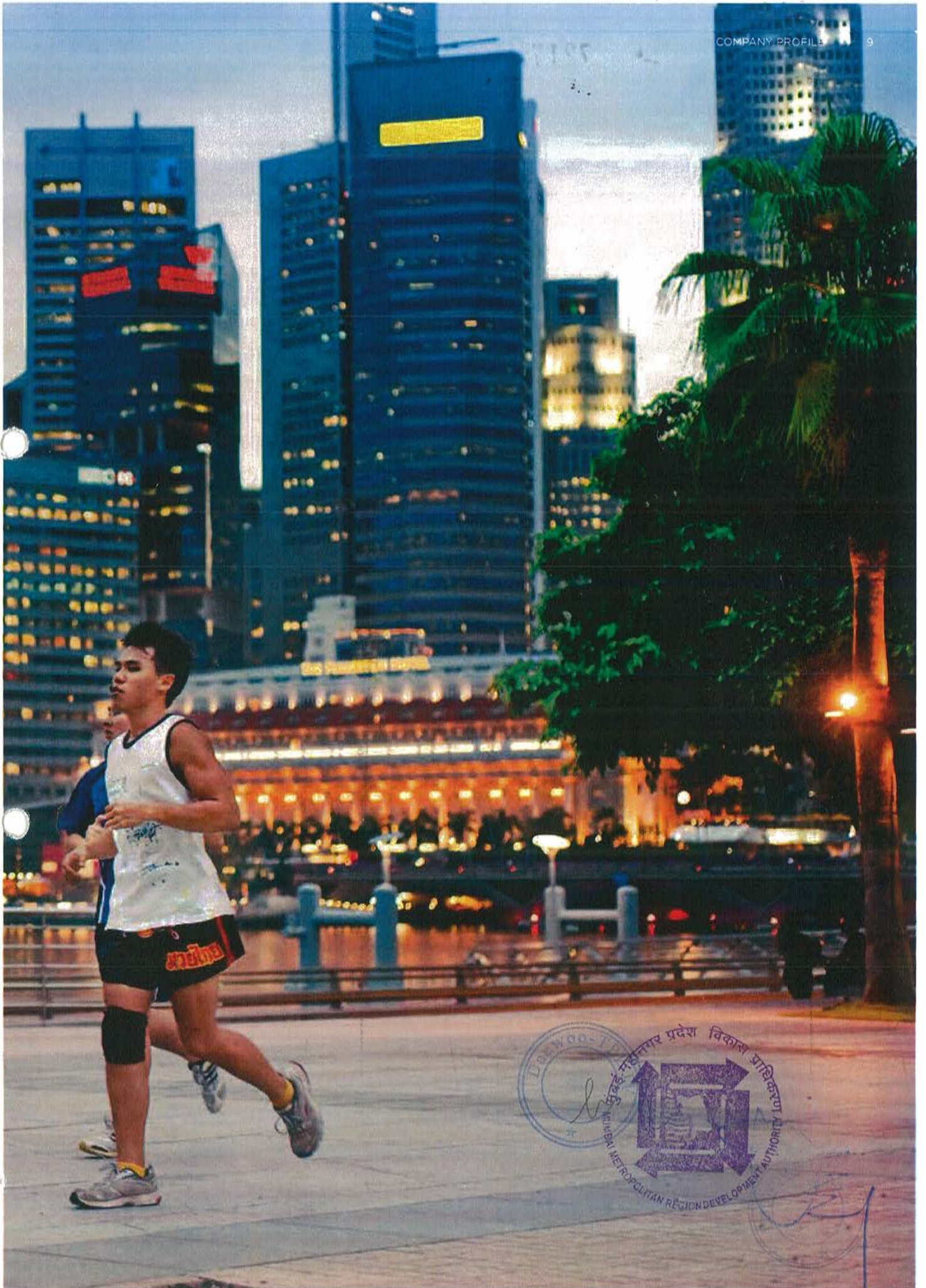
By providing an integrated multidisciplinary service across eight markets, Ramboll offers world class technical and scientific capabilities, creative thinking, and service excellence. This ensures that clients receive fully optimised solutions and maximum value on investments.



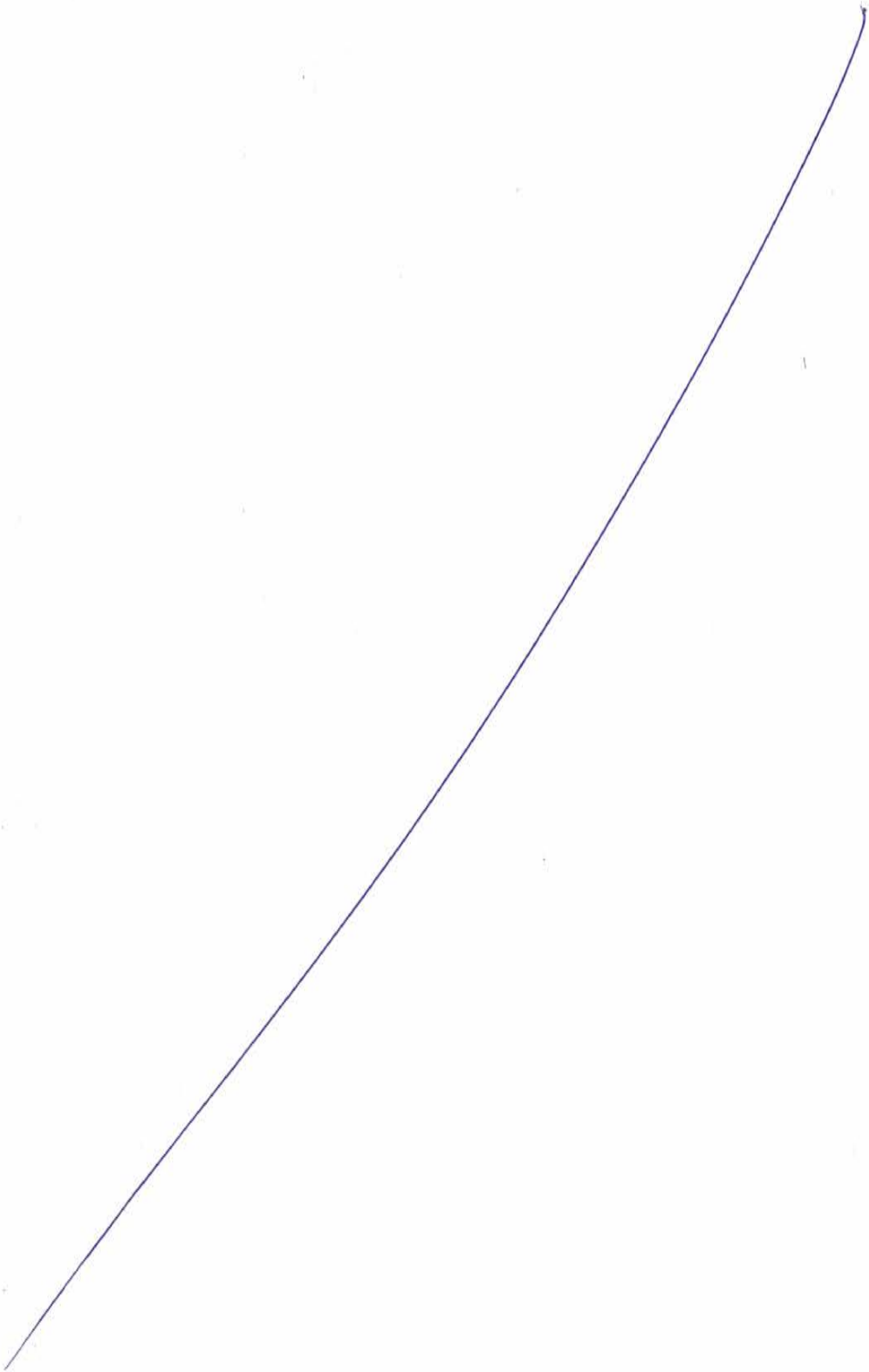
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BUILDINGS

As a top three buildings consultancy in Europe, we have designed inspiring, efficient, and award-winning buildings for several decades and we are the preferred partner for some of the world's leading architects and developers. Our design philosophy is to always consider the human experience and we challenge assumptions to create the most practical and economic designs.

Revenue (2016)

EUR 443 million

Number of specialists

3,849

Geographical spread

100 offices in 10 countries

Signature sectors

Hospitals, arts & culture, airports, hotels & leisure, pharma & labs, sports

Key clients

Architects, contractors, developers, municipalities, hospitals and universities



01



02

10 MILLION M²

Area of buildings Ramboll designs for 10,000 projects annually

01. TATE MODERN, UK

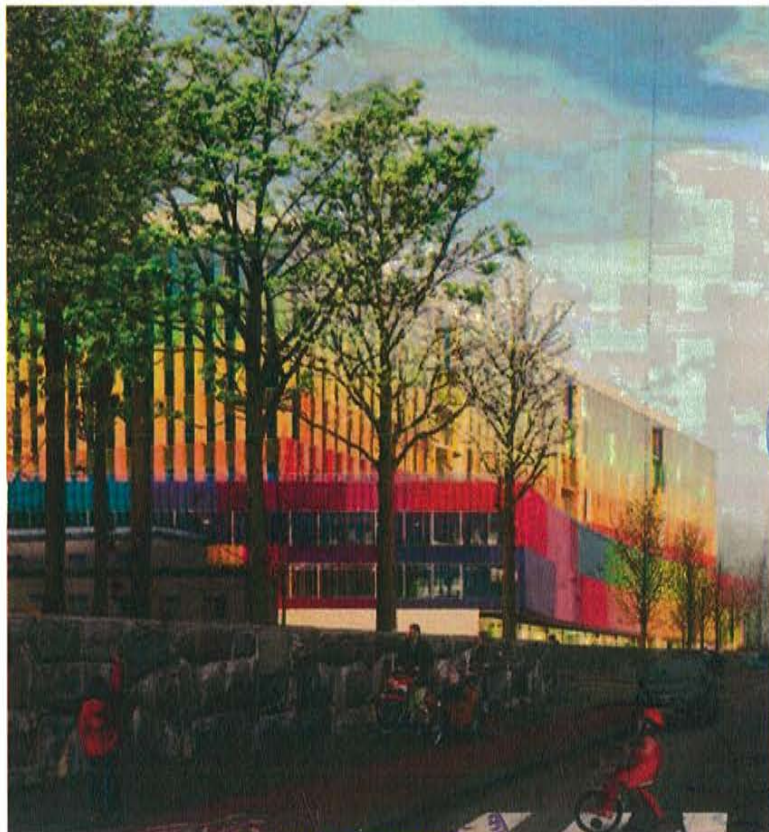
This landmark extension will increase Tate Modern's display area by 60% to cater for the increasing number of visitors. Ramboll developed the engineering design to accommodate the building's structural specifications and realise the architect's visions. Image: Hayes Davidson and Herzog de Meuron.

02. PANUM - UNIVERSITY EXTENSION, DENMARK

The 42,000 m² landmark extension to Copenhagen University's Panum complex will serve as a modern, vibrant, and flexible centre for science and education accommodating world-leading specialists in cancer, ageing, and lifestyle-related diseases. Ramboll is providing all engineering services. Image: C. F. Møller Arkitekter and SLA Urbanity

03. UUSI LASTENSIRAALA CHILDREN'S HOSPITAL, FINLAND

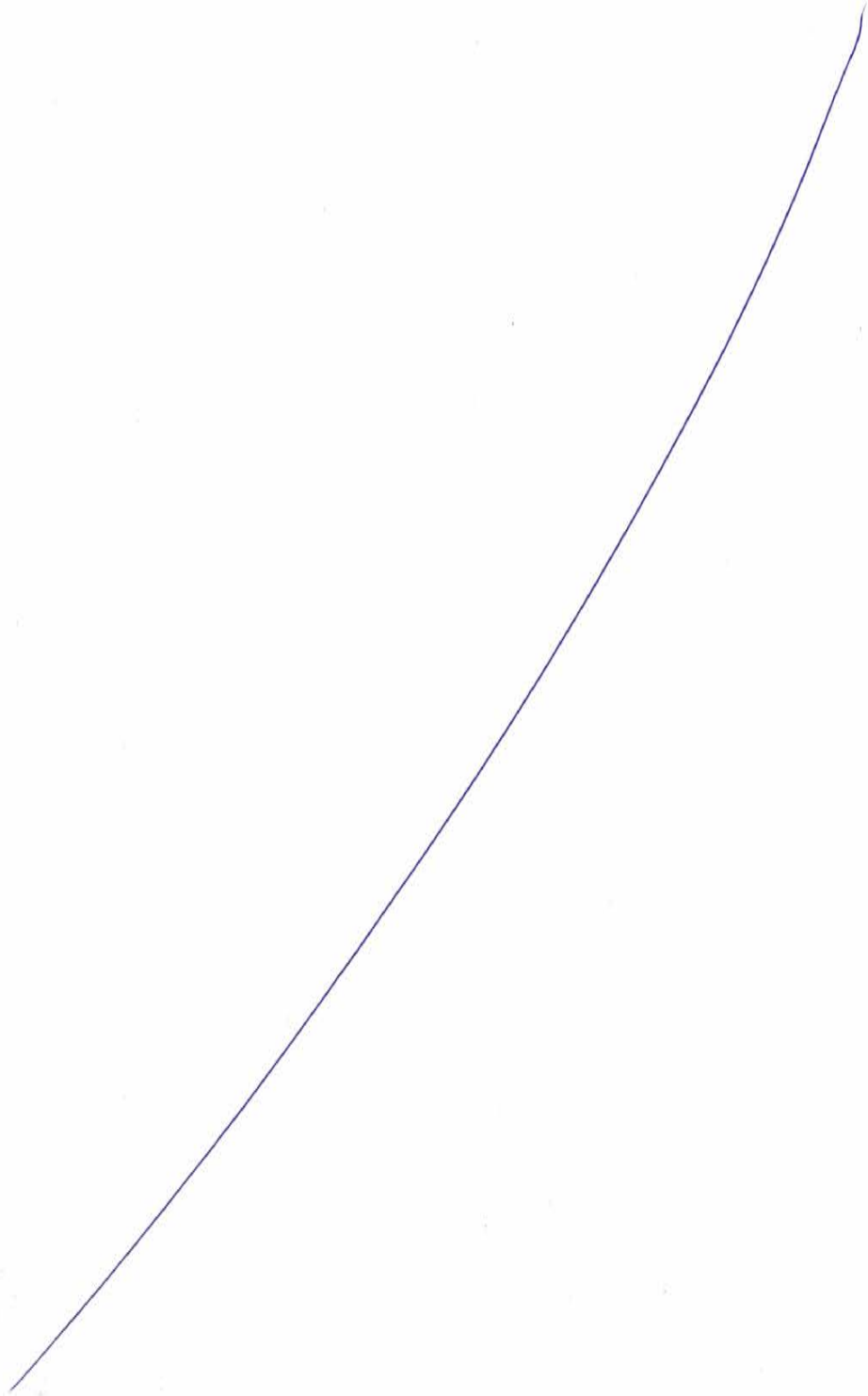
This ambitious new 48,000 m² children's hospital in Helsinki has been planned with special attention to youngsters' perspectives and needs. Ramboll is structural and geotechnical engineer for the EUR 160 million project, which emphasises Building Information Modeling (BIM), life cycle thinking, and a healthy indoor environment. Image: SARC Architects



03



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**Revenue (2016)**

EUR 319 million

Number of specialists

2,810

Key clients

Public authorities at the national, regional and municipal levels, contractors, investors, transport operators, and other private companies.

World class services

Aviation, bridge engineering, ports & marine structures, rail engineering, tunnel engineering, infrastructure asset management

2,810

number of Ramboll
transport specialists
worldwide



02



03

01. FEHMARN BELT TUNNEL LINK, DENMARK/GERMANY

The world's longest road and rail tunnel beneath the Fehmarn Strait will realise the vision of a permanent, close and direct link between Scandinavia and Central Europe. Ramboll's design solution challenges existing tunnel building standards and will significantly reduce travel times whilst creating new opportunities for freight transport. Image: Femern A/S

02. DOHA METRO, QATAR

The Green Line forms part of Doha's new metro system, which is a key delivery for the 2022 FIFA World Cup. Ramboll is the Design Verification Engineer for the project, which brings together experts from the Middle East, the UK and Denmark, and draws on our competences in geotechnics, temporary structures, tunnels, mechanical, electrical and plumbing (MEP) and structures. Image: Qatar Railways Company

03. GATEWAY ASIA 2030, PHILIPPINES

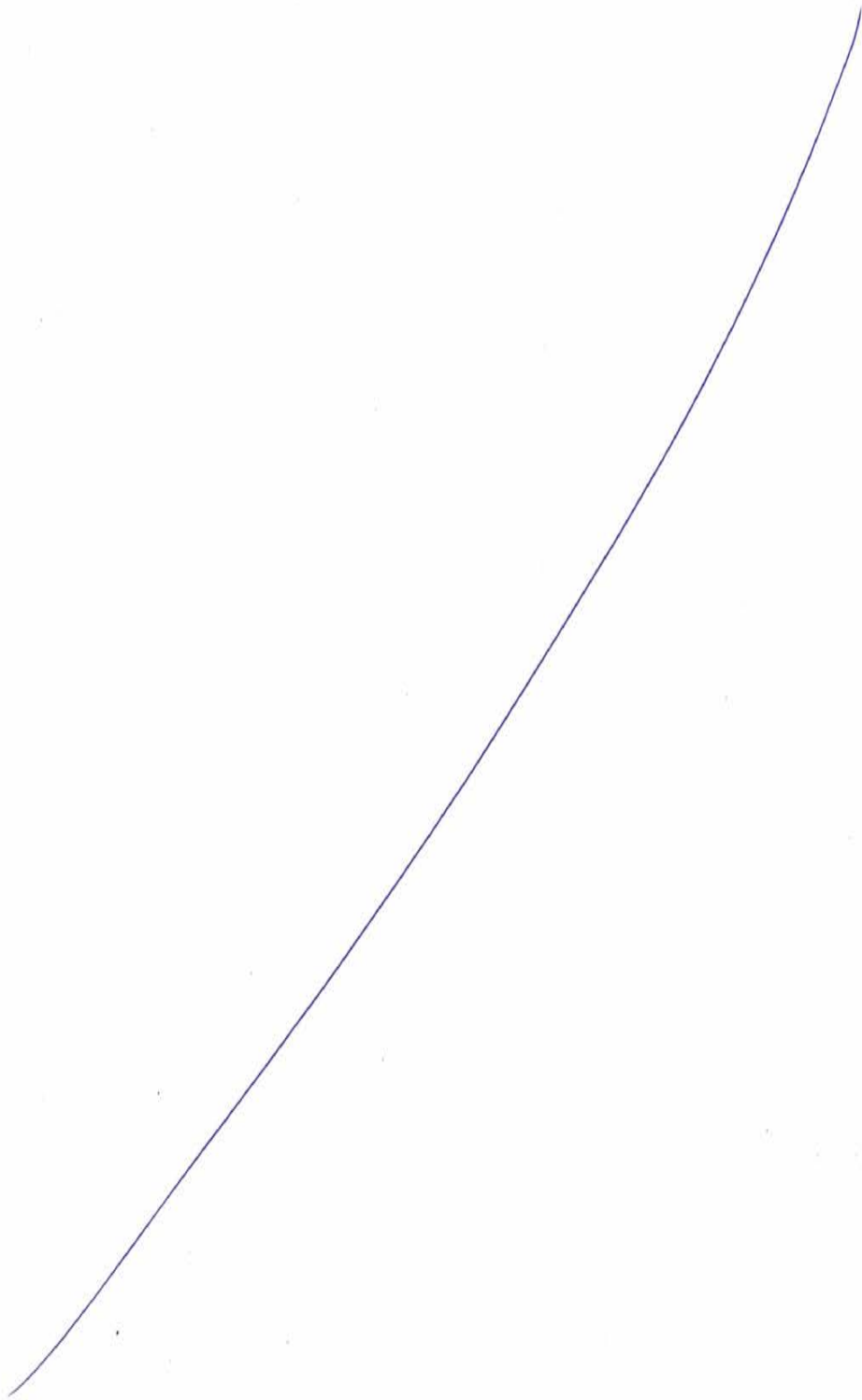
Ramboll is developing a large-scale transport plan for Manila Bay that is focused on promoting growth and solving congestion issues in the world's most densely populated city. The plan, which has been initiated by private developer, All-Asia Resources and Reclamation Corporation, will see the creation of interconnected air and seaport facilities with a rapid metro link to central Manila.

TRANSPORT

Mobility fuels economic and social development and with 53% of the world's population now living in cities, efficient transport systems are an essential component of urban liveability. As the 13th largest transportation consultancy globally, we work on some of the world's biggest and most cutting edge infrastructure projects. We combine advanced technical competences with resource-minimising design to identify the best possible solution at the lowest cost.



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11

ENVIRONMENT & HEALTH

A leading global environmental and health consultancy, we maintain a science-first approach to helping clients resolve their most challenging environmental, health and social issues. Our culture of excellence, innovation and client service has earned us the respect and loyalty of private and public clients around the world.

TOP 10

Ramboll's global ranking in environmental engineering and design (ENR 2015)

Revenue (2016)
EUR 331 million

Number of specialists
2,191

Geographical spread
129 offices in 27 countries

World class services
Air Quality; Compliance, Strategy & Transaction Services; Ecological Services; Health Sciences; Impact Assessment; Laboratory Services; Resource & Waste Management; Site Solutions



"The nature of our work frequently positions us at the intersection of science, business and policy - fertile ground for developing groundbreaking solutions."

Tom Vetrano, Managing Director, Ramboll Environment & Health

01. ADDRESSING AIR QUALITY, HONG KONG

We developed a comprehensive atmospheric modeling system for the Hong Kong Environmental Protection Department to analyse emissions, meteorological and air quality data and to forecast regional air quality.

02. HANNUKAINEN MINE, FINLAND

To facilitate production of iron concentrate, gold and copper, Ramboll is conducting environmental impact assessment reporting and land use planning for the whole life cycle of the mine.

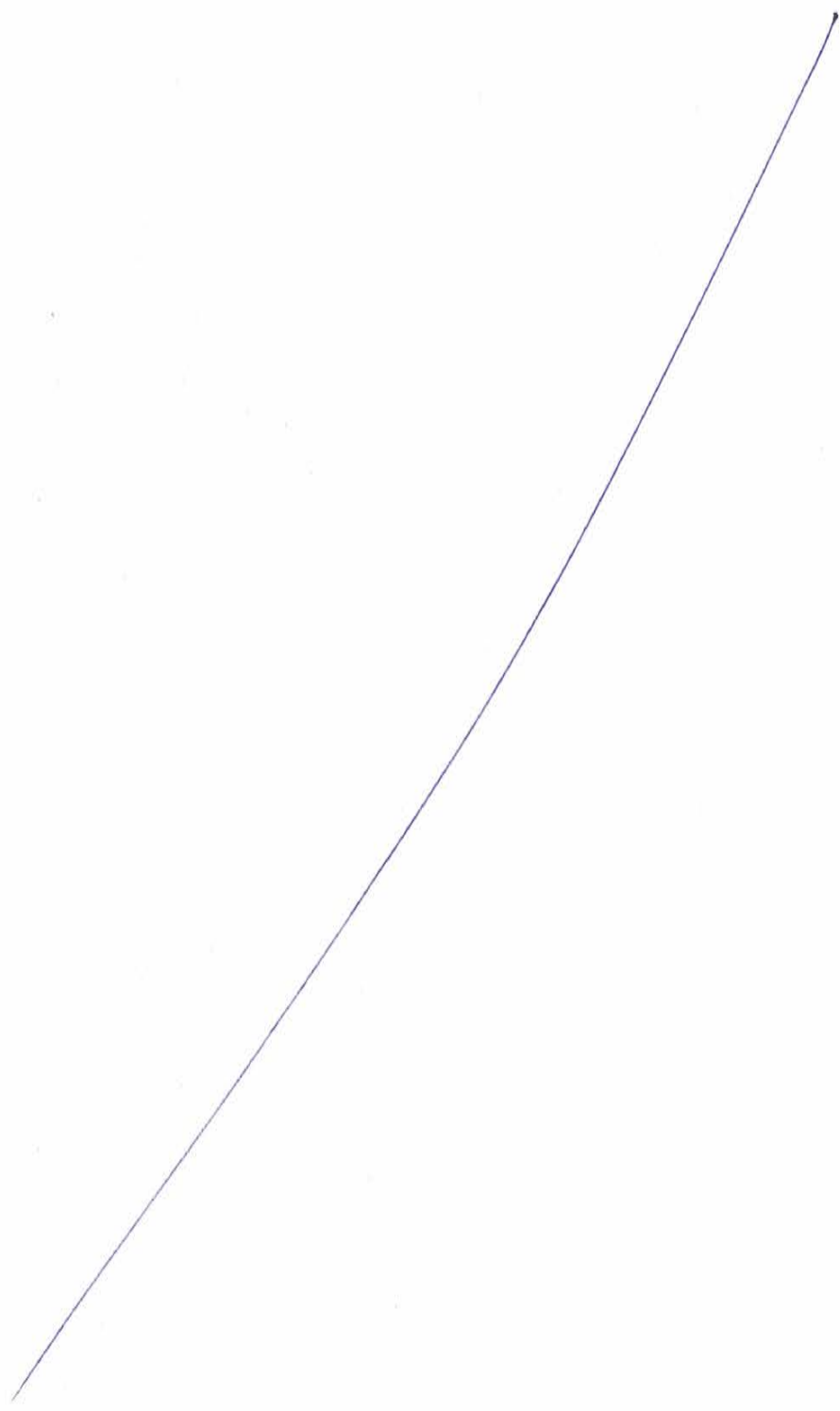
03. SCIENCE BENEFITS HOMES, USA

Our scientists discovered the gases and chemical reactions causing odours and corrosive effects on copper and silver from Chinese drywall used in residential buildings, enabling the gases to be eliminated and repairs to be made to over 2500 homes.



1068 25 1949

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WATER

Ramboll experts address global water and climate challenges by working across the entire water cycle from water resources and supply, processing and treatment, to sewerage and discharge. We draw on proven multidisciplinary expertise to create innovative, sustainable and liveable solutions for our clients and society.



Revenue (2016)

EUR 79 million

Number of specialists

702

Geographical spread

40 offices in 6 countries

Key clients

Utilities, Municipalities, industry, and private companies

42

Number of water-related awards won by Ramboll in the last five years



"From blue-green infrastructure to wastewater treatment we assist government agencies and large companies with their most challenging water management issues."

Hanne Christensen, Managing Director, Ramboll Water



01. THE BLUE-GREEN GARDEN CITY, DENMARK

For Denmark's largest current climate adaption project in the town of Kokkedal, Ramboll is combining flood prevention measures on a local waterway with the creation of attractive recreational areas to promote social cohesion, increased property prices, and improved well-being for the local community. Image: Schønher, Ramboll, BIG

02. THE FUTURE OF STOCKHOLM'S WASTEWATER TREATMENT, SWEDEN

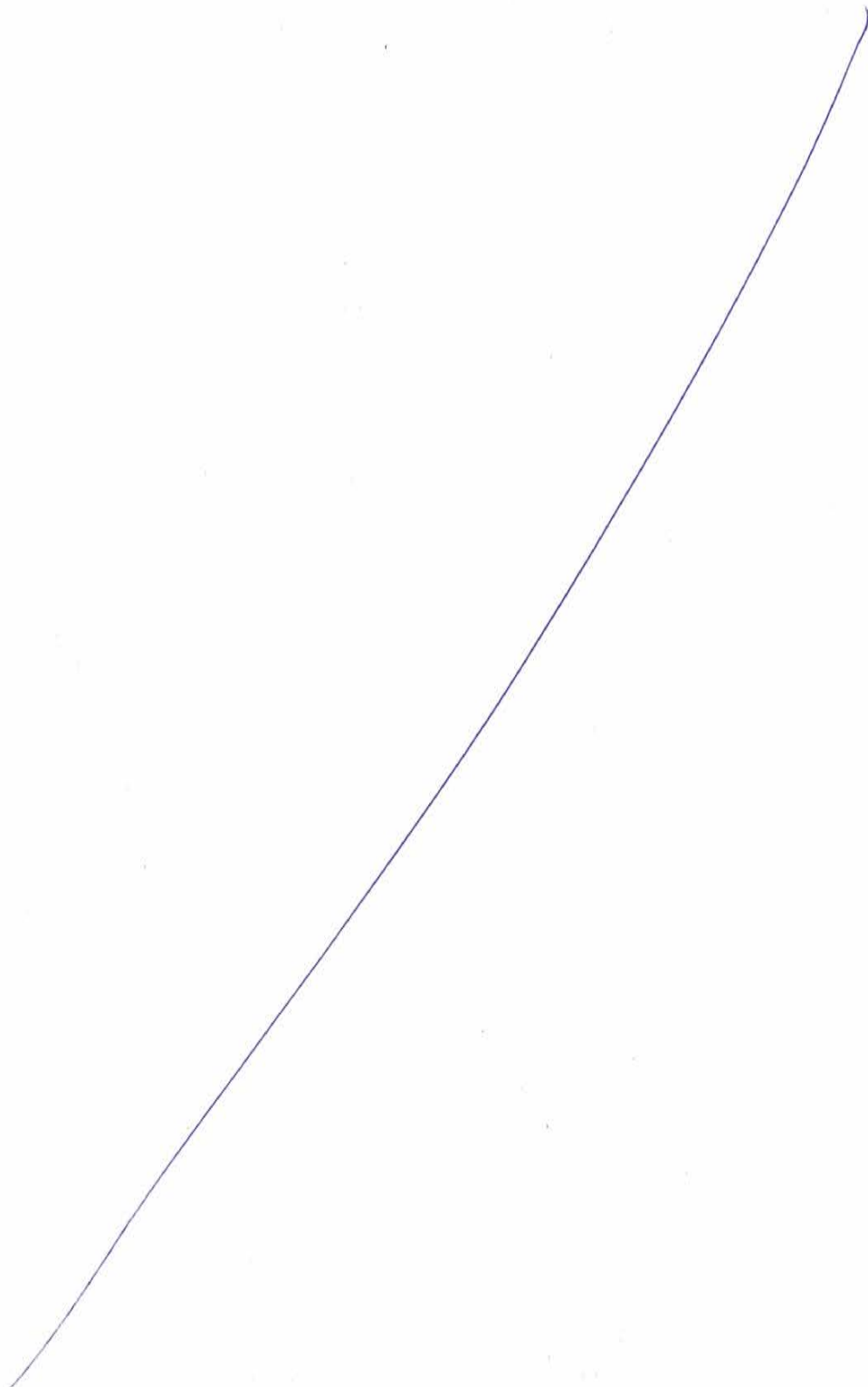
To accommodate annual population growth of 20,000 in Sweden's capital, expansion of the wastewater treatment infrastructure is required, which will also create much needed space for new homes. Ramboll is responsible for the preliminary design and design management of the new facilities.

03. ARAD COUNTY WATER PLAN, ROMANIA

Ramboll assisted Arad County in identifying and prioritising investments in water quality improvements such as upgrading sewerage systems and improving supply stability to ensure compliance with the European Water Framework Directive. 98% of the region's 250,000 inhabitants now have clean drinking water compared to three quarters five years ago.



7225



ENERGY

Security of supplies, climate change, energy efficiency and resource scarcity are top priorities on the global agenda. Ramboll is at the forefront of addressing these issues with world-leading competencies in offshore wind, waste-to-energy, thermal power and district energy. Ramboll has worked on waste-to-energy projects in 40 countries and 200 district energy systems worldwide. We have also designed 90 major power plants and 65% of the world's offshore wind turbine foundations.

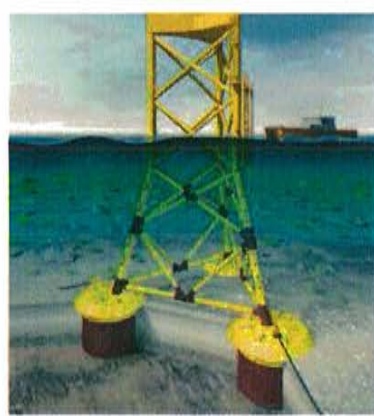
Revenue (2016)
EUR 116 million

Number of specialists
809

Geographical spread
25 offices in Denmark, Sweden, Norway, UK, Germany, Poland, Switzerland and Canada

90

Number of major power plants designed by Ramboll



01



02

01. BORKUM RIFFGRUND 1 OFFSHORE WIND FARM, GERMANY

As wind farms move to deeper water with larger turbines, bottom-mounted foundation concepts are required in place of traditional monopiles. Ramboll has performed the innovative structural design for the first installed full-scale jacket foundation and suction buckets: a technology used for offshore oil and gas platform foundations with several economic and environmental advantages.

02. COPENHILL, DENMARK

Copenhill will be one of the most efficient waste-to-energy facilities in the world. Ramboll has assisted in the planning and implementation of the EUR 469 million facility, which will feature recreational facilities on the roof. Image: Amager Ressourcecenter

03. DISTRICT COOLING IN MAKKAH, KINGDOM OF SAUDI ARABIA

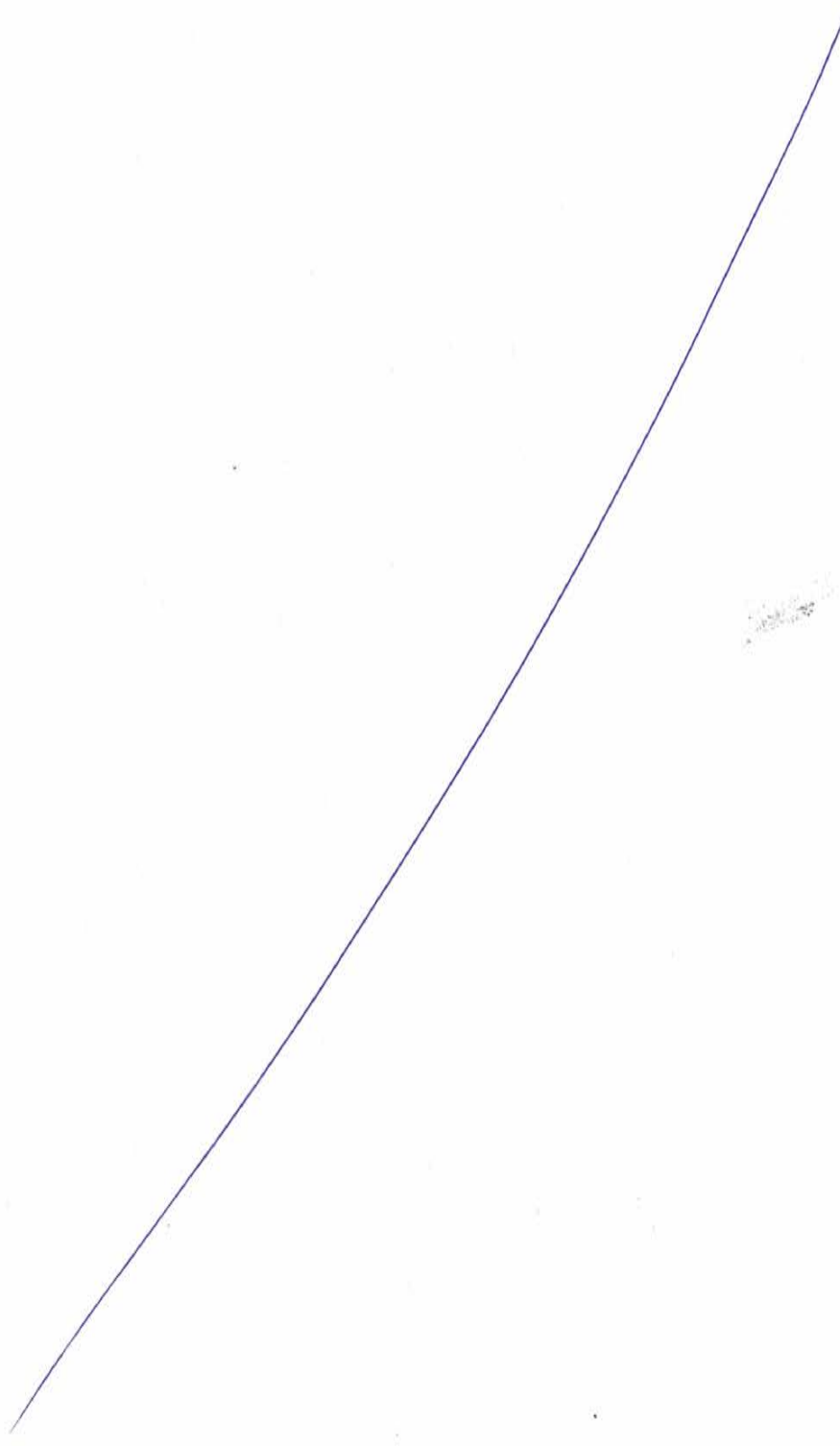
The King Abdul Aziz Road Project includes two roads, a metro line, a grand mosque and over 200 plots for houses along a new pedestrian pathway running from the city outskirts to the Grand Holy Mosque. The district cooling system that will ensure a comfortable journey through Makkah for the millions of pilgrims during Hajj will be one of the largest in the world. Ramboll is carrying out preliminary studies, conceptual design and procurement of the system.



03



7227





Revenue (2016)

EUR 66 million

Number of specialists

599

Number of offices

Nine offices in Denmark, Norway, UK, Qatar, UAE, India and USA

4

Number of decades' experience Ramboll has in the oil and gas industry



02



03

01. POLARLED PIPELINE, NORWEGIAN NORTH SEA

This 481 km offshore pipeline sets a world record for the deep water installation of a 36" pipeline and will connect new fields in the Norwegian Sea with existing infrastructure to secure future energy supply to Europe. Drawing on extensive knowledge of subsea pipeline design and state-of-the-art analytical software, Ramboll specialists are delivering an optimised, innovative, and cost effective solution.

02. CULZEAN FIELD WELLHEAD JACKET DETAILED DESIGN, BRITISH NORTH SEA

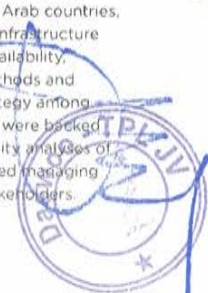
The newly discovered Culzean oil field has potential to meet around 5% of UK gas demand by 2020/21. The development concept comprises a wellhead platform, a processing facility, and a platform for utilities and living quarters. Ramboll made the detailed design of the wellhead platform's jacket substructure, associated piles and appurtenances, and the FEED for two additional jackets.

03. CREATING ONE SINGLE ARAB ENERGY MARKET

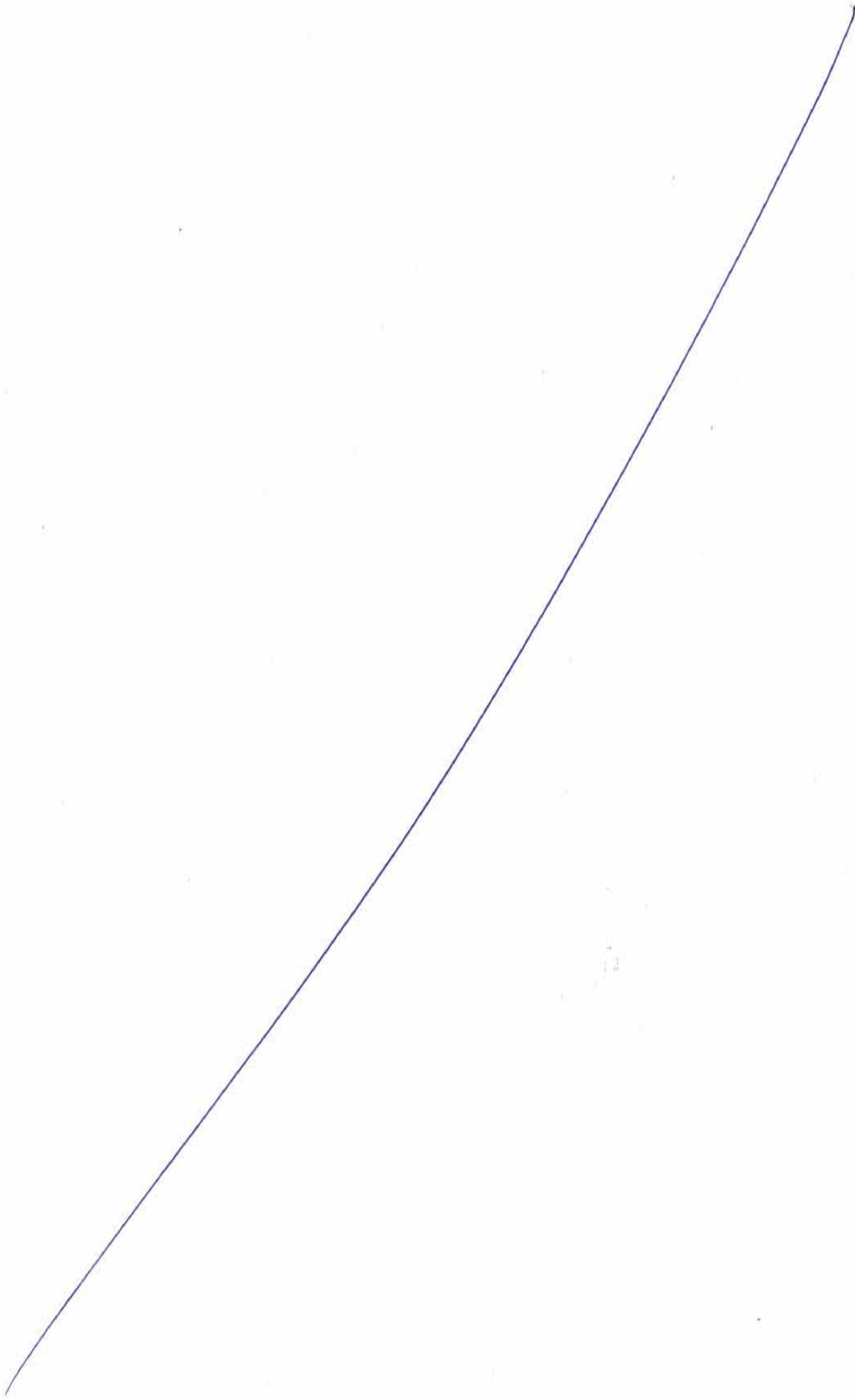
To determine the best options for electrical and gas interconnections creating one single energy market for 20 Arab countries, Ramboll proposed feasible infrastructure options to ensure energy availability, identify implementation methods and outline an energy trade strategy among Arab countries. The options were backed by techno-economic feasibility analyses of several scenarios and involved managing relations with almost 60 stakeholders.

OIL & GAS

Success in today's fast paced and competitive oil and gas market depends on cost effective and advanced technical solutions coupled with stringent health, safety and environmental safeguards during the production and distribution processes. With four decades of experience - offshore as well as onshore - we have exhaustive industry knowledge and a project track record from oil and gas hotspots worldwide. Our multidisciplinary service portfolio covers the entire asset and project life cycle.



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PLANNING & URBAN DESIGN

Ramboll has an extensive proven track record working with a number of the world's largest cities to create liveable, sustainable, and implementable urban development solutions that are fully adapted to the local context.



Number of specialists
500

Geographical spread
Nordic countries, UK, Middle East, Singapore, Beijing, North America

Key clients
City authorities and private developers

01. NORDHAVN, DENMARK

Nordhavn is Scandinavia's largest city development project and rethinks how urban life can be combined with sustainable energy, environment, traffic and cityscape solutions. Ramboll is working on urban development projects in the Aarhusgade and Sundmolen areas as well as the new 3 km long road link, road tunnel, and Metro Extension, which will connect the district to the wider city. Image: Ramboll's original Nordhavn masterplan, 2nd stage competition proposal. COBE, Sleth, Polyform and Ramboll.

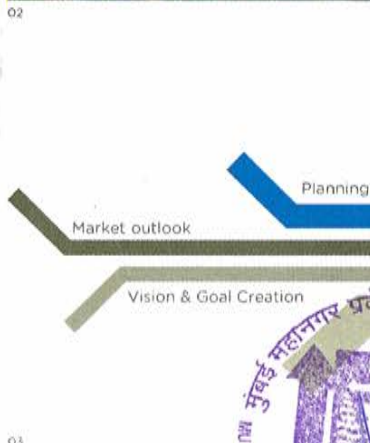


"Our holistic approach to urban development encompasses strategy, planning, and renowned technical design services and is based on an integrated multidisciplinary skills base."

Neel Strøbæk, Group Director for Planning & Urban Design, Ramboll Group

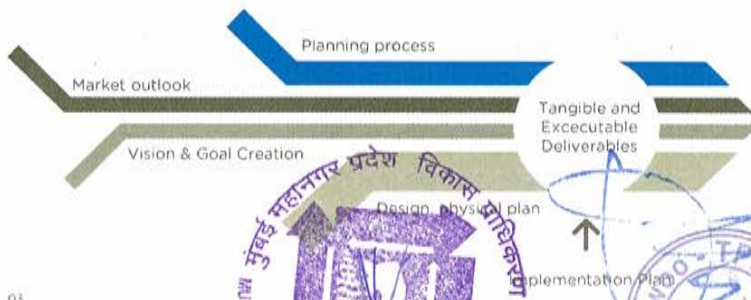
02. MANDAI NATURE SAFARI PARK, SINGAPORE

Just 30 minutes from downtown Singapore, the 128ha Mandai Nature Safari Park is being rejuvenated into a world class integrated wildlife and nature area. Ramboll Studio Dreiseitl is leading the master planning team for the initial development phase.

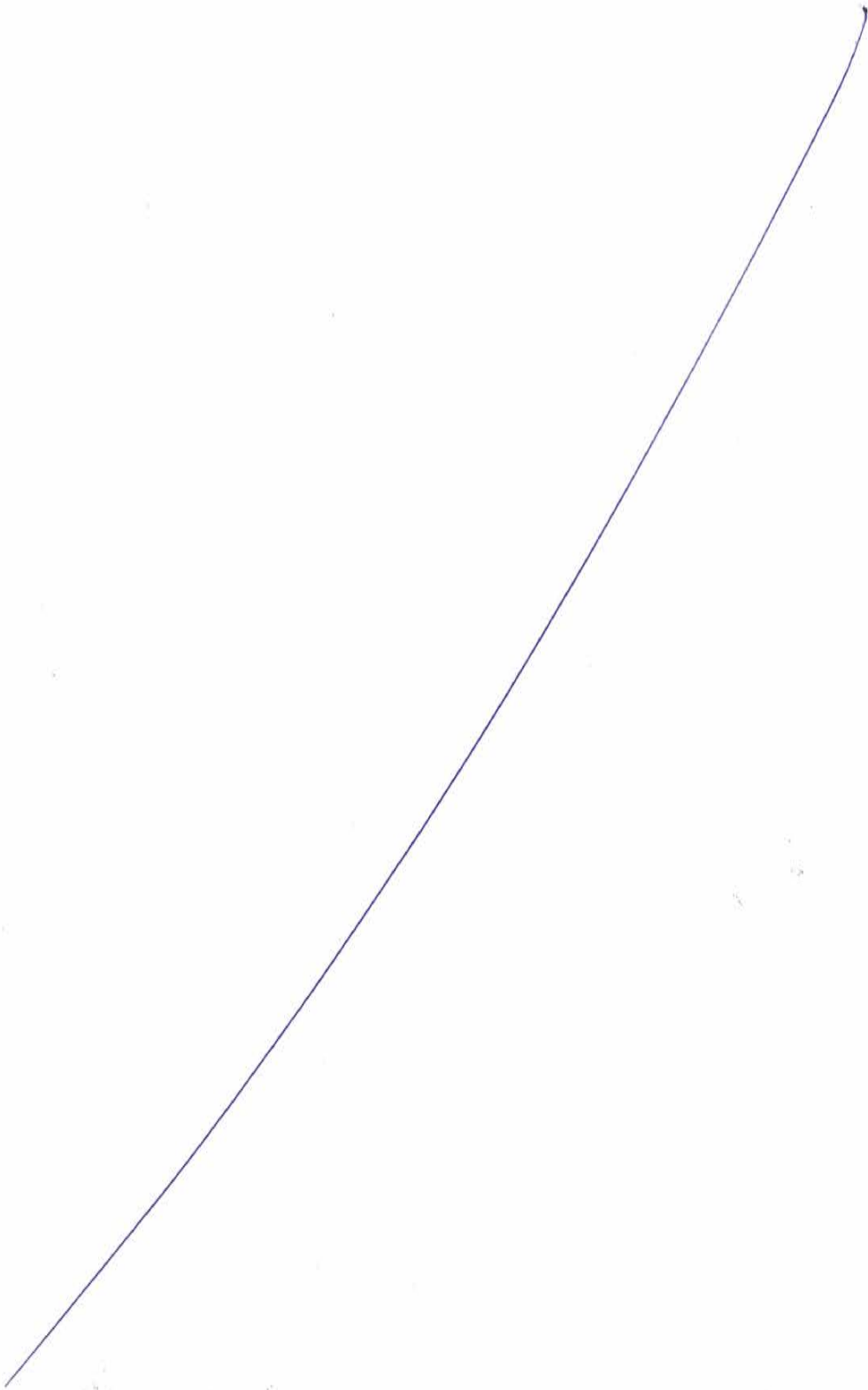


03. RAMBOLL'S PLANNING IMPLEMENTATION MODEL

Ramboll's approach to urban planning is focused on delivering executable solutions and maximising value.



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MANAGEMENT CONSULTING

Ramboll is one of the largest management consultancies in Northern Europe and is committed to supporting change. As a trusted partner to private sector clients, we deliver the complete chain of transformation; defining strategic direction, forming new organisational structures, optimising processes and driving leadership and cultural transition. Our strong track record in enabling public-sector development includes qualified guidance on social affairs, labour market policies and employment, and facilitating stakeholder engagement and community dialogue in urban master planning initiatives.



01



02

Revenue (2016)
EUR 70 million

Number of specialists
635 worldwide

Geographical spread
9 offices in 6 countries

Services
Strategy & operations, client & market, leadership & HR, business technology, city & society development, policy advice & evaluation

4.46

Client satisfaction score for Ramboll's management consultancy services on a scale of 1 to 5



03

01. BOOSTING COMPETITIVENESS OF EUROPEAN ENERGY GIANT, SWITZERLAND

A strategy developed through scenario building has empowered major energy supplier, Alpiq, to meet an ever-changing market. The scenarios made it possible to build an action oriented strategy including concrete steps to address a number of uncertainties. Image: Alpiq

02. 'PERFORM TO GROW' PROJECT AT RITTAL, GERMANY

Over the course of 2½ years, Ramboll helped global industry solutions provider, Rittal, transform its decentralised procurement operations into a global purchasing and supply chain organisation. The project was runner up in the 2014 EOE Awards.

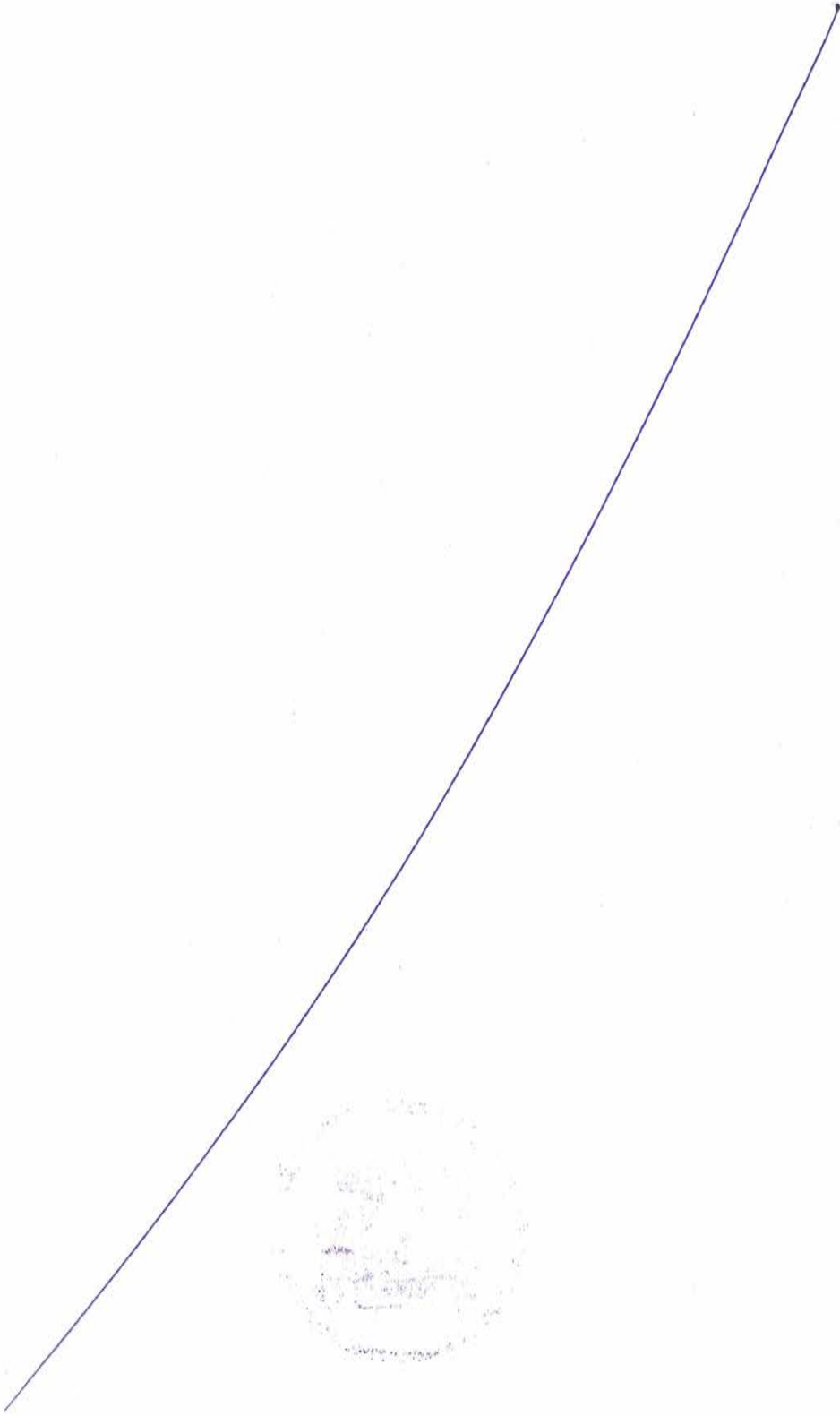
03. STOCKHOLM MUNICIPALITY ORGANISATIONAL DEVELOPMENT, SWEDEN

For almost a decade, Ramboll has been a trusted management consulting advisor to Stockholm Stad, the municipality in the ever growing capital of Sweden. The consultancy has aimed to strengthen management capabilities and improve quality and efficiency in the organisation.



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INNOVATING FOR A BRIGHT FUTURE

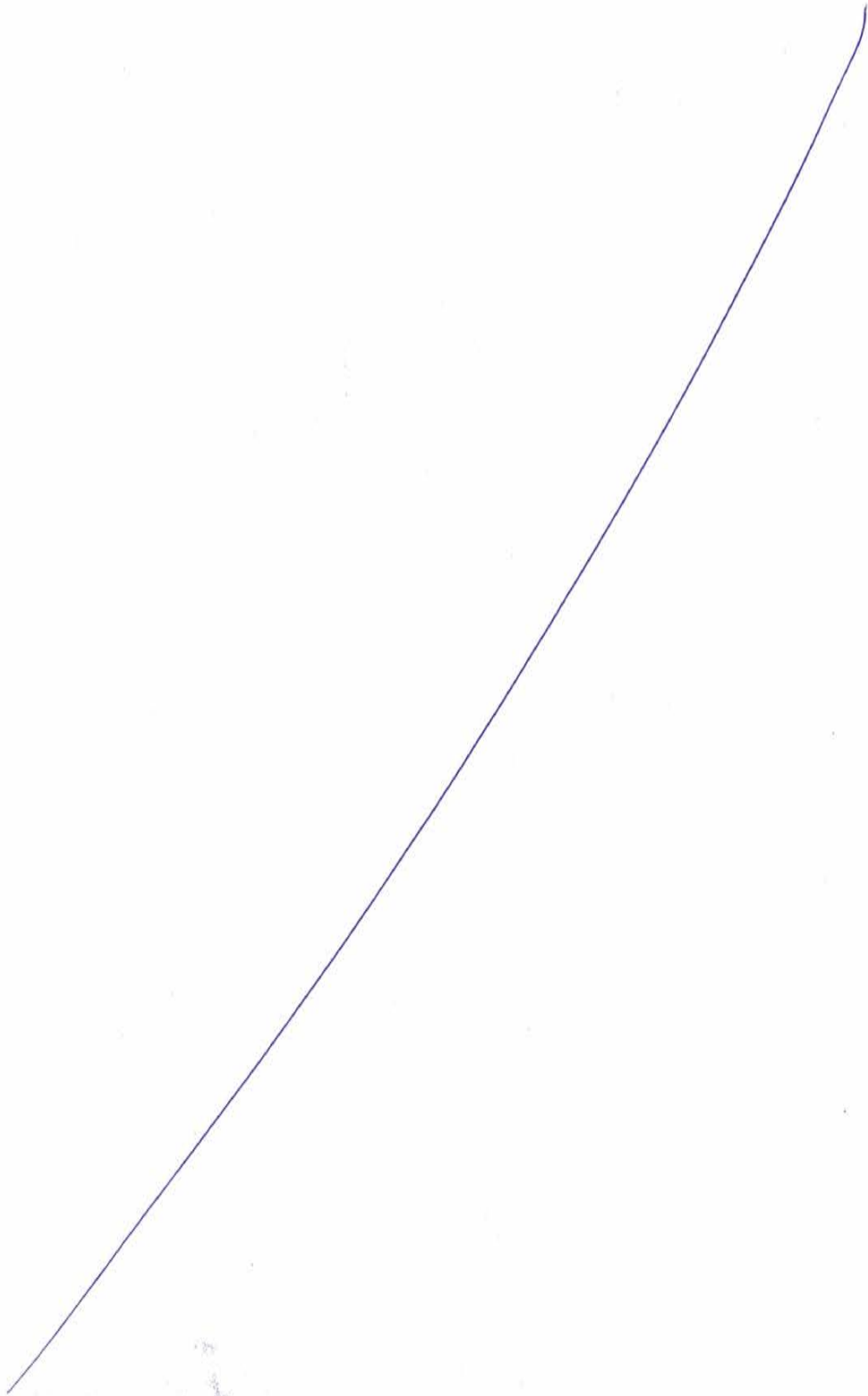
Ramboll is committed to continually developing and combining knowledge and technology in new and different ways. As an internationally recognised thought leader and expert practitioner in each of the markets in which we operate, we provide cutting edge solutions to solve our clients' and society's largest challenges.

CHICAGO LAKESIDE, USA

Ramboll has produced the design concept for sustainable energy, water management and waste management to transform the 600-acre Chicago Lakeside city district into a model community based on 21st century infrastructure and technologies. The concept will reduce the use of fossil energy by 90%, potable water by 60% and landfill to 1% with 90% of stormwater infiltrated and directed to Lake Michigan.

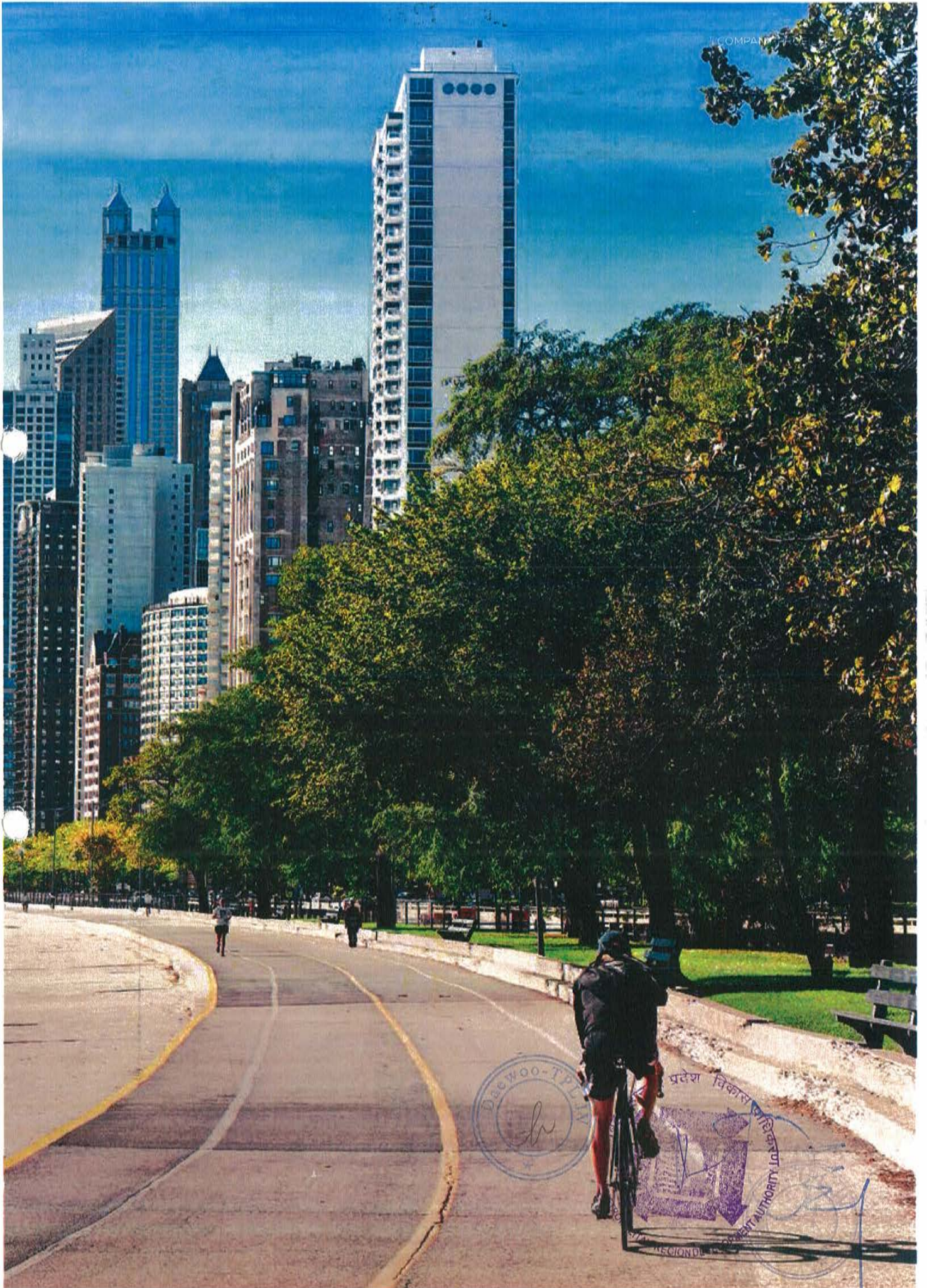


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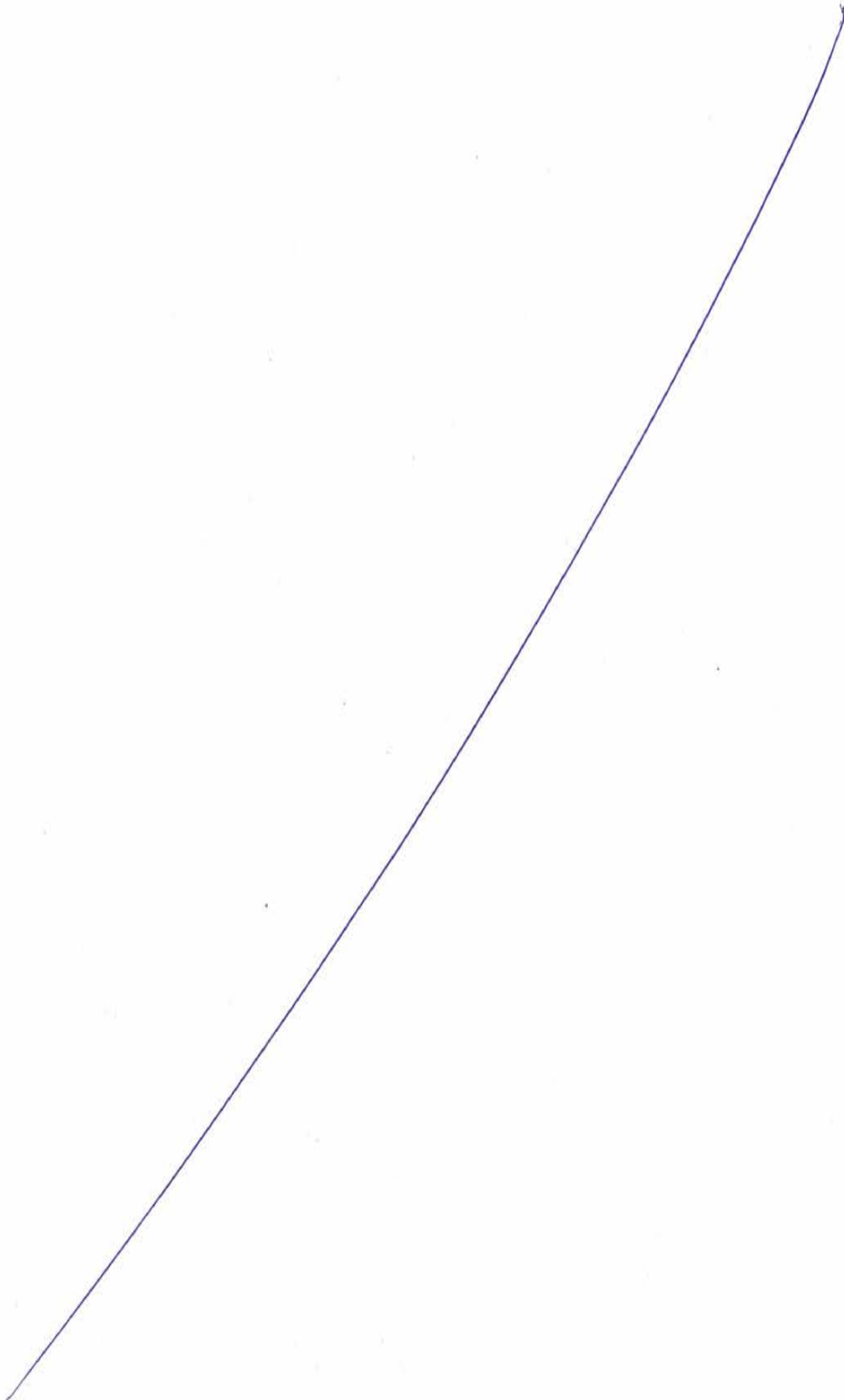
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DEGWOOTPLAN
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प्रदेश विकास प्राधिकरण
REGIONAL DEVELOPMENT AUTHORITY
INDIA

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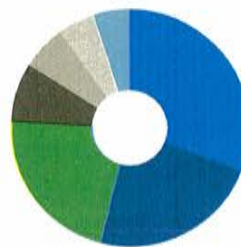


SOLID FOUNDATIONS AND GROWTH

In achieving our strategic ambitions to become a global and diversified consultancy, Ramboll has grown by 250% over the last decade. Revenue in 2016 was EUR 1.4 billion.

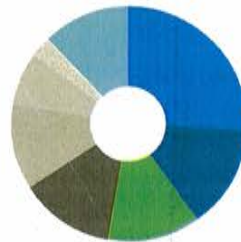
250%

Growth in Ramboll revenue over the last decade



REVENUE BY MARKET 2016

- Buildings 31%
- Environment & Health 23%
- Transport 22%
- Energy 8%
- Water 6%
- Management Consulting 5%
- Oil & Gas 5%



REVENUE BY PROJECT LOCATION 2016

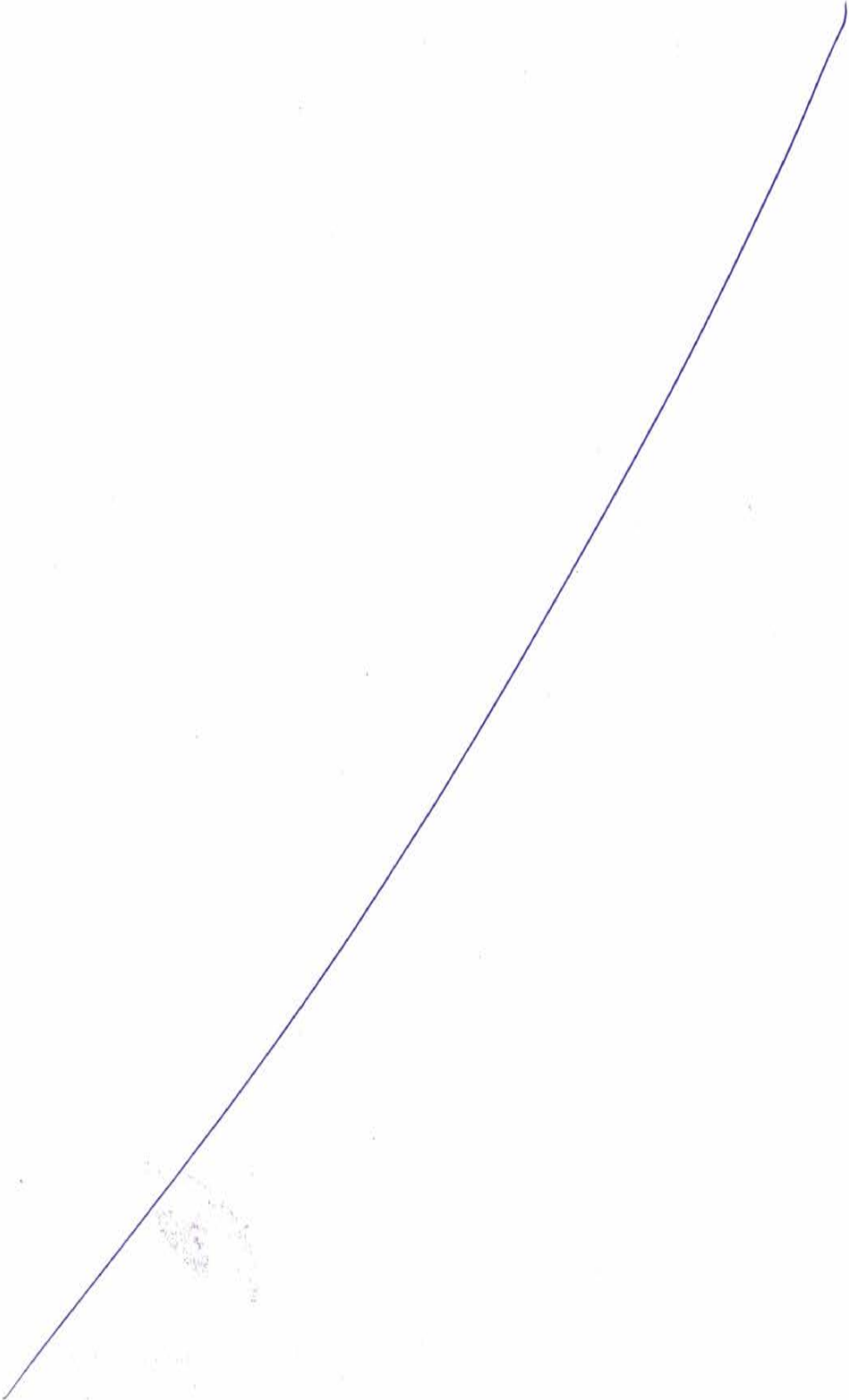
- Denmark 26%
- Norway 14%
- Finland 13%
- Sweden 13%
- USA 12%
- UK 7%
- Germany 3%
- Rest of World 12%

Key figures and financial ratios	2016	2016	2015	2014	2013	2012
Income statement, DKK million		EUR m				
Revenue	1,423.9	10,607.7	10,589.3	8,291.9	7,794.1	7,552.5
EBITA	80.8	602.1	474.7	413.2	389.9	405.6
Operating profit (EBIT)	45.4	338.0	146.7	286.7	287.2	290.3
Profit before tax	45.9	342.0	222.6	265.1	252.3	277.1
Profit for the year	23.7	176.9	76.3	164.5	143.1	168.3
Balance sheet, DKK million						
Total assets	856.9	6,383.8	5,381.3	4,289.5	4,268.4	
Total equity	290.2	2,162.1	2,113.1	1,859.5	1,702.5	1,679.7
Net interest bearing cash/(debt)	3.7	35.0	380.2	590.0	372.2	
Non-financial indicators						
Private sector revenue, %		65	69	59	58	59
Public sector revenue, %		35	31	41	42	41

The figures in EUR have been translated from DKK using an exchange rate of 7.45.



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CORPORATE RESPONSIBILITY

Responsible corporate citizenship based on trust, integrity, transparency and professionalism have been the hallmarks of Ramboll's business approach since the company's foundation nearly 70 years ago.

292,454 CONFERENCE CALLS IN 2016

Extensive use of video technology has helped reduce our travel-related CO₂ emissions per FTEE despite our international expansion.



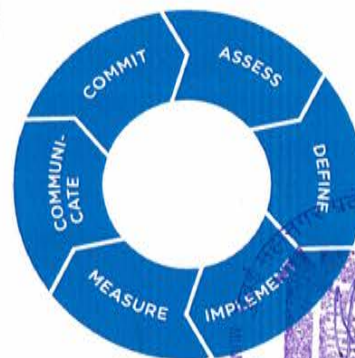
GLOBAL COMMITMENT

As a longstanding signatory to the UN Global Compact, an internationally recognised framework for advancing corporate responsibility, our performance is measured and reported in four main areas:

- Human rights
- Labour
- Environment
- Anti-corruption

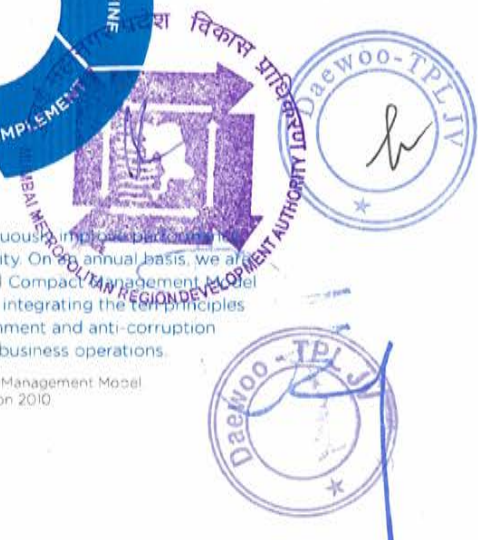
Ramboll's 'Global Commitment' directly links these areas to our operations and services by creating the framework for all our corporate policies and informing the way in which our employees and suppliers operate.

www.ramboll.com/csr

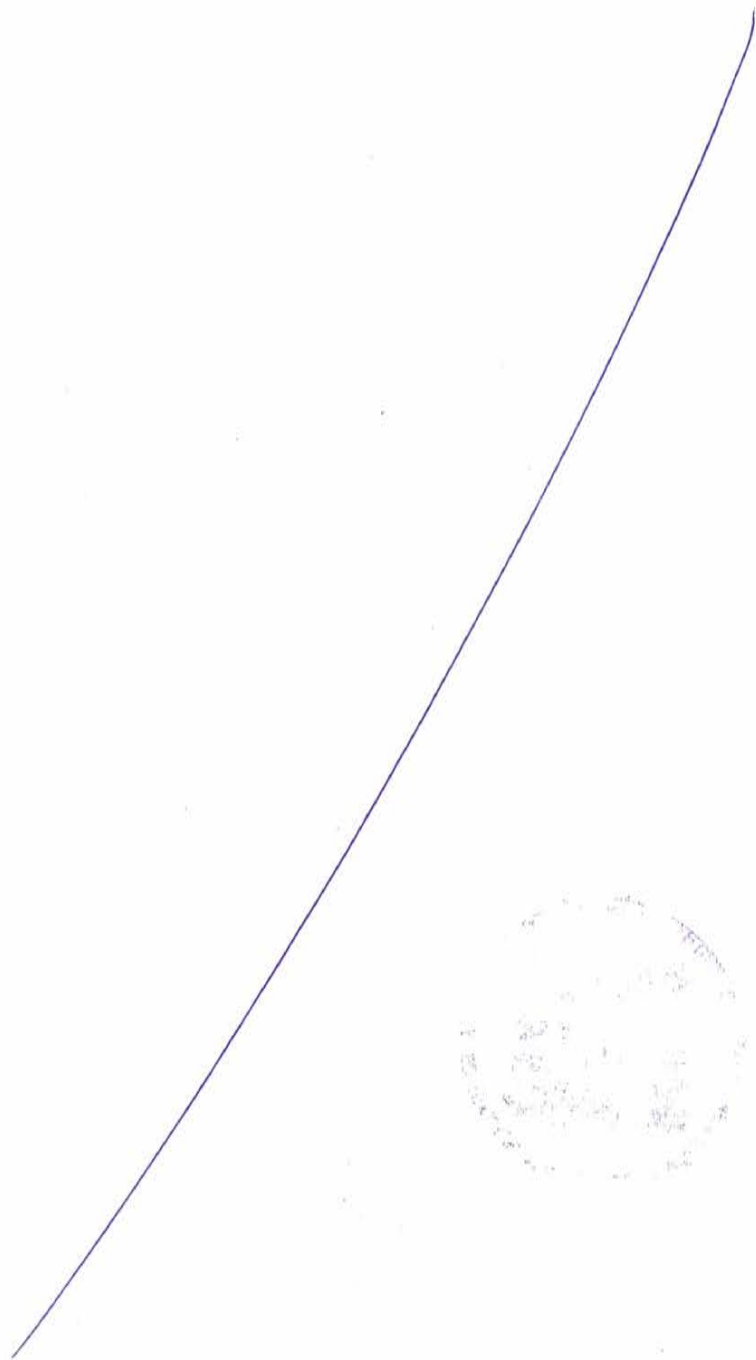


Ramboll works to continuously improve its performance on corporate responsibility. On an annual basis, we are guided by the UN Global Compact Management Model to support our efforts in integrating the 10 principles on human rights, environment and anti-corruption into core strategies and business operations.

Source: UN Global Compact Management Model framework for implementation 2010.

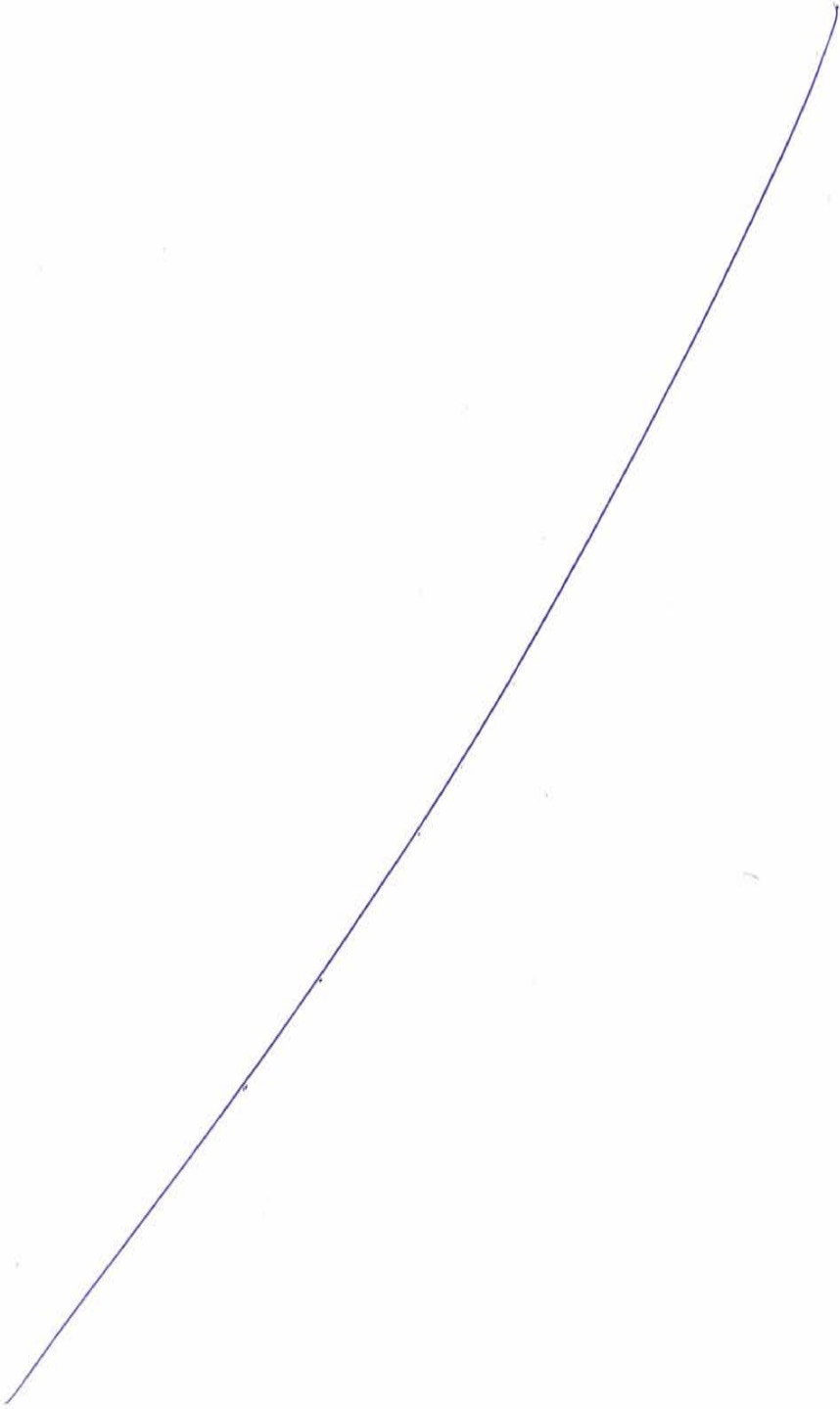


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70 YEARS' OF SUSTAINABLE DEVELOPMENT

Passion for engineering and contributing to society guided Ramboll's founders, B. J. Rambøll and J. G. Hannemann, when they established the company in 1945. Whilst Ramboll has evolved into a global multidisciplinary consultancy, these values and our Nordic roots remain cornerstones of the company today.

Foundation ownership enables us to take a long-term perspective and provide advice to clients that is independent of external or personal interests. Over the last five years, the Foundation has donated more than EUR 1 million to fund a range of technical research and support relief efforts for natural disasters worldwide.

www.ramboll.com



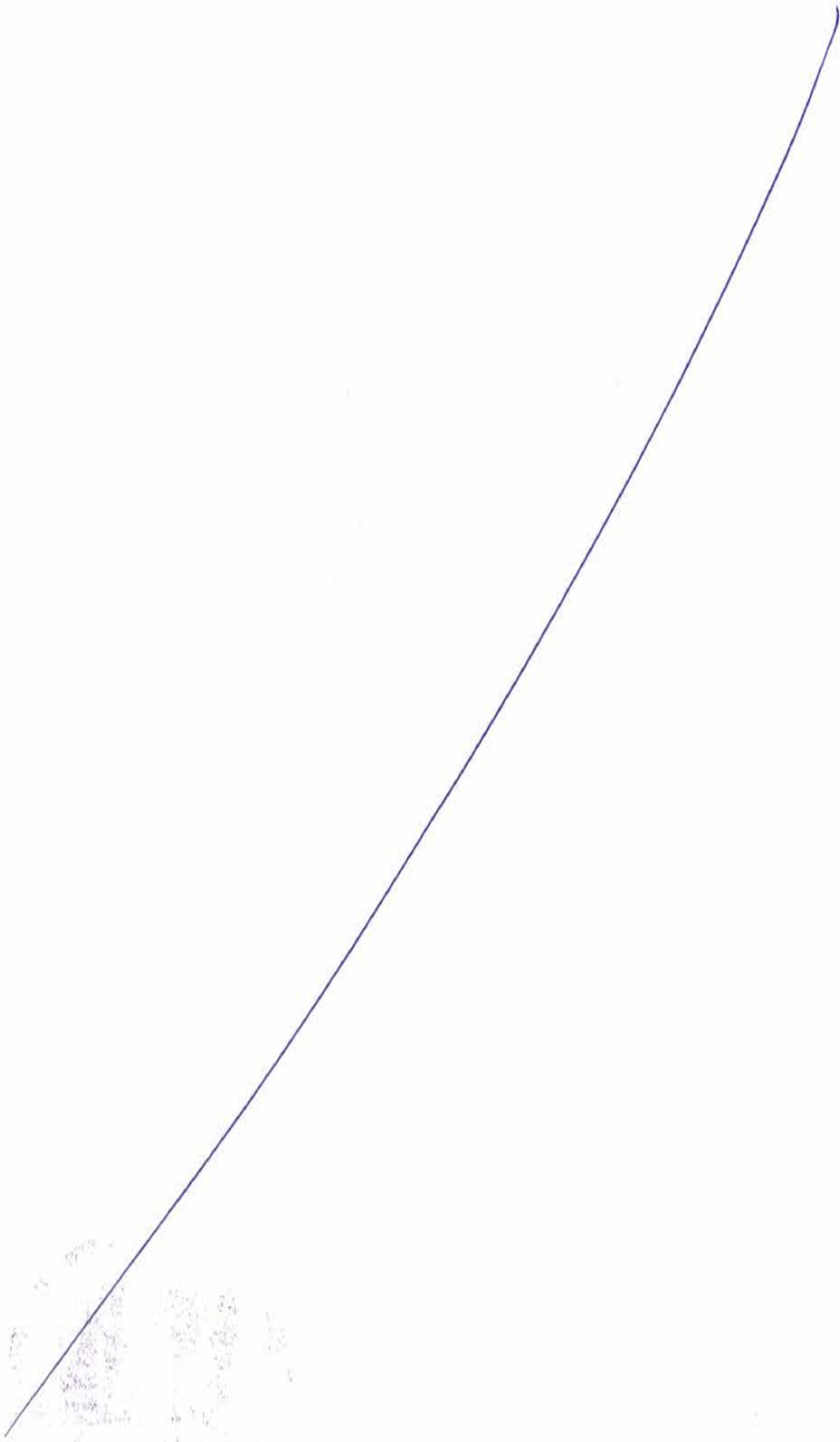
"Being decent and proper does not only concern whether your tie is in place when doing business. It is about treating other people and society well in long-term perspective."

B. J. RAMBØLL

Ramboll's expansion has been achieved through consistent organic growth and large strategic acquisitions in Denmark, Sweden, India, UK and USA.



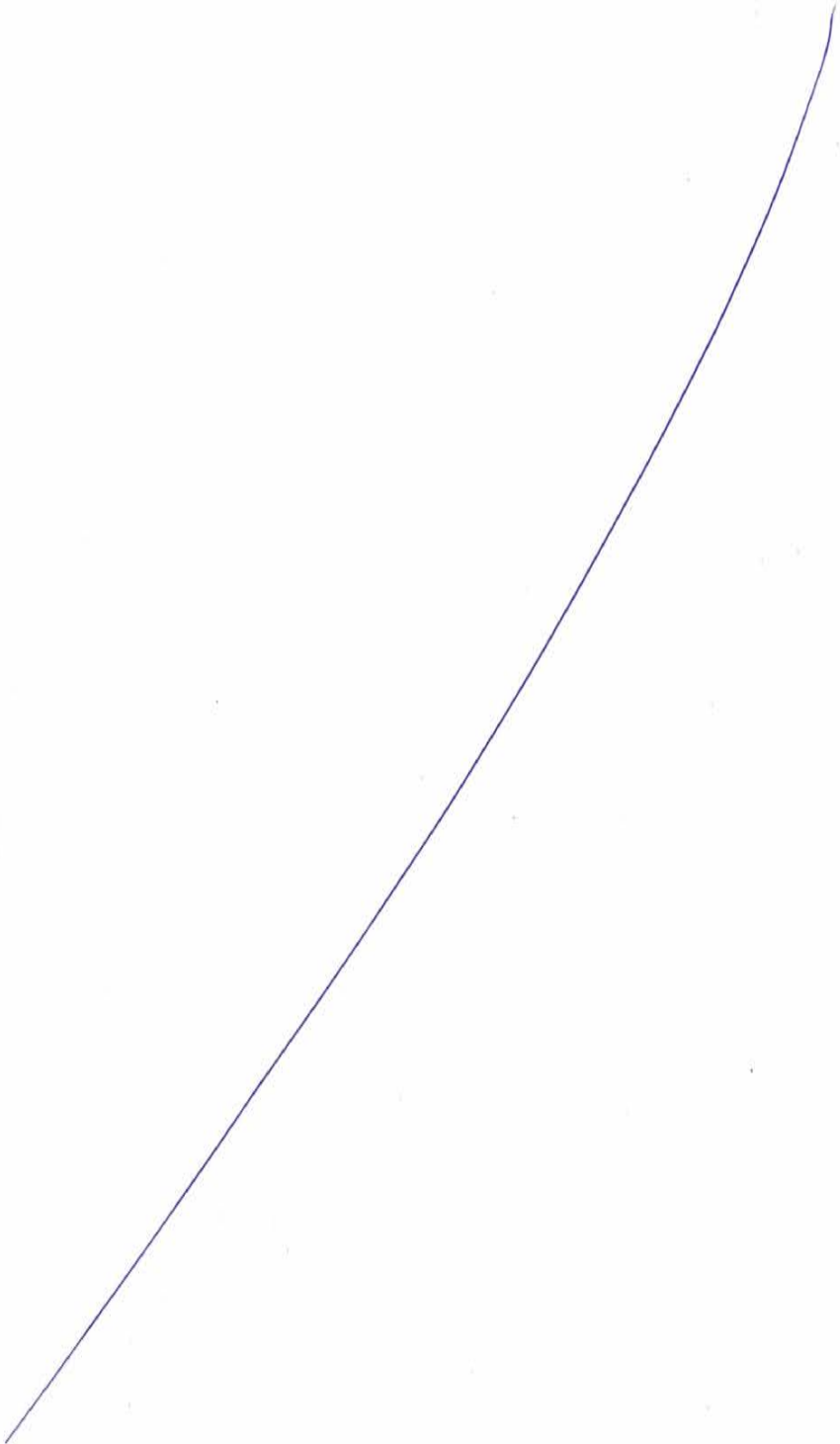
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RAMBOLL

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राइट्स लिमिटेड

(भारत सरकार का प्रतिष्ठान)

RITES LIMITED

(Schedule 'A' Enterprise of Govt. of India)

No.: RITES/RI/RCED/MISC/2017

Date: 14.07.2017

TO WHOM IT MAY CONCERN

It is certified that M/s RAMBOLL, Denmark carried out for us complete design work for composite steel truss superstructure between 2007 & 2009 for the Bogibeel Bridge across river Brahmaputra in Assam.

Bogibeel Bridge is a fully welded double deck composite steel truss bridge. Upper deck has a concrete slab and is to be used by road traffic motor vehicle. Lower deck is for double track railway traffic. The stringers are designed in such a way, that they could be easily exchanged. There are 39 spans of 125m lengths & two compensating end spans to reach a total length of 4.94km.

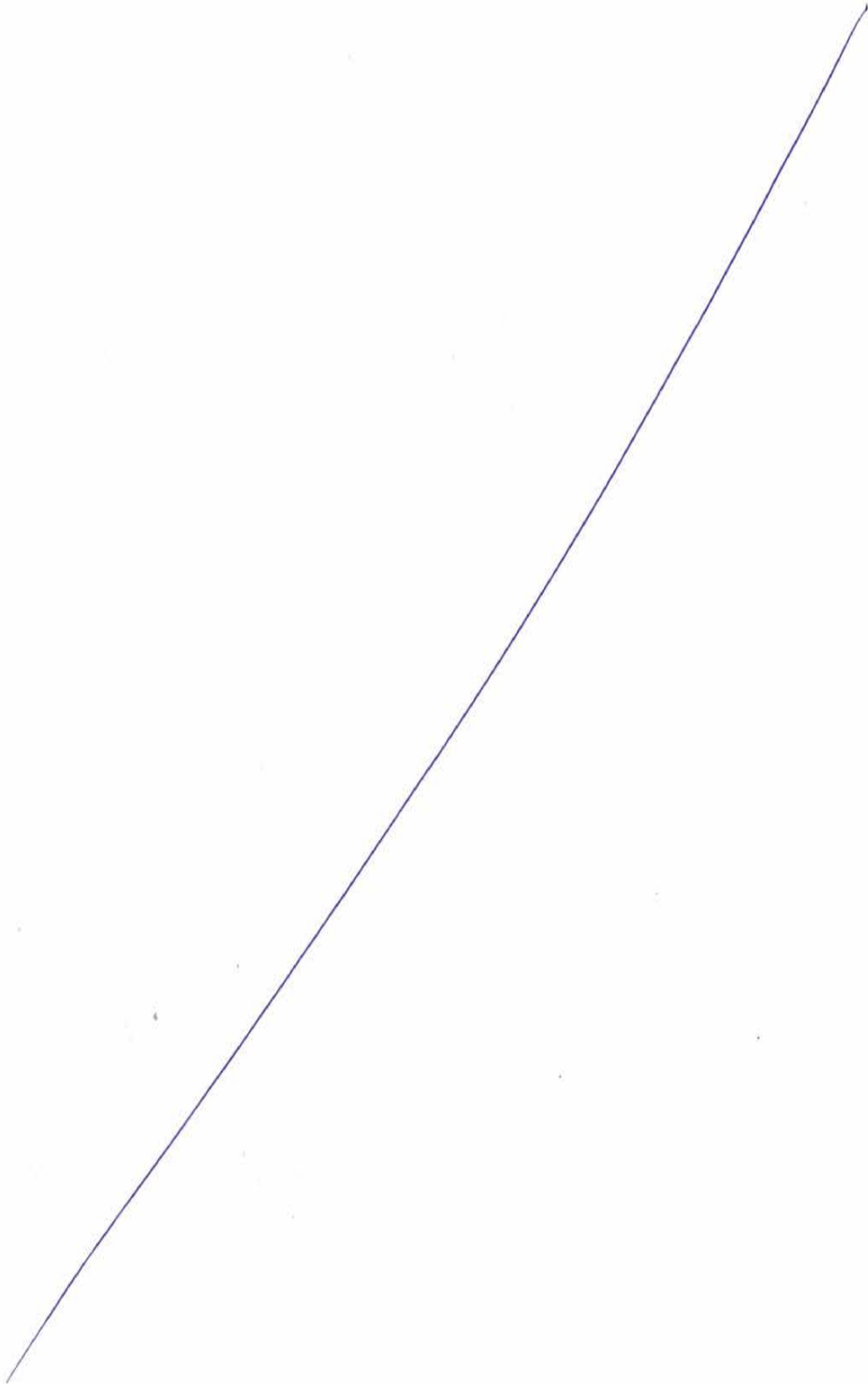
Cost of superstructure:	154 Mio Euro (Presently INR 1200 Crores for 41 spans)
Height of cross section:	12.5m approx.
Width of cross section:	12m approx.
Weight of Bridge:	60,000 tonne (For 41 spans)

We certify that M/s RAMBOLL, Denmark have experience, the full engineering competency and reliability to carry out the design of complex structures. They have done the design in case of Bogibeel Bridge to the highest technical standards. The quality work carried out by M/s RAMBOLL, Denmark was to our full satisfaction. We wish M/s RAMBOLL, Denmark all success and all good luck for the future assignments.

(Anil Khanna)
Group General Manager
SBU Head/RCED



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Form PER -2: Resume of Proposed Personnel

Date: [10, July, 2017]

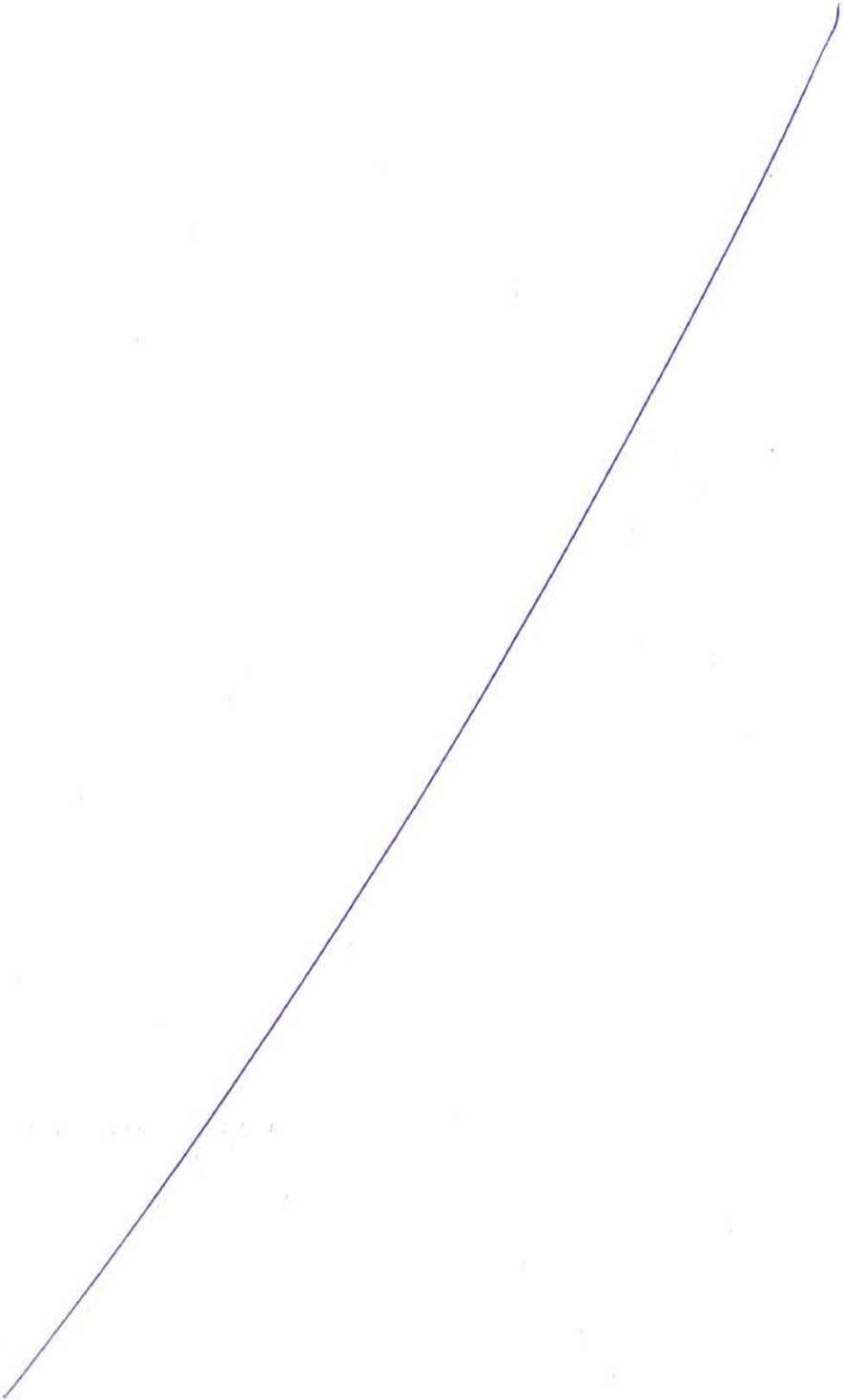
Page [1] of [3]

Pages

Position: Project Director	
Personnel information	Name: Peter Curran Date of Birth: 25/11/1960
	Final Education: BSc (Hons)
	Professional qualifications: CEng, BSc, MICE, MIStructE
Present employment	Name of employer: Ramboll UK
	Address of employer: 240 Blackfriars Road, London SE1 8NW, United Kingdom
	Telephone: +44 7736497481 Contact name and title: Peter Curran, Mr.
	Fax: E-mail: Peter.Curran@ramboll.co.uk
	Job title: Director Years with present employer: 34



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[Summarize professional experience over the last 20 years, in reverse chronological order:

Indicate particular technical and managerial experience relevant to the Works/services.

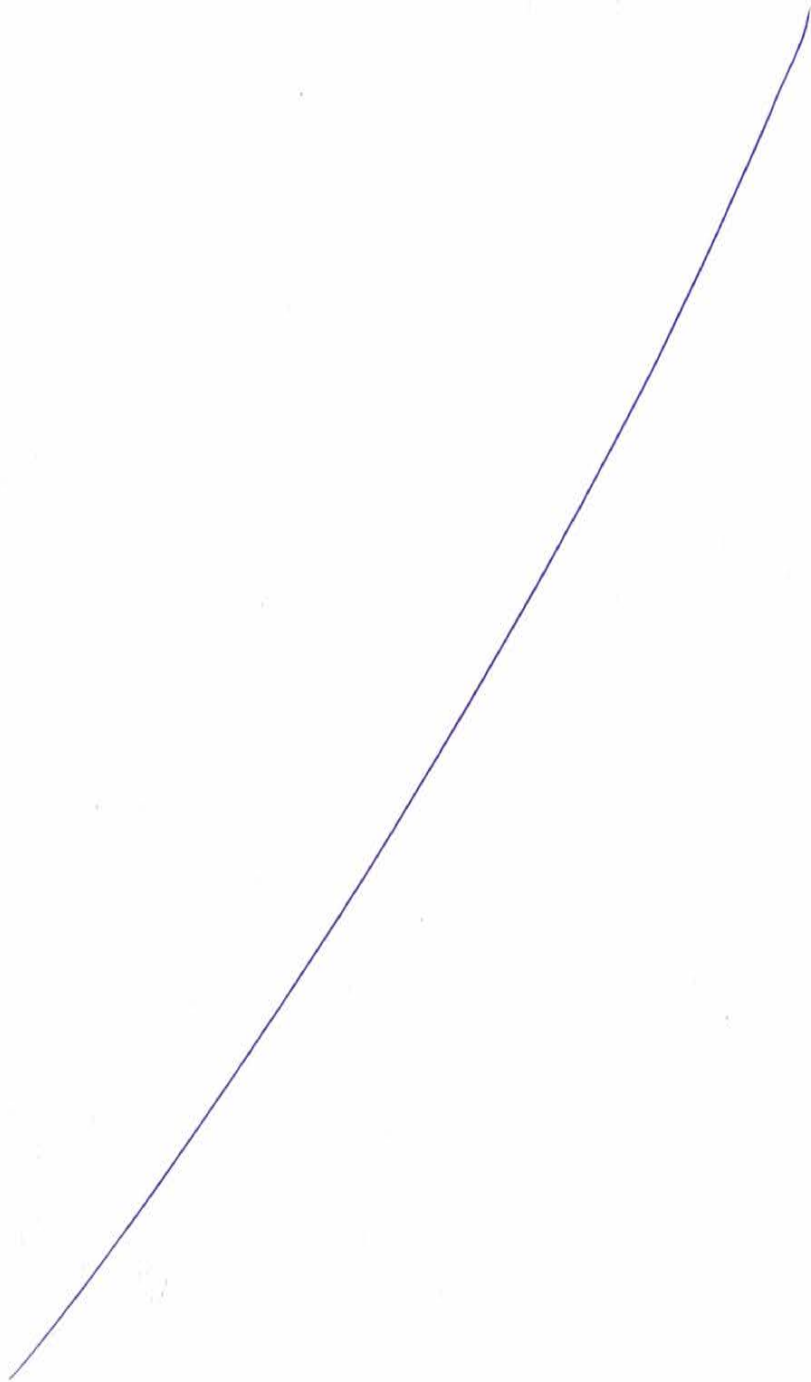
Experience in similar works must be clearly indicated, to demonstrate compliance with the requirements set forth in Section III, Sub-Clause 1.1.1.]

From	To	Company/Project/ Position / Outline of the Project / Relevant Technical and Management Experience
2010	2017	<p>Queensferry Crossing Transport of Scotland/Forth Crossing Bridge Constructors, United Kingdom Project Director and Ramboll Representative</p> <p>Project Director and Ramboll representative on the Design Joint Ventures Board for the tender design of a major replacement bridge crossing of the Forth Estuary, working with Joint Venture partners Ramboll, Sweco and Leonhardt Andre as well as the multinational Contracting Joint Venture. Ramboll UK responsibilities included foundation design, geotechnical design, road and land based structures and environmental inputs.</p> <p>The Queensferry crossing comprises a dual two-lane carriageway with widened hard shoulders. The overall length of the bridge is 2.65km between abutments with two main spans each of 650m; two side spans of 223m and 10 approach spans varying from 104 to 64m. At its centre is a three masted cable stayed structure with a unique arrangement of overlapping stay cables to provide enhanced stiffness and stability to the central tower. The three towers rise to a height of 210m making it the tallest bridge in the UK. The overall width of the deck is 39.8 metres and is configured as a three-corridor arrangement with the towers and stay-cables located in the central zone between the two carriage ways.</p>
2016	2017	<p>Fourth Panama Crossing Temporary Customer, Denmark</p> <p>Tender Design for a new bridge across Panama Canal in Panama city including network connections on both side. Ramboll is responsible for the Approach Viaduct design including foundations for all bridges which also includes a 540m span cable stayed bridge</p>
2008	2010	<p>Media City Footbridge, Salford Peel Media Limited, United Kingdom Project Director</p> <p>Project Director for a £10m landmark opening footbridge as part of the Media City development in Salford. The 100m long stayed structure sits upon a central plant room and pivot point located within the ship canal about which the bridge swings.</p>
2003	2011	<p>Twin Sails Bridge, Poole Borough of Poole, United Kingdom Project Director</p> <p>Project Director for Second Opening Bridge, Poole, the competition winning landmark opening bridge and viaduct within Poole Harbour. He led the design and environmental team successfully through the statutory processes including a comprehensive EIA, successfully engaging with the legal teams and securing the Consent of the Secretary of State following a public inquiry.</p>
2007	2008	<p>Bishops Stortford Goods yard Footbridge East Herts Council, United Kingdom Project Director</p> <p>Project director for an unusual z shaped architectural steel footbridge cantilevering over the River Stort, won on a quality/cost basis as part of a design and build contract</p>
2005	2008	<p>Forthside Pedestrian Bridge, Stirling Stirling Council, United Kingdom Project Director</p>



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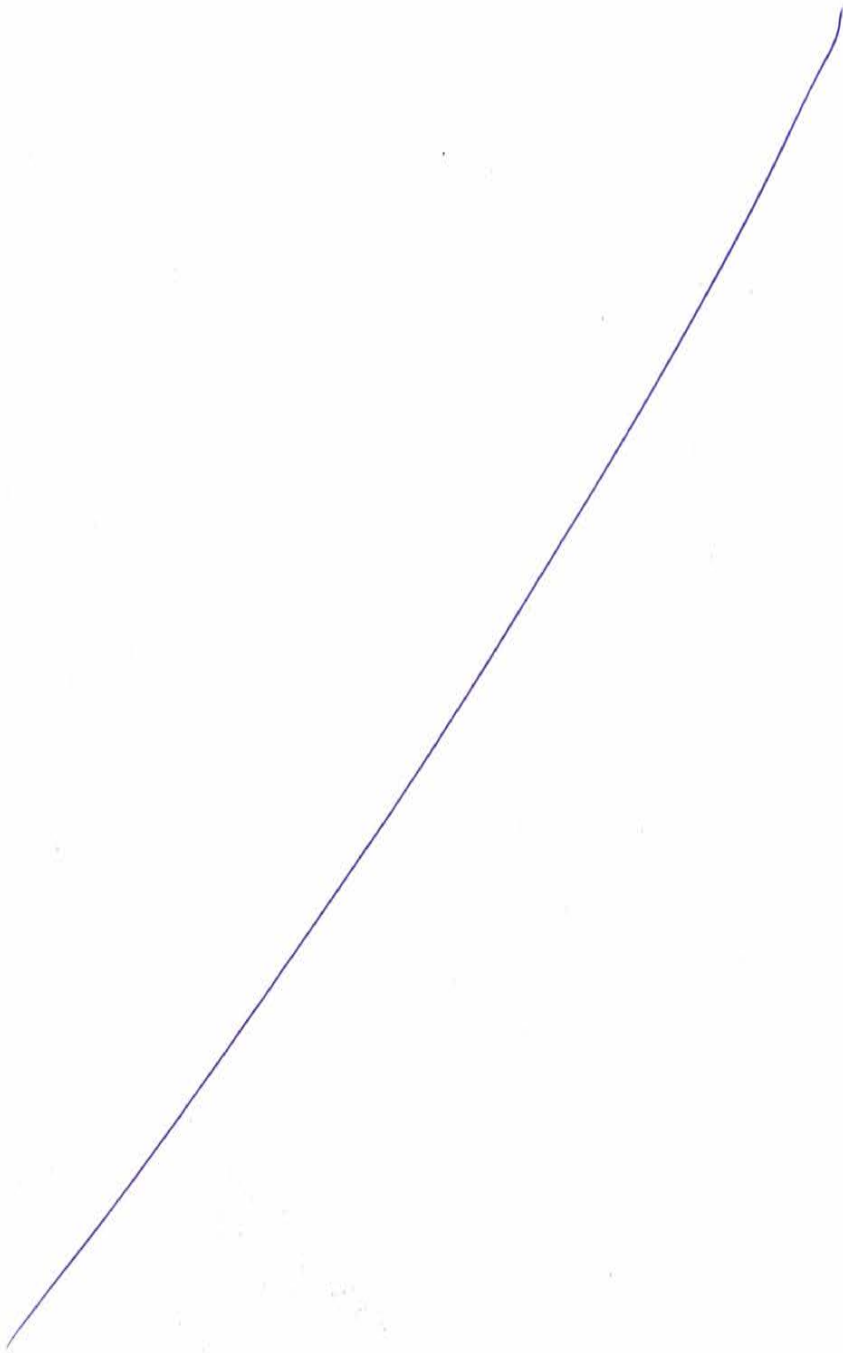
O

		Project Director for a 110m long inverted fink truss structure across the railway lines at Stirling Station.
2004	2006	N15 Bundoran/Ballyshannon Bypass SIAC/Wills Brothers JV, United Kingdom Project Director Project Director for design and checking of 14 structures including 120m two-tiered RC arch at Cathleen's Falls.
2003	2006	Pont Dewi Sant Costain, United Kingdom Project Director Project Director for independent check and construction phase geometric control of 227m long, 2 span cable stay bridge over Afon Sirhowy, Wales
2003	2004	A249 Swale Crossing to Isle of Sheppey Balfour Beatty Civil Engineering, United Kingdom Project Director Project Director for independent check of 1.3km long, 19 span steel composite viaduct.
2002	2012	Docklands Light Railway Extension Arup/Taylor Woodrow, United Kingdom Project Director Project Director for independent design check of 3km elevated viaduct comprised of post-tensioned box girder construction and associated multi-span reinforced concrete structures
2002	2006	Project Director Design and Construction of 150m long S-shaped cable stayed combined cycle and footbridge over River Towy. Design included dynamic analysis and aerodynamic testing.
2002	2006	Mardyke Walk Pedestrian Bridge Cork City Council, United Kingdom Project Director Project Director for the design of a 57m span asymmetric arch footbridge over the River Lee in Cork, Ireland.
2002	2004	Great Wharf Road Bridge London, United Kingdom Project Manager Project Manager for the design of 68m span 4 lane lifting bridge over dock in Canary Wharf, London



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Form PER -2: Resume of Proposed Personnel

Date: [10, 07, 2017]

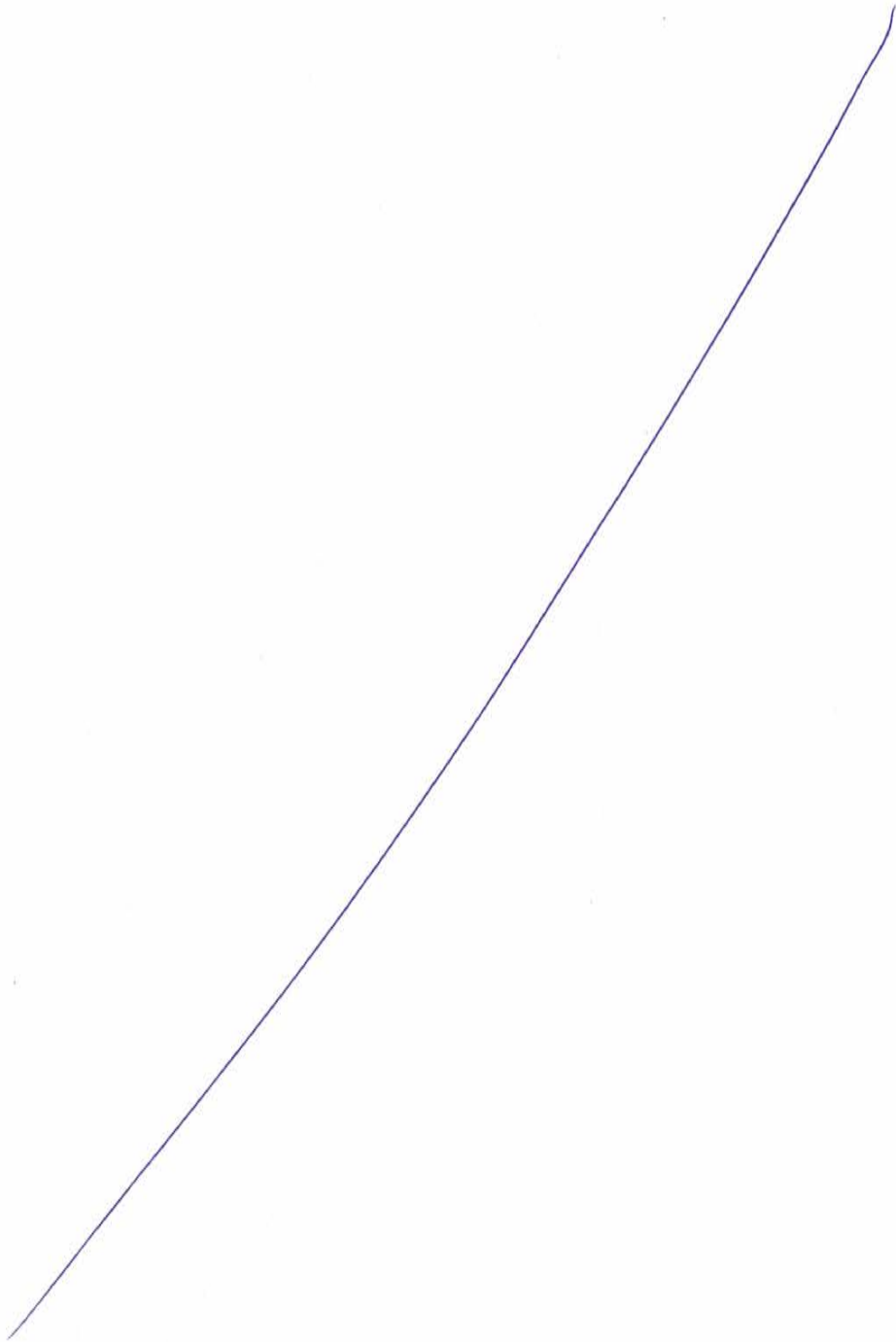
Page [1] of [18]

Pages

Position: Project Manager	
Personnel information	Name: Aditya Sharma Date of Birth: 07th June 1968
	Final Education:
	Professional qualifications: B.E. (Civil) from Punjab University Chandigarh, India, 1989
Present employment	Name of employment: Ramboll India Pvt. Ltd.
	Address of employer: The Epitome, Level 17, Building NO-5, Tower-B, Cyber City Phase-III, Gurgaon-122002
	Telephone: Contact name and title:
	Fax: E-mail:
	Job title: Years with present employer:



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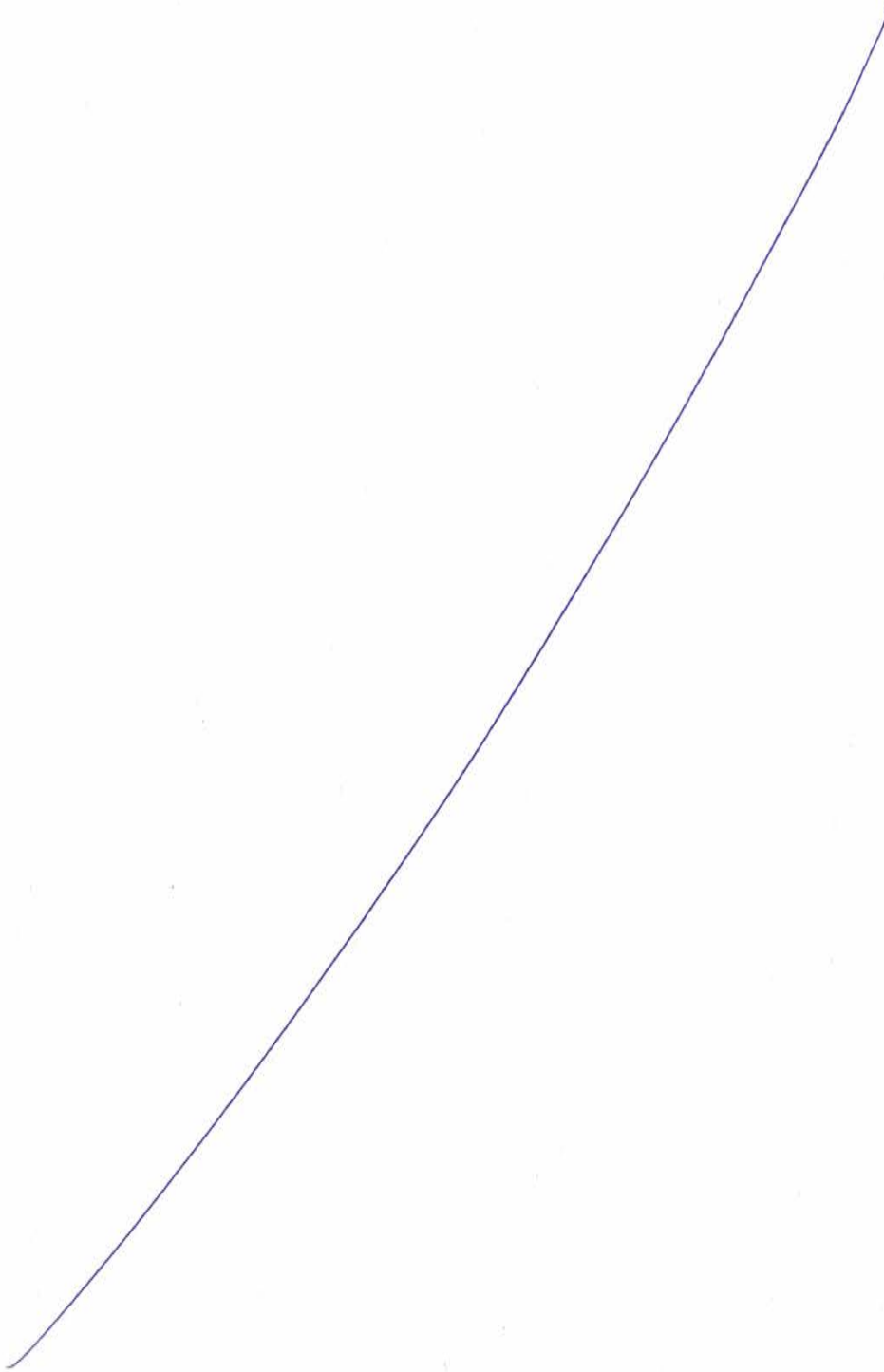


[Summarize professional experience over the last 20 years, in reverse chronological order:
Indicate particular technical and managerial experience relevant to the Works/services.
Experience in similar works must be clearly indicated, to demonstrate compliance with the requirements set forth in Section III, Sub-Clause 1.1.1.]

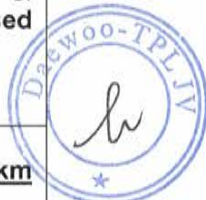
From	To	Company/Project/ Position / Outline of the Project / Relevant Technical and Management Experience
March 2013	Till Date	Director Transport India Pvt Ltd Ramboll
January 2016	Ongoing	Company: Ramboll India Pvt Ltd Project: <u>Consultancy Services for Post Bid Detailed Design of Package-III Eastern Peripheral Expressway.</u> Client: Jay Pee Associate Duration: January 2016 - Ongoing Position : Project Director Outline of the Project: Involved in planning, design of 26 km long 6 lane greenfield expressway
January 2016	Ongoing	Company: Ramboll India Pvt Ltd Project : <u>Consultancy Services for Post Bid Detailed Design of Udampur-Ramban Section of NH-1A (Now NH-44).</u> Client: Gammon India Ltd Duration: January 2016 - Ongoing Position : Project Director Outline of the project: Involved in planning, design of 40 km long 4lane highway in hilly terrain
November 2015	Ongoing	Company: Ramboll India Pvt Ltd Project : <u>Consultancy Services for Proof Checking of 4 laning of the stretch of NH-17B from Varunapuri to Sada Junction and elevated road cum flyover cum ROB from Ravindra Bhavan junction to gate no.09 of the MPT including its loop connectivity ramps in the State of Goa on EPC Mode Engineering.</u> Client: Gammon India Ltd Duration: November 2015 – Ongoing Position : Project Director Outline of the project: Involved in proof checking of elevated corridor comprising of continuous structures with pretension girders resting on open/pile foundations
October 2015	March -2015	Company: Ramboll India Pvt Ltd Project : <u>Consultancy Services for Post Bid Detailed Engineering Design of Harike bypass on NH-15 near Amritsar, Punjab</u> Client: S.P. Singla Pvt Ltd Duration: October 2015 – March -2015 Position : Project Director Outline of the Project: Involved in planning, design of 9km long 4lane highway which includes detailed design of 1.2 km long bridge across river Sutlej.



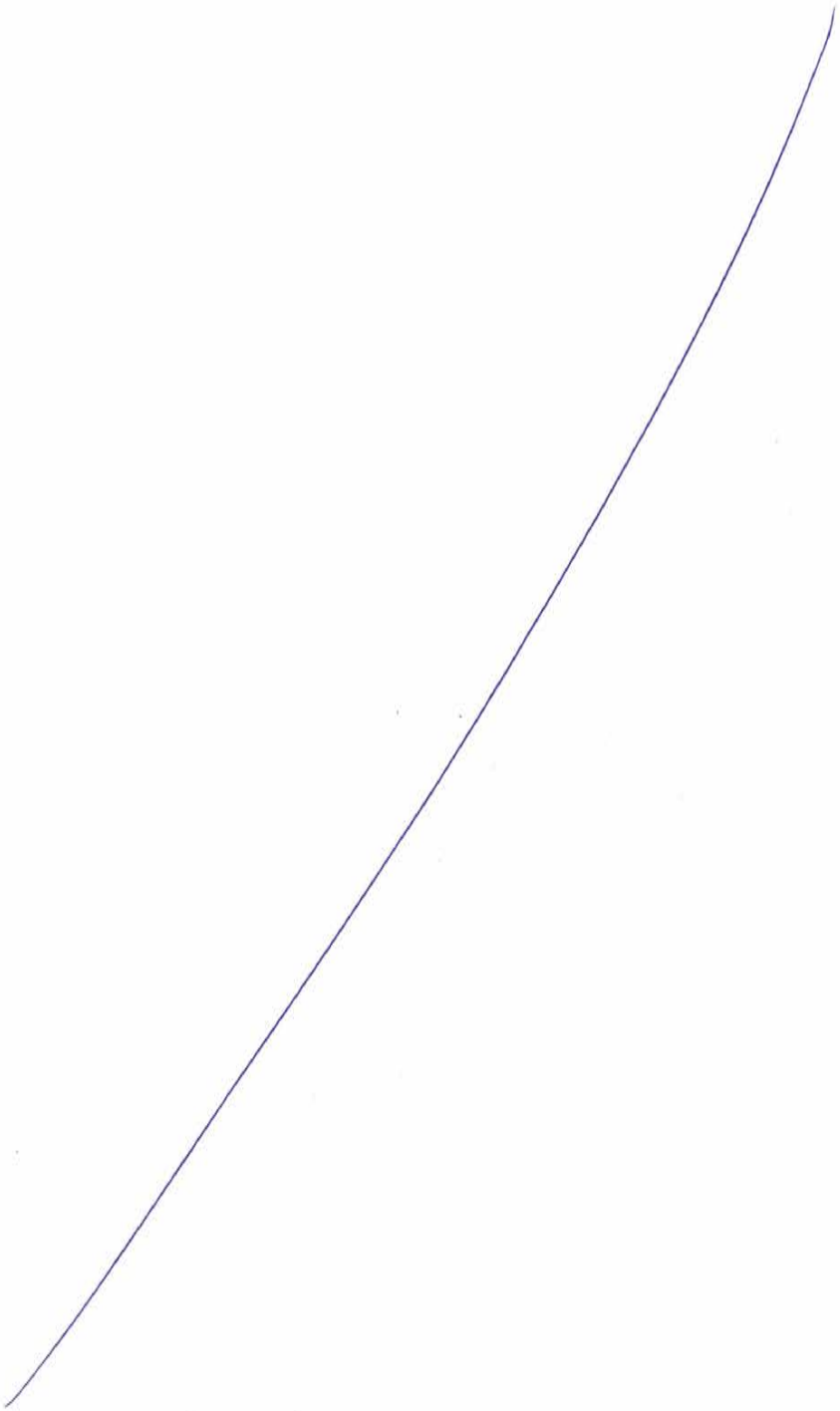
7259



		The four lane bridge (22m wide deck) is designed on single well foundation of 7.3m dia.
October 2015	March -2015	<p>Company: Ramboll: Ramboll India Pvt Ltd</p> <p>Project : <u>Consultancy Services for Post Bid Detailed Engineering Design of Harike bypass on NH-15 near Amritsar, Punjab</u></p> <p>Client: S.P. Singla Pvt Ltd</p> <p>Duration: October 2015 – March -2015</p> <p>Position : Project Director</p> <p>Outline of the Project: Involved in planning, design of 9km long 4lane highway which includes detailed design of 1.2 km long bridge across river Sutlej. The four lane bridge (22m wide deck) is designed on single well foundation of 7.3m dia.</p>
December 2014	December 2015	<p>Company: Ramboll India Pvt Ltd</p> <p>Project : <u>Consultancy Services for Post Bid Detailed Engineering Design of Package-II Agra- Lucknow Greenfield Expressway.</u></p> <p>Client: AFCONS</p> <p>Duration: December 2014- December 2015</p> <p>Position : Project Director</p> <p>Outline of the Project: Involved in planning, design of Package-II, 61 km long 6 lane greenfield expressway. The project includes design of road, major bridges, minor bridges</p>
September 2014	2015	<p>Company: Ramboll India Pvt Ltd</p> <p>Project : <u>Consultancy Services for Feasibility Study for Bridge across river Brahmaputra near Narengi in Guwahati in the State of Assam.</u></p> <p>Client: Public Works Department, Assam</p> <p>Duration: September 2014- 2015</p> <p>Position : Project Director</p> <p>Outline of the Project: Project is being carried out in Joint Venture of RITES, Ramboll & STUP. Ramboll is Involved in preparing scheme design of superstructures for of 650 long cable stay and 140m extradosed spans</p>
Dec 2013	2015	<p>Company: Ramboll India Pvt Ltd</p> <p>Project : <u>Consultancy Services for Proof Checking of 21 km Ganga Path at Patna in the State of Bihar.</u></p> <p>Client: Navyuga Engineering Ltd.- BSRDC</p> <p>Duration: Dec 2013- 2015</p> <p>Position : Project Director</p>



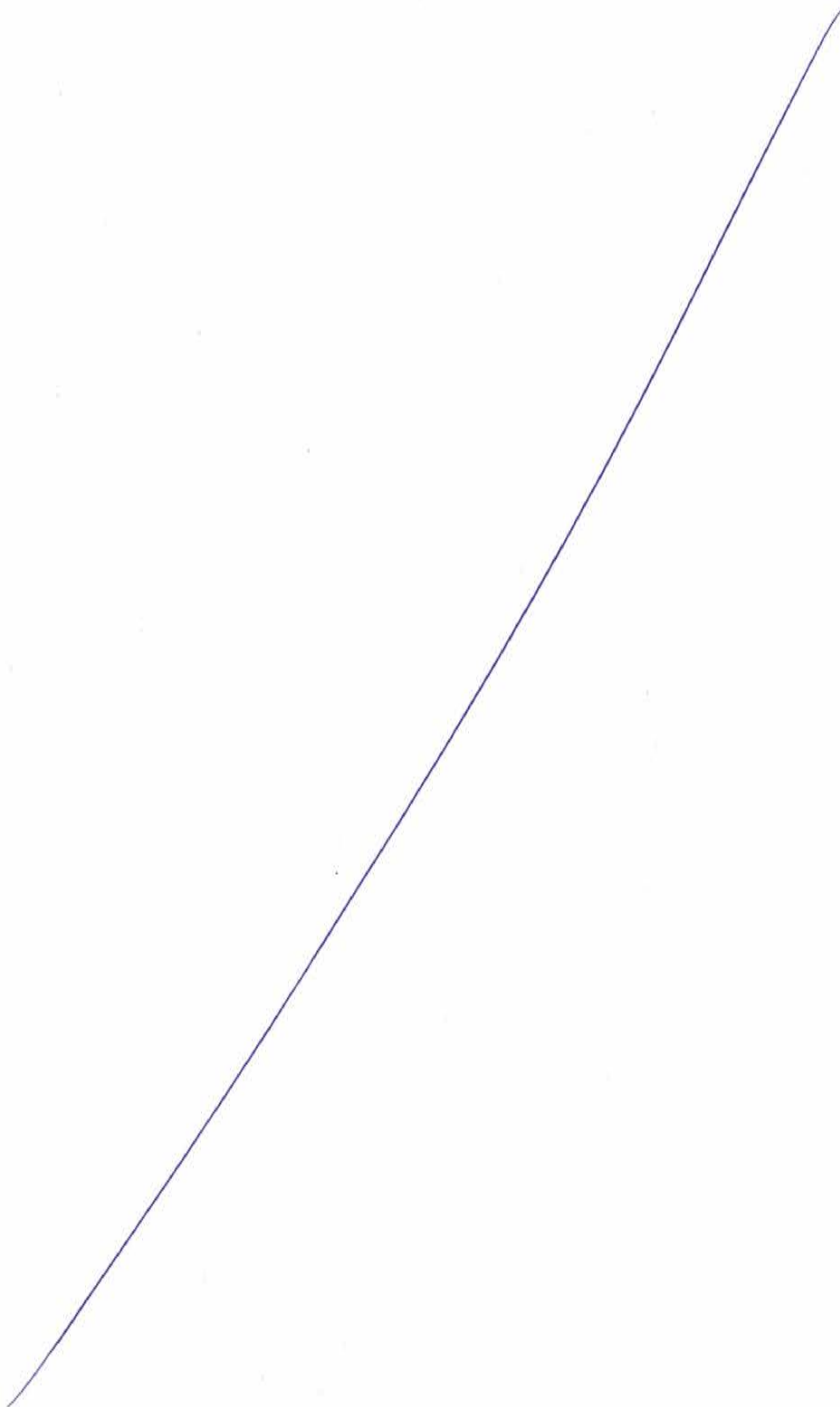
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		<p>Outline of the project: Involved in the proof checking of 21 km long road along the bank of Ganges in Patna. The project comprises of 7.6 km long bridge on the bank of Ganges and embankment of 19m high. Carried out rigorous non-linear analysis for design of large diameter deep piles in ganges having scour depth of 34 from lowest bed level</p>
2013	2015	<p>Company: Ramboll India Pvt Ltd Project : <u>Consultancy Services for Detailed Engineering for Upgradation of Bikaner-Suratgarh (2 lane) road section of NH-15 in the state of Rajasthan.</u> Client: MBL Infrastructures Ltd. Duration: 2013 - 2015 Position : Project Co-ordinator Outline of the project: Involved as a Project Co-ordinator in the detailed engineering for the upgradation of. The length of the project is 176kms</p>
2013	2015	<p>Company: Ramboll India Pvt Ltd Project : <u>Consultancy Services for Detailed Engineering for Upgradation of Bikaner-Suratgarh (2 lane) road section of NH-15 in the state of Rajasthan.</u> Client: MBL Infrastructures Ltd. Duration: 2013 - 2015 Position Held: Project Co-ordinator Outline of the project; Involved as a Project Co-ordinator in the detailed engineering for the upgradation of. The length of the project is 176kms</p>
2013	2014	<p>Company: Ramboll India Pvt Ltd Project : <u>Consultancy Services for Detailed Engineering for Upgradation of 6 Roads (Pkg-III A & Pkg IIIB in the state of Punjab.</u> Client: Punjab Infrastructure Development Board Duration: 2013 - 2014 Position : Project Co-ordinator Outline of the project: Involved as a Project Co-ordinator in the detailed engineering. The length of the project is 350 kms which comprises of 6 roads located in different parts of Punjab June 2009 : March 2013</p>
2012	2014	<p>Technical Director Gifford India Pvt Ltd</p>
2012	2014	<p>Company: Gifford India Pvt Ltd Project : <u>Consultancy Services for Detailed Engineering for a Six lane Bridge across River Falgu in Gaya</u> Client: Bihar Rajya Pul Nigam Limited. Duration: 2012 - 2014 Position : Senior Bridge Engineer Outline of the Project: Involved in the detailed engineering a six lane 570m long bridge across river Falgu in Gaya city. The bridge is having segmental superstructure resting on single pile foundation</p>



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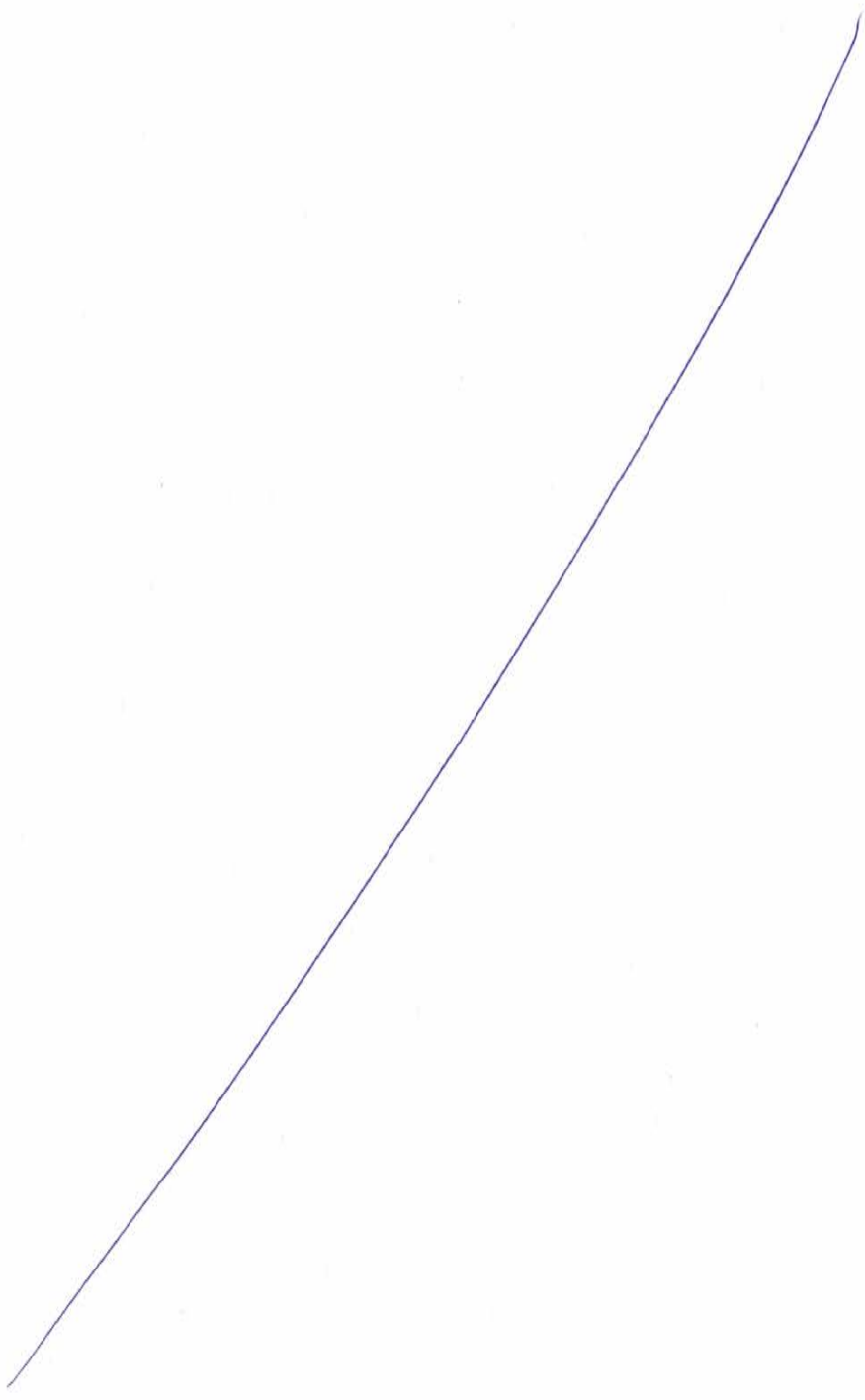
2012	2014	<p>Company: Gifford india Pvt Ltd Project: <u>Consultancy Services for Detailed Engineering for Upgradation of Seoni – Katangi (2 lane) road section of SH-54 in the state of Madhya Pradesh.</u> Client: MBL Infrastructures Ltd. Duration: 2012 - 2014 Position : Project Co-ordinator Outline of the Project: Involved as a Project Co-ordinator in the detailed engineering for the upgradation of Seoni – Katangi section of SH-54 in the state of Madhya Pradesh. The length of the project is 76kms</p>
2012	2014	<p>Company: Gifford india Pvt Ltd Project: <u>Consultancy Services for Detailed Engineering for Upgradation of Waraseoni – Lalbarra (2 lane) section of a MDR in the state of Madhya Pradesh.</u> Client: MBL Infrastructures Ltd. Duration: 2012 - 2014 Position : Project Co-ordinator Involved as a Project Co-ordinator in the detailed engineering for the upgradation of Waraseoni - Lalbarra section of MDR in the state of Madhya Pradesh. Outline of the Project: Waraseoni – Lalbarra road is a segment of MDR having total length of 18.340kms</p>
2011	2014	<p>Company: Gifford india Pvt Ltd Project: <u>Consultancy Services for Preparation of DPR for Two-laning of Muzaffarpur - Barauni Section of NH-28 from km 519.00 to km 627.00 in the State of Bihar under NHDP III on Design, Build, Finance, Operate and Transfer (DBFOT) basis</u> Client: KNR/ JKM Infra Projects Ltd. Year: 2011 – 2014 Outline of the project:: Involved as a Project Coordinator in the preparation of detailed project report for Two Laning of Muzaffarpur – Barauni section of NH-28 in the state of Bihar. The total project length is 108kms.</p>
		<p>Company: Gifford India Pvt Ltd Project: <u>Proof Checking of Substructure & Superstructure of Design and Construction of 317.5 mtr long PSC Bridge over River Govind Sagar at Bagchhal, Himachal Pradesh.</u> Client: Gammon India Ltd. Position : Senior Bridge Engineer Outline of the Project: As a Senior Bridge Engineer, involved in the review of design & drawings for Superstructure, Substructure & Foundations of 317.5m long bridge over river Govind Sagar at Bagchhal, Himachal Pradesh. The Bridge comprises of 185m central span to be constructed on balanced cantilever technique</p>



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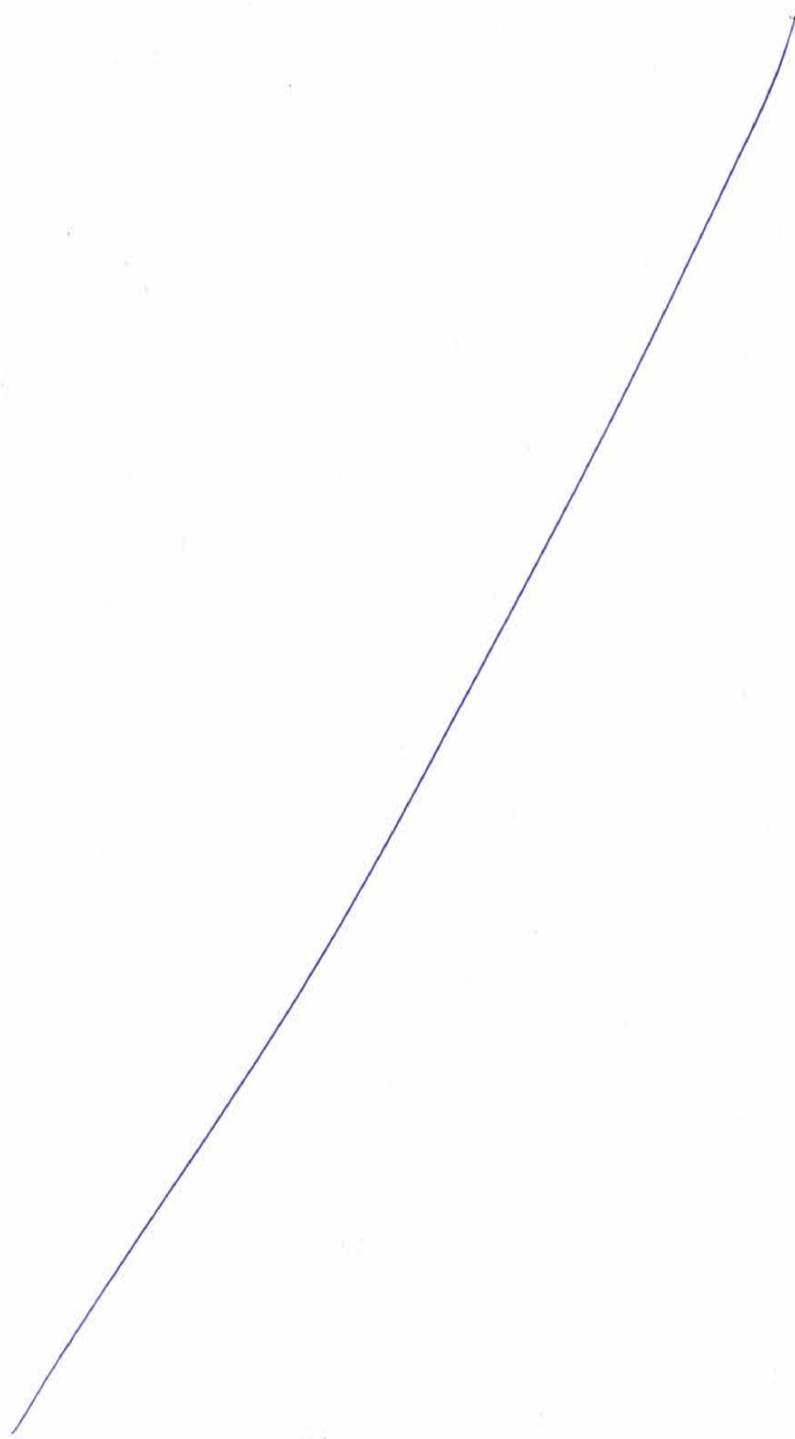
		<p>Company : Gifford India Pvt Ltd</p> <p>Project: <u>Design Consultancy Services for Upgradation to 2 Lane with paved shoulder configuration of Chapra - Gopalganj section of NH-85 in the state of Bihar.</u></p> <p>Client: Abhijeet Projects Ltd., Nagpur</p> <p>Duration: 2011 – 2013</p> <p>Position : Team Leader of the Design team</p> <p>Outline of the project: As a Team Leader for the Design Team, involved in the preparation of Detailed Design & Good for construction drawing for the concessionaire and getting the approval from Independent Consultant of NHAI for up-gradation of Chapra - Gopalganj section of NH-85 to 2 Lane with paved shoulder configuration in the state of Bihar. The Project Includes 4 ROB's, 2 Major Bridges, 2 Minor Bridges & Culverts. The Total Length of project is 94.7kms</p>
2010	2011	<p>Company: Gifford India Pvt Ltd</p> <p>Project: <u>Consultancy Services for Detailed Design and Drawings for Four Laning of Barhi to Hazaribagh section of NH-33 from Km. 0.00 to Km. 41.313 in the state of Jharkhand.</u></p> <p>Client: Abhijeet Projects Ltd., Nagpur</p> <p>Duration: 2010 – 2011</p> <p>Position Held: Team Leader of the Design Team</p> <p>Outline of the project: As a Team Leader for the Design Team, involved in the preparation of Detailed Design & Good for construction drawing for the concessionaire and getting the approval from Independent Consultant of NHAI for Four Laning of Barhi to Hazaribagh section of NH-33 from Km. 0.00 to Km. 41.313 in the state of Jharkhand. The project includes detailed design of 3 major bridges across rivers Barhi (3x20m), Kweta (3x20m) & Siwaney (4x20m). The total length of the project is 41.313kms.</p>
2010	2012	<p>Company:</p> <p>Project: <u>Consultancy Services for Detailed Engineering for Four Laning of Patna – Bakhtiyarpur section of NH-30 from Km 181.300 to Km 231.950 in the state of Bihar under NHDP Phase III DBFOT (Toll) Basis.</u></p> <p>Client: BSC – C&C Consortium</p> <p>Duration: 2010 – 2012</p> <p>Position : Team Leader of the Design Team</p> <p>Outline of the project: As a Team Leader for the Design Team, involved in the preparation of Detailed Design & Good for construction drawing for the concessionaire and getting the approval from Independent Consultant of NHAI for Four Laning of Patna – Bakhtiyarpur section of NH-30 from Km 181.300 to Km 231.950 in the state of Bihar. The project includes detailed design of 2 ROB's, 3 Grade separators, 1 Major Bridges, 11 Minor Bridges, 7 PUPs & culverts. The total project stretch is 50.</p>



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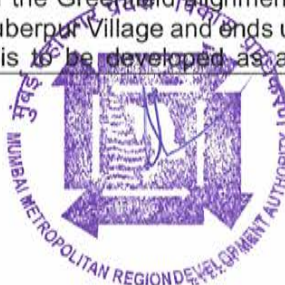
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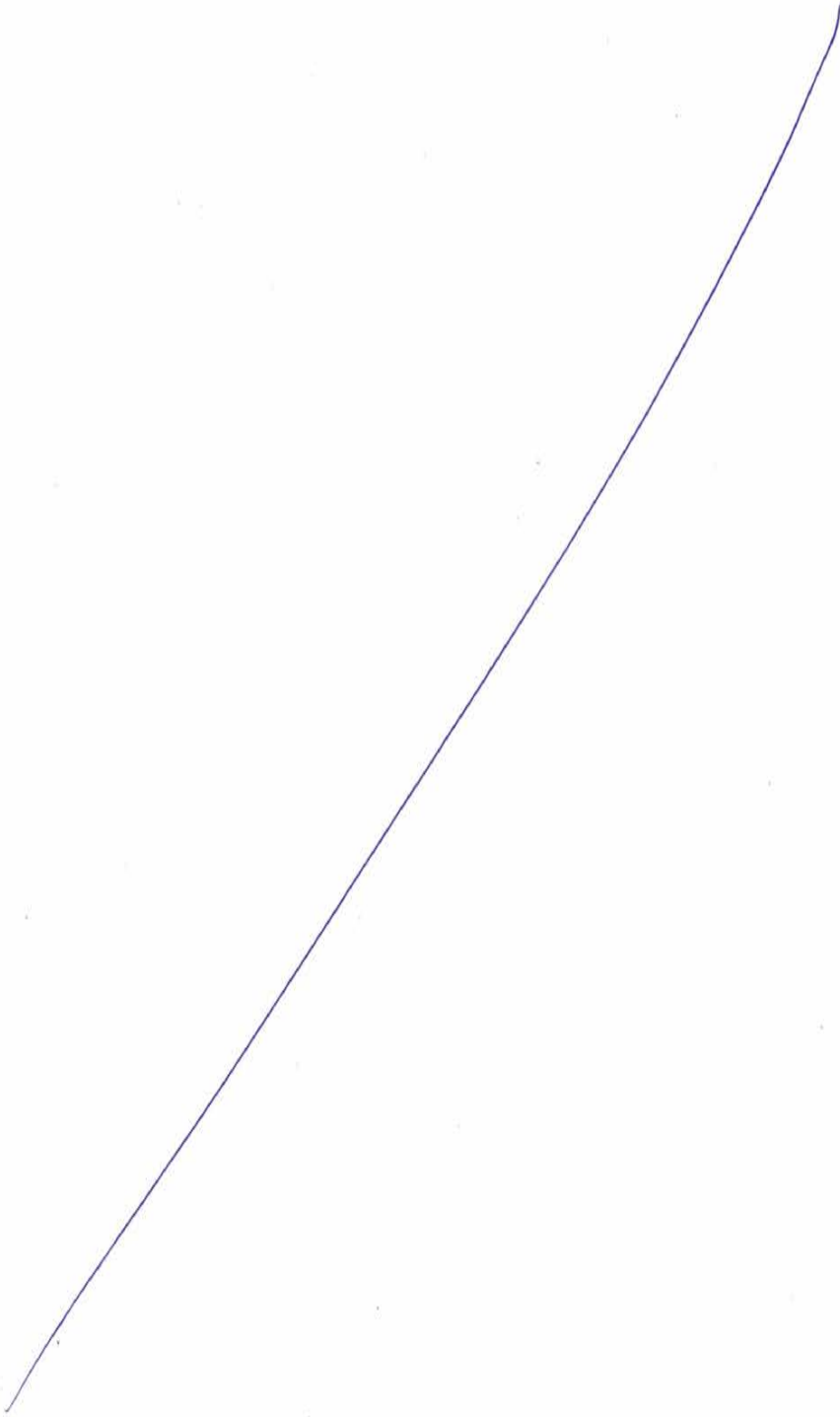


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2010	2012	<p>Company: Gifford India Pvt Ltd Project: <u>Consultancy Services for Two Laning with paved shoulders of Muzaffarpur - Sonbarsa section of NH-77 from Km 2.8 to Km 89.000 in the state of Bihar under NHDP Phase III DBFOT Basis</u> <u>. Length of the project is 86.2kms</u> Client: BSC-C&C Consortium Location: India Duration: 2010 – 2012 Positions : Project Manager / Senior Bridge Engineer Outline of the Project: Activities Performed: Detailed Design of 1 major bridge, 22 minor bridges, 3 ROBs and culverts. These bridges lie in high seismic zone of IV & V and the subsoil is highly liquefiable potential. The span configuration varies from 18m to 30m consisting of simply supported span with well / pile foundation. The total length of bridges is around 625m with deck width of 12m i.e. (750 sq.m of deck area). The total length of the project is 86.20kms.</p> <hr/> <p>Company: Gifford India Pvt Ltd Project: <u>Consultancy Services for Preparation of Detailed Project Report for Six Laning of Dewas - Indore section of NH-3 from Km 577.550 to Km 610.000 and from Km 0.000 to Km 12.600 of National Highway No.3 in the state of Madhya Pradesh. Length of the project is 45.05kms.</u> Client: Dewas Indore Tollways Ltd. Duration: 2010 – 2013 Position : Project Manager Outline of the Project: As a Project Manager, was involved in the preparation of detailed project report for six laning of Indore – Dewas section of NH-3 from Km 577.550 to Km 610.000 and from Km 0.000 to Km 12.600 of National Highway No.3 in the state of Madhya Pradesh. The project consists of both Rigid & Flexible pavements. The total length of the project is 45.05kms. The project includes the design of continuous bridge across river Shipra having span arrangement of 6x37.10m, Four flyovers design as continuous structures, VUP and PUP</p>
2009	2010	<p>Company: Gifford India Pvt Ltd Project: <u>Preparation of Detailed Project Report for development of Inner Ring Road in Agra (Senior Bridge Engineer) Client: Jay Prakash Ventures Ltd. Length of the project is 27kms</u> Client: Jaypee Associates Ltd. Duration: 2009 – 2010 Position : Senior Bridge Engineer Outline of the Project: involved as a Senior Bridge Engineer for the Preparation of Detailed Project Report for development of Inner Ring Road in Agra. The length of the Greenfield alignment is 27 kms which starts from NH-2 near Kuberpur Village and ends up at NH-3 near Village Rohta. The section is to be developed as a 6 lane road configuration</p>



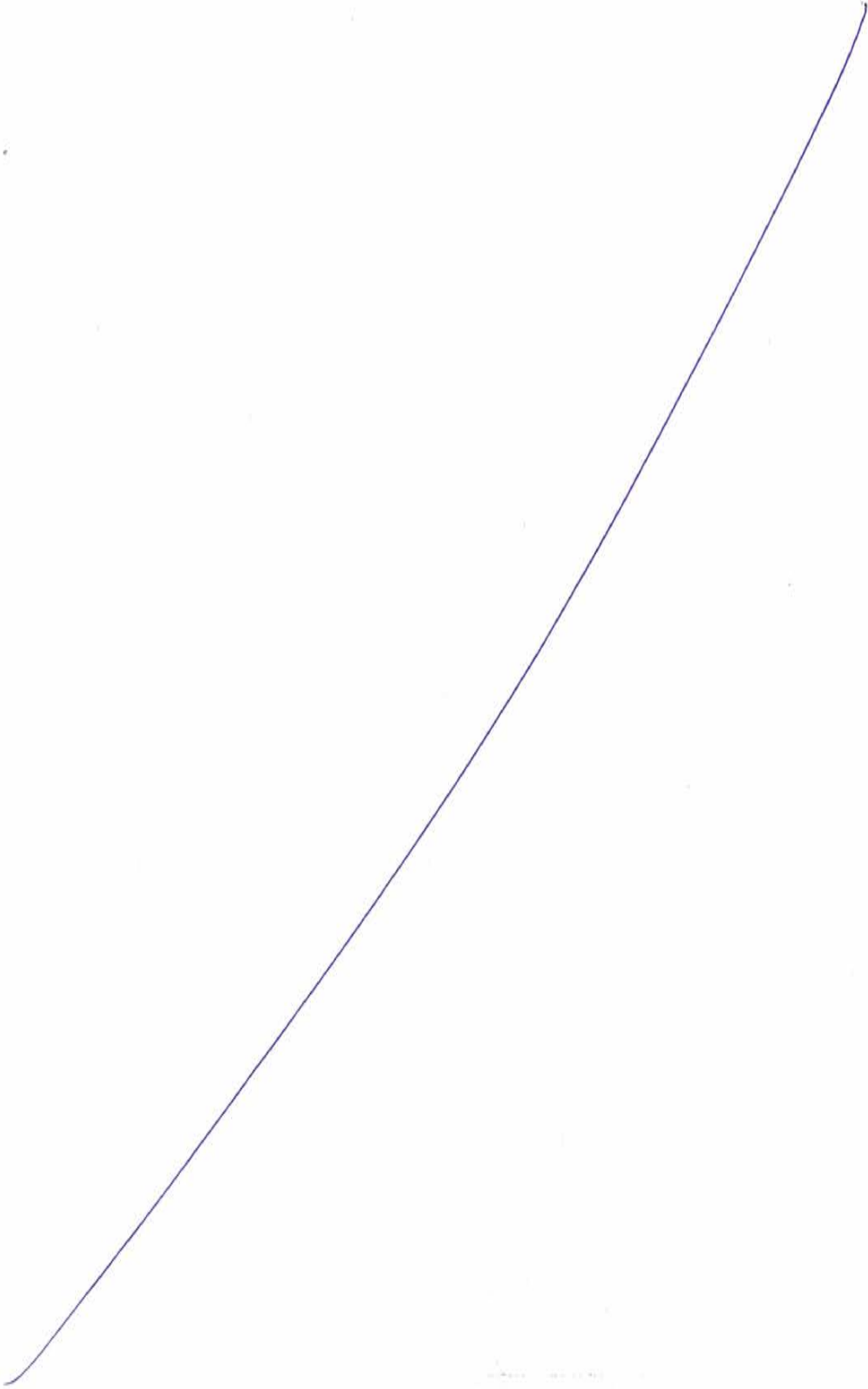
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		<p>extendable to 8 lane. The project is extension of under construction Yamuna Expressway from Greater Noida to Agra. The project includes the detailed design of 2.5km elevated road on Fatehabad road and 3.3km at grade road for a smooth connection to Taj Mahal for the users using Yamuna Expressway. The project comprises of three full clover leaf interchanges.</p>
2009	2010	<p>Company: Gifford India Pvt Ltd Project: <u>Feasibility Study for 4 Laning with paved shoulders from Pinjore to Nalagarh in the state of Himachal Pradesh Client: HP PWD, Length of the project is 35kms.</u> Client: Himachal Pradesh PWD Duration: 2009 – 2010 Position : Project Manager cum Senior Bridge Engineer Outline of the Project: Involved as a Project Manager cum Senior Bridge Engineer for preparation of Feasibility Report. The Project includes 7.7 Km of Pinjore Bypass as a major connecting link between NH-22 & NH-21A. The project includes 5 Major Bridges & 22 Minor Bridges, 1 RUB, 5 VUP's & Culverts</p>
2009		<p>Company: Gifford India Pvt Ltd Project: <u>Detailed design of 7 underpasses for expansion of Abu Dhabi International Airport as sub consultancy from main consultant DIWI Emirates.</u> Client: DIWI Consult Duration: 2009 Position : Team Leader of the Design Team Company: Gifford India Pvt Ltd Outline of the Project: As a Team Leader of the Design Team, the services rendered include detailed design, preparation of BOQ for 7 underpasses for Expansion of Abu Dhabi International Airport Project. 3 underpasses are designed for A380 Airbus loading and rest all with AASHTO HL-93 loading. The designs are carried out based on guidelines of AASHTO LRFD 2007.</p>
2009		<p>Company :Gifford India Pvt Ltd Project: <u>Proof Check of design & drawings for Two Skew Bridges (Skew angles 58 & 72 degree) on Javer Distributory on Yamuna Expressway connecting Greater Noida & Agra for Jay Pee Ventures Ltd. –</u> Position:Team Leader of Design Team Client: Jaypee Associates Ltd Duration: 2009 Location: India Outline of the Project: Involved in proof checking two bridges on Javer Distributory crossing Yamuna Expressway having skew angle of 54 & 72 degree. Bridges consists of Pre cast Post tension girders and RCC deck slab resting on highly liquefiable soil on pile foundation.</p>



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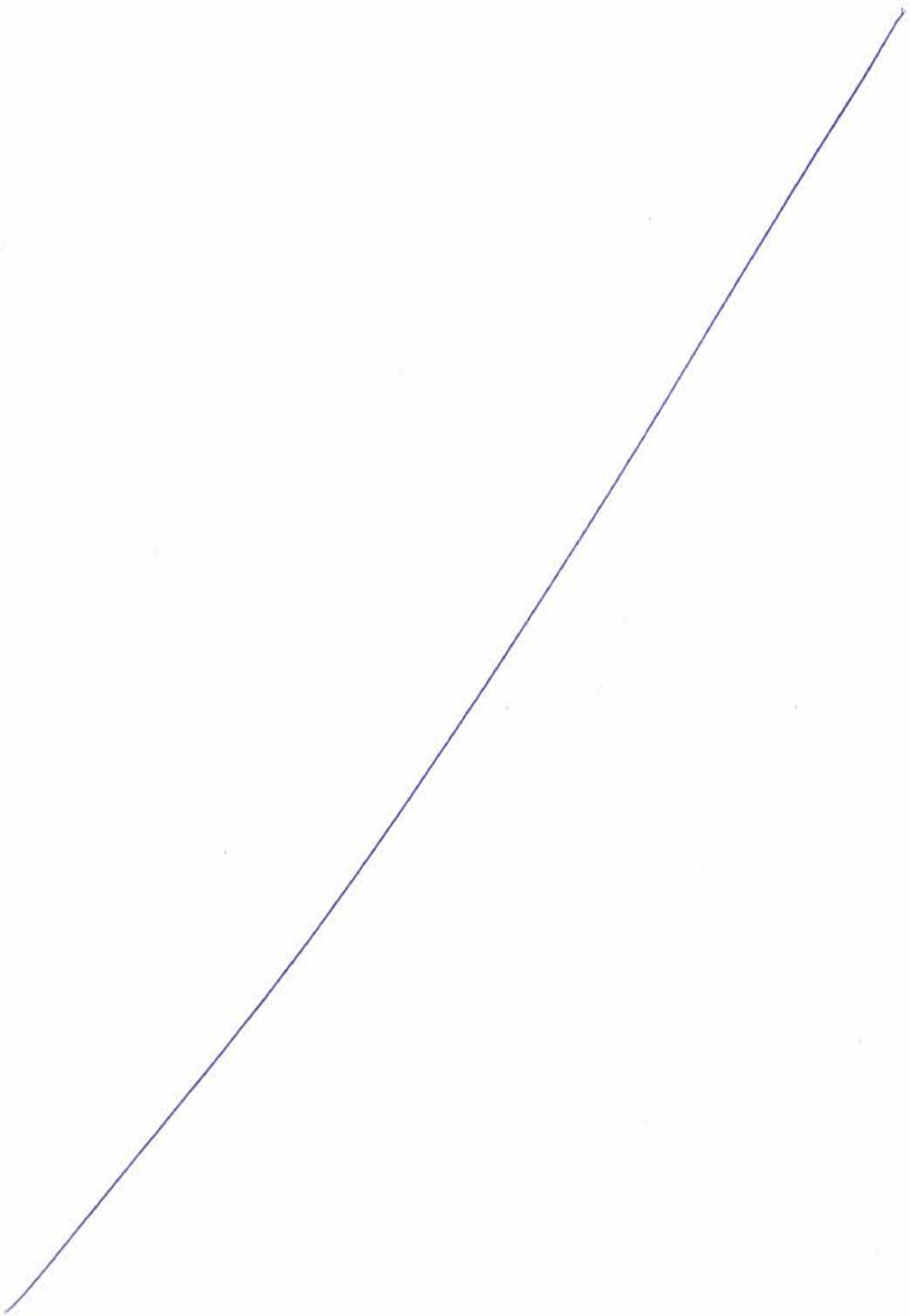


2008	2009	<p>Company : Gifford India Pvt Ltd</p> <p>Project: <u>Detailed Design of 5 underpasses to be constructed by "Push Box" technology from Rajiv Chowk to Toll Plaza section of NH-8 in Gurgaon and Feasibility Study of Elevated corridor of the stretch as extended consultancy contract</u></p> <p>Client: National Highway Authority of India</p> <p>Duration: 2008 to Nov 2009</p> <p>Position : Sr. Bridge Engineer</p> <p>Outline of the Project: Gifford Pvt. Ltd & Gifford Ltd, UK was commissioned by National Highway Authority of India for Detailed Engineering of underpasses on operational expressway stretch of NH-8. The 5 underpasses would be designed based on "push box" technology across the busiest section of NH-8. The length of push box underpasses designed is 65m</p>
February 2008	June 2009	<p>Associate Diector Gifford India Pvt Ltd</p>
2008	2009	<p>Company:</p> <p>Project: <u>Detailed Design of N9/N10 Kilcullen to Waterford Scheme Phase-3: Kilcullen to Carlow. –</u></p> <p>Client: Kildare County Council, Ireland</p> <p>Duration: 2008 to 2009</p> <p>Position : Team Leader of the Design Team</p> <p>Outline of the Project: The project was outsourced by Gifford UK to Gifford India to carry out the design of Integral bridges on project road. Project comprises of design of 19 bridges having pre tensioned U & I-beams integral with piers and bank seated abutments. Bridge Design is undertaken on SAM Leap Software accustomed to British Standards.</p>
2008	2009	<p>Company:</p> <p>Project: <u>Consultancy Services For Preparation of Feasibility Cum Preliminary Project Report for Construction of Major Road Bridge Across River Ganges & 45.40kms long approach road connecting Bakhtiyarpur and Shahpur Patori to be executed on BOT/Annuity/any other PPP format on DBFO pattern.</u></p> <p>Client: IL&FS Infrastructure Development Corporation Limited (IL&FS)</p> <p>Duration of Services: 2008 to 2009</p> <p>Position : Team Leader cum Sr. Bridge Engineer</p> <p>Outline of the Project: The project includes 5500m long (4 lane) bridge with 2250m as navigational spans of 125m each resting on Double D type well 65m deep foundations and 3250m as non navigational spans. The project also includes the approaches of 45.40km long Greenfield alignment connecting NH-31 and NH-28. The project also includes 2 Grade Separators, 2 Rail Over Bridges and 2 Major Bridges.</p>



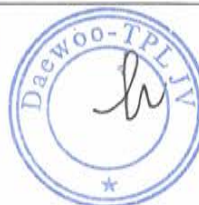
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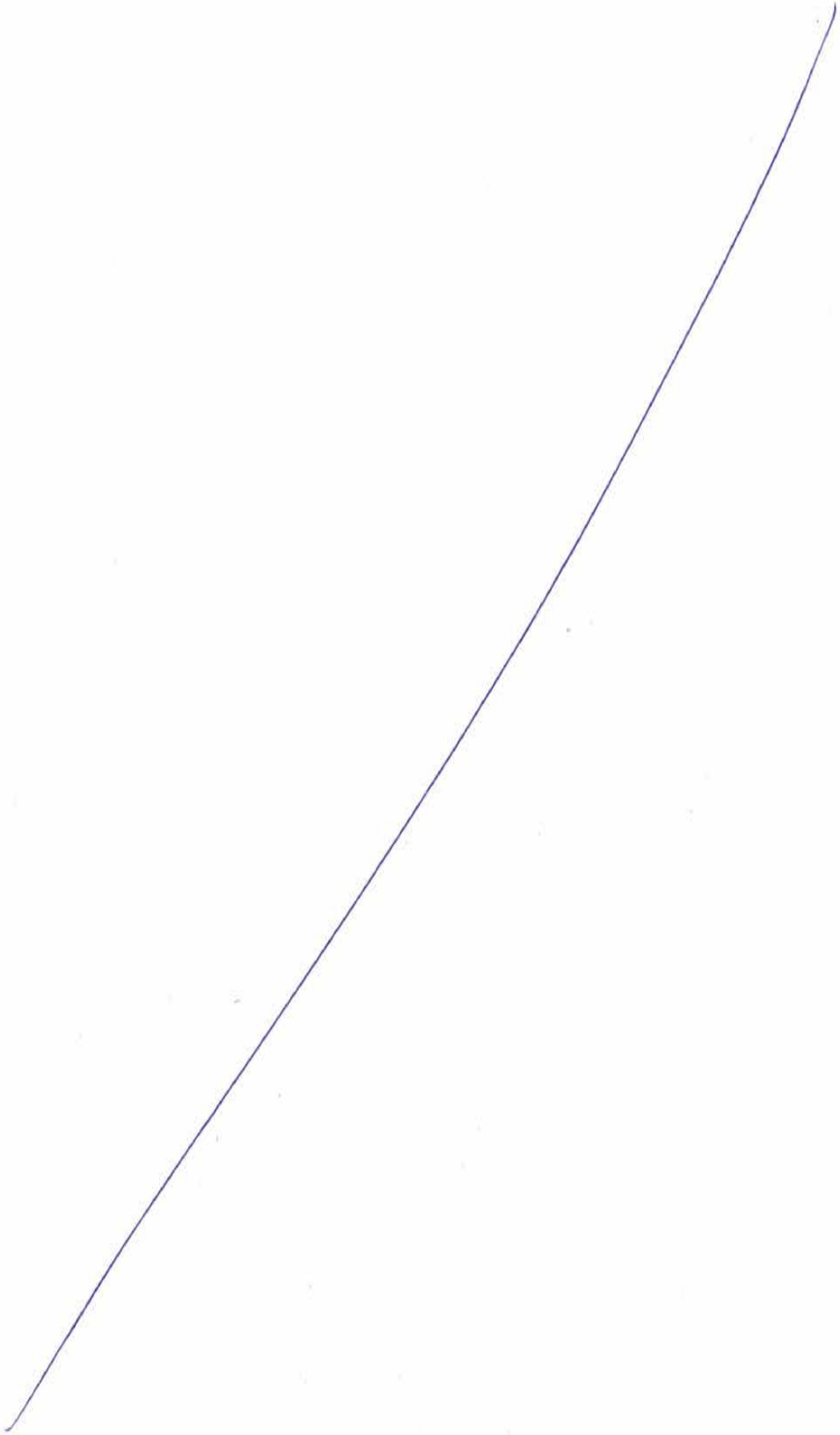


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2008	2009	<p>Company:</p> <p>Project:</p> <p>Consultancy Services for Preliminary Design for Mumbai WFSL project (Worli to Haji Ali) – Phase IIA.</p> <p>Client: JV of Gammon India & Dragados</p> <p>Duration of Services: 2008 to 2009</p> <p>Position : Team Leader of Design Team</p> <p>Outline of the Project:</p> <p>The competitive scheme a 3.3 km long bridge structure in sea was prepared for JV of Gammon & Dragados. The scheme comprises of dual four lane (15.5m) carriageway having continuous box girder of 300 m length span 60m built in with pier. Each carriageway is supported on monopile embedded in hard rock. The project includes the design of connectors crossing the main sea link.</p>
June 2007	January 2008	<p>Deputy General Manager (HW)</p> <p>RITES Ltd</p>
2007	2008	<p>Company: RITES LTD</p> <p>Project:</p> <p>Development of 8-lane access controlled Ganga Expressway from Greater NOIDA to Ghazipur-Ballia on Public Private Partnership</p> <p>Client: Government of Uttar Pradesh</p> <p>Duration: 2007 to 2008</p> <p>Position : Senior Bridge Engineer</p> <p>Outline of the Project:</p> <p>Responsible for preparation of RFQ (Request for Qualification) and setting of criteria, pre qualification of bidders based on criteria set in RFQ. Preparation of RFP which includes technical, non technical schedule and concession agreement. Evaluation of bid and selection of concessionaire and recommending its appointment to GoUP. Preliminary design of major structures across river Ganges and preparing General arrangement drawings. The project involves preparation feasibility study of two packages of Ganga Expressway involving 500 km length</p>
2007	2008	<p>Company: RITES LTD</p> <p>Project:</p> <p>Proof Checking of Major Bridges (>60m) falling on Agra Bypass section of North-South Corridor</p> <p>Client: National Highway Authority of India</p> <p>Duration: 2007 to 2008</p> <p>Location: India</p> <p>Position: Bridge Engineer</p> <p>Outline of the Project:</p> <p>As a Bridge Engineer, was responsible for proof checking of design and drawings of consultant and issue of "Good for Construction" drawings for 2 flyovers and one major bridge (250m length). The structural component includes, deep foundations (well and pile), substructure consisting of wall type and spill through abutments, wall/circular/hollow piers and cantilever/corbel pier caps and RCC and PSC superstructure.</p>



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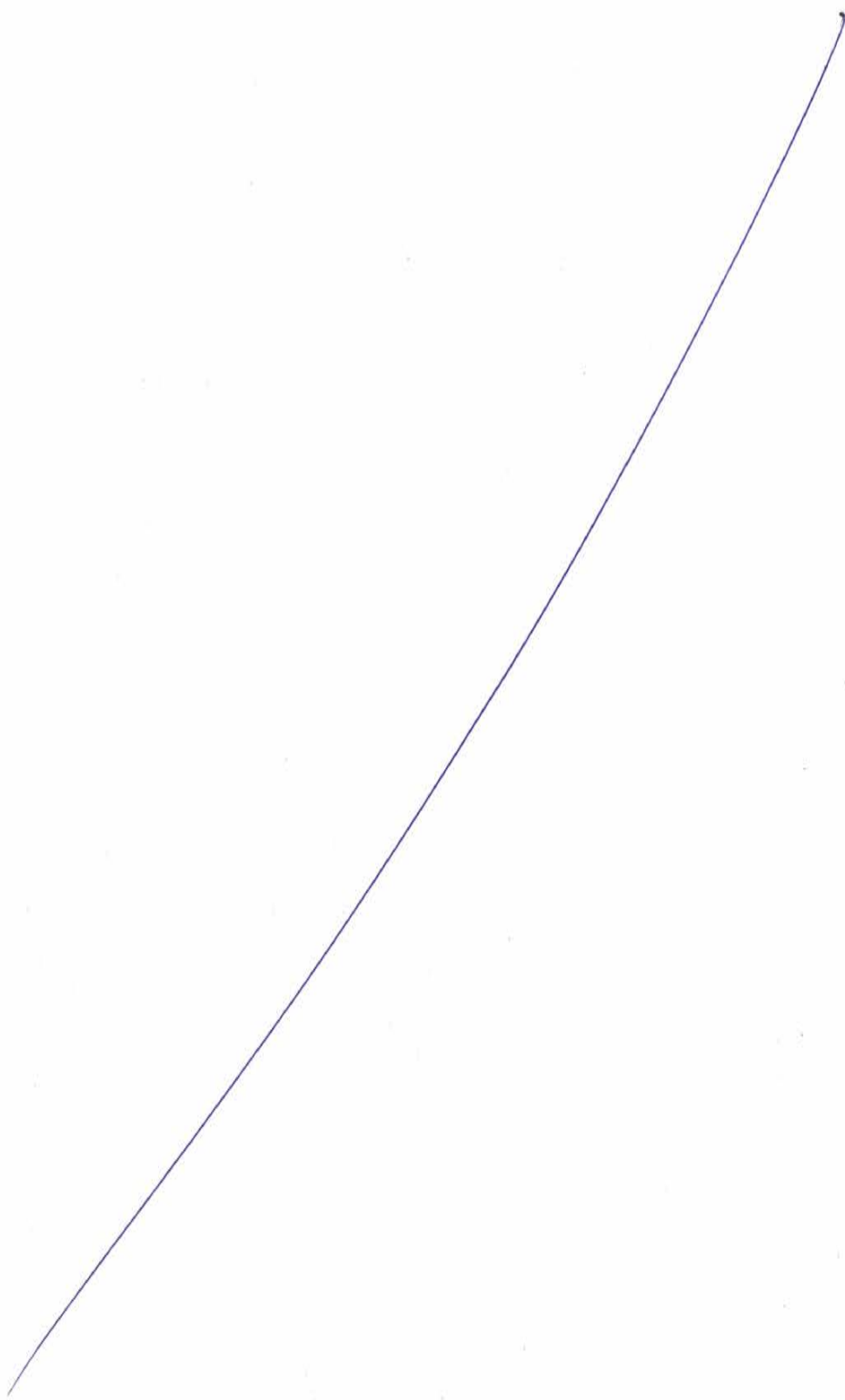


2007	<p>Company: RITES LTD Project: <u>Field Investigation, detailed engineering and preparation of Tender Documents for Tshesbe- Masunga Road, Consultancy value : Pula 2.0 million for Roads Department of Government of Botswana.</u> Client: Road Department, Govt. of Botswana Duration: 2007 Position : Team Leader & Project Manager Outline of the Project: Responsible for preparation of Detailed Project Report which includes design of highway, pavement, drainage system, Tender documentation and coordinating the multi-disciplinary team for 2 lane with paved shoulders highway (2 x 3.75m + 2.5m paved shoulder on both sides) having length of 32 km connecting Tshesebe - Masunga in Botswana. The design was based on BS and SABS (South Africa Bureau of Standards) to be constructed on open and pile foundations respectively.</p>
	<p>Company: RITES LTD Project: <u>Proof Checking of Major Bridges (>60m) falling on Jalandhar-Pathankot Section of NH-1A of North-South Corridor.</u> Client: National Highway Authority of India Position: Bridge Engineer Outline of the Project: Responsible for proof checking of design and drawings of consultant and issue of "Good for Construction" drawings for major bridges. The structural component includes, deep foundations (well and pile), substructure consisting of wall type and spill through abutments, wall/circular/hollow piers and cantilever/corbel pier caps and RCC and PSC superstructure. The project includes the proof checking of bridge across river Beas having 42m long 16m spans (672m) resting on deep well foundation.</p>
	<p>Company: RITES LTD Project: <u>Detailed Project Report of Raiganj- Dalkola Section of NH-34 in West Bengal.</u> Client: National Highway Authority of India Position : Bridge Engineer Outline of the Project: Detailed design of structural components, preparation of tender documents based on FIDIC guidelines, submission of construction drawings and preparation of specifications. The project includes 3 Major bridges (170m, 62m & 80.7m length) having PSC box, RCC T-beam superstructure and well foundation in stiff clay strata. 13 minor bridges with box type structures. One flyover consisting of 36m span having PSC girder superstructure resting on pile foundation. 2 Rail Over bridges with PSC superstructure resting on pile foundations.</p>



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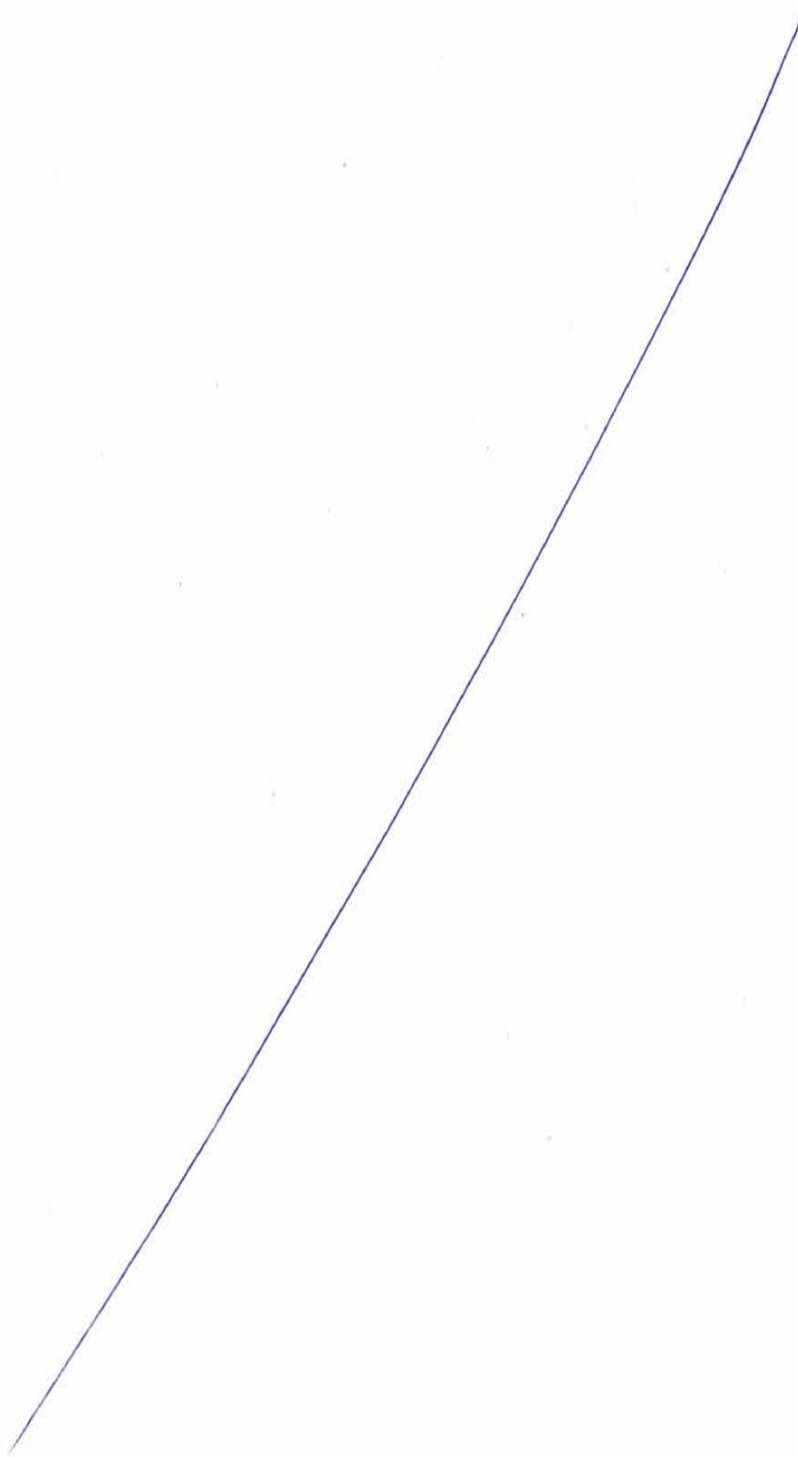
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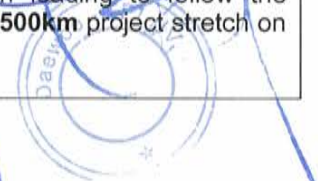
April 2004	June 2007	RITES Africa Ltd., Botswana Director
April 2004	June 2007	<p>Duties: Carrying out technical coordination of various infrastructure projects being undertaken by RITES in Botswana and SADC region. Preparation of Technical and Financial proposals ; The following projects have been secured through competitive bidding and completed within time schedule with my input as:</p> <p>Project Manager cum Team Leader: Field Investigation, Detailed Design and Tender documentation and construction supervision of Road Network comprising of 112 km length having 2 lane with paved shoulder and Drainage System for Pandamatenga Commercial farms, Botswana, 2002-04</p> <p>Project Manager Cum Team Leader : Field Investigation, detailed engineering and preparation of Tender Documents for 85 km Francistown- Ramokgwebana Road, Consultancy value : Pula 2.0 million for Roads Department of Government of Botswana. The project consists of two lanes of 3.75m each and with paved shoulder of 2.5 m</p> <p>Detailed Project Report includes design of drainage system consisting of 86 minor structures and 2 bridges (> 60m length). The detailed design of road and bridges is carried out on BS and SABS standards.</p> <p>Bridge Engineer: Preparation of bridge inventory and up gradation of Bridge Management System software for Botswana Public Highway Network, Client: Roads Department, Government of Botswana, Consultancy value : Pula 0.8 million</p> <p>Consultancy includes inventorisation of 150 bridges on Botswana Public Highway Network and up gradation of Bridge Management System (BMS). The study includes preparation/up gradation of Inventory Module based on DER (Degree, Extent and Relevancy) rating, Budget Module, Map Module and Maintenance Module. Recommendations for rehabilitation/retainability of critical existing bridges found during field study through out put generated by BMS software based on DER rating. CSIR-Pretoria South Africa is our sub-consultant for this project.</p>



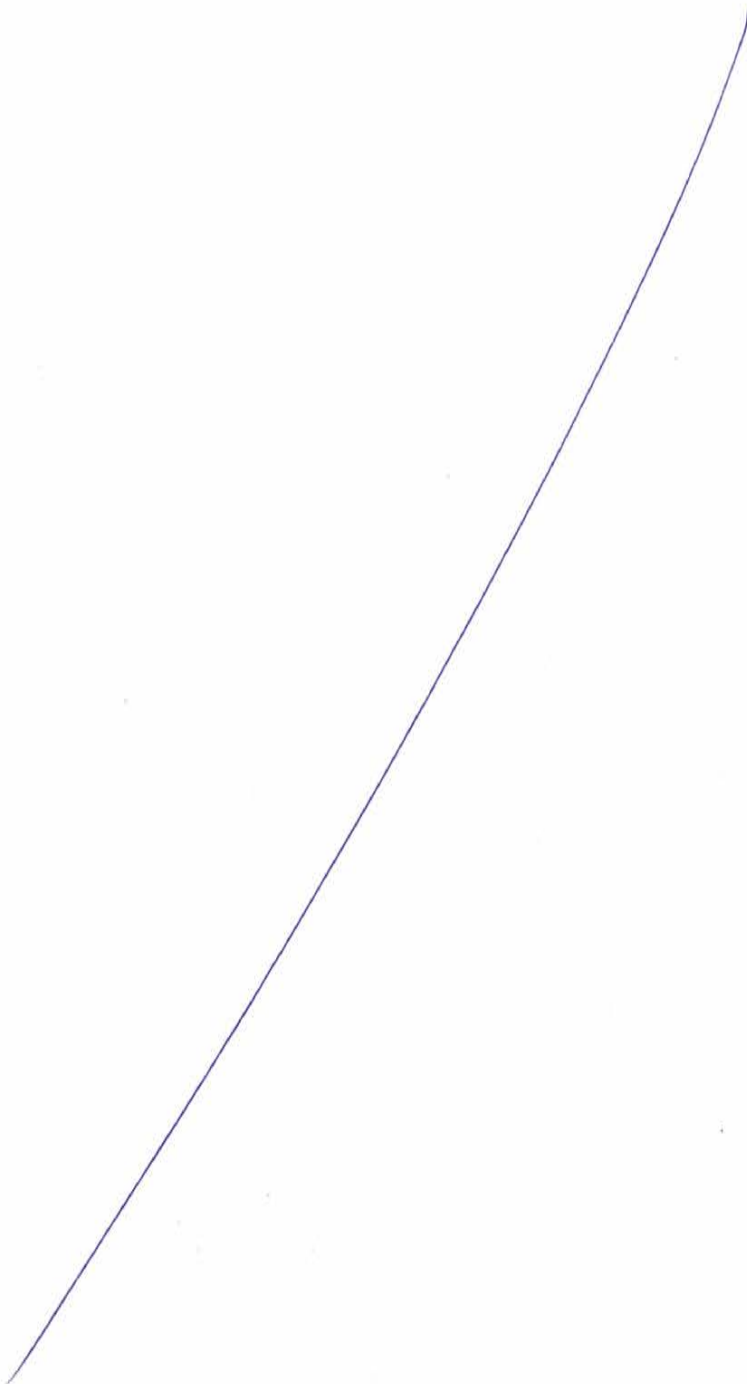
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March 2003	March 2004	Manager (HW)	RITES Ltd
March 2003	March 2004	<p>Company: RITES LTD Project: <u>Company Detailed Design for Widening to 4 lanes and Rehabilitation of Existing 2 lane carriageway of NH Section in State of Gujarat</u> Client: National Highway Authority of India Duration: 2003 to 2004 Location: Gujarat, India Position: Bridge Engineer, was responsible for detailed design of all component of highways, preparation of plan & profile preparation of tender documents based on FIDIC guidelines, submission of construction drawings, preparation of specifications. Outline of the Project: Project is 500 km road length and part of prestigious East West Corridor under NHDP with estimated cost US \$450 million, funded by Asian Development Bank.</p>	
2003		<p>Company: RITES LTD Project: <u>Detailed Project Report Preparation for Chennai Bypass Phase-1 and Phase-II connecting NH-4 & NH-5 passing through Ambattur Industrial Estate in Tamil Nadu.</u> Client: National Highway Authority of India Duration: 2003 Location: Tamil Nadu, India Position : Bridge engineer Outline of the Project: Was involved as Bridge Engineer in detailed design, submission of construction drawings, preparation of specifications, bill of quantities and ICB documents for 6 lane 5.0 km long Chennai bypass Phase-1 Phase-2.</p>	
2003	2004	<p>Company: RITES LTD Project: <u>Proof checking of Feasibility Study & Detailed Project Report for Rehabilitation and Upgrading to 4/6-lane Divided carriageway Configuration of East-West Corridor in the State of Gujarat, Madhya Pradesh, Rajasthan and UP.</u> Client: National Highway Authority of India Duration: 2003 to 2004 Location: Madhya Pradesh, India Position: Bridge engineer Outline of the Project: Was involved in the review and Proof checking of design and drawings of design consultants deployed by the client. The duties include preparation generalized approach leading to follow the uniform design standard for consultant for 500km project stretch on East-West Corridor.</p>	



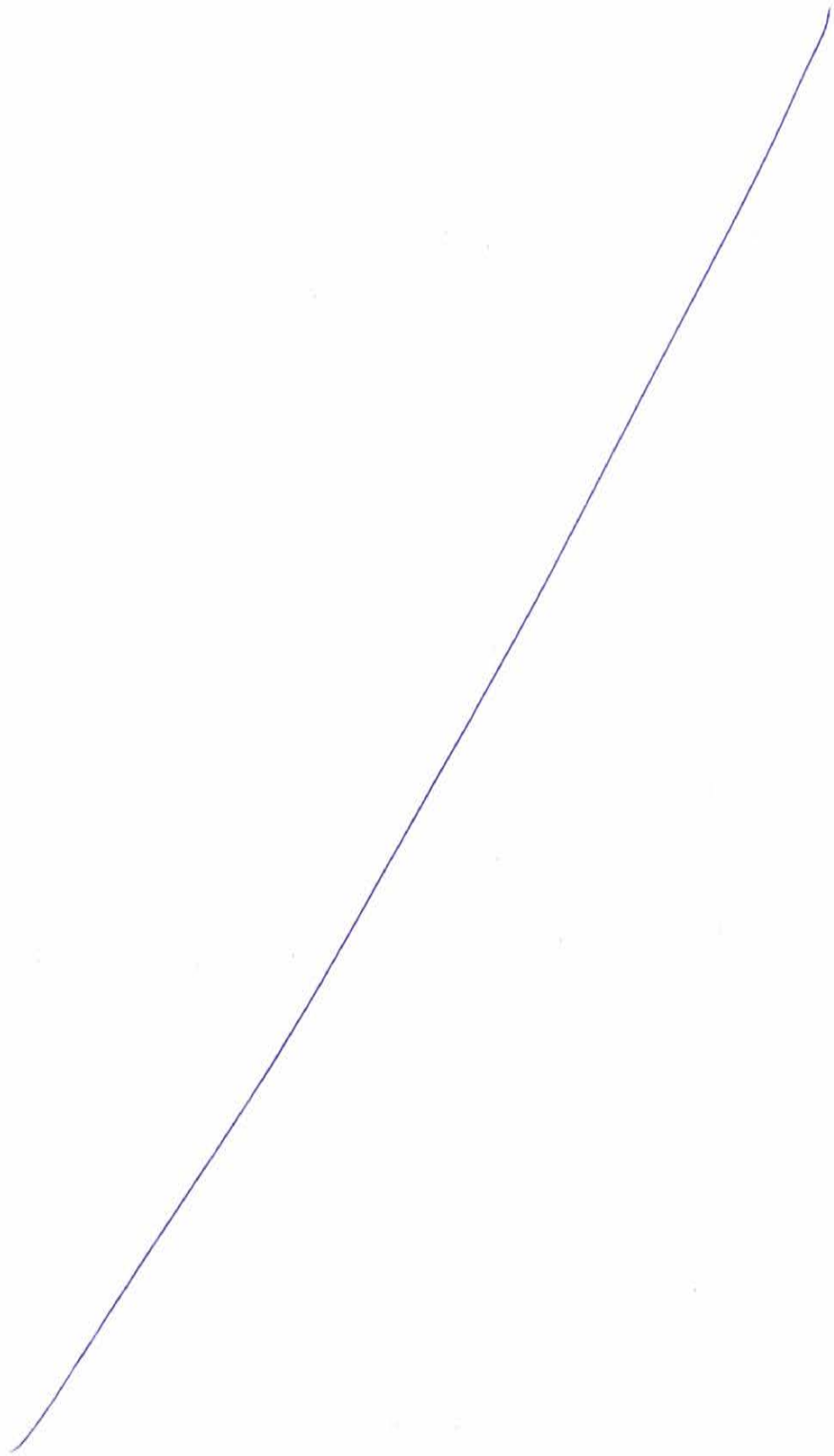
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October 2001	March 2003	<p>Senior Bridge Engineer ,</p> <p>Deputed to World Bank Division as a Team of Expert to NHAI (National Highway Authority of India) from RITES</p>
		<p>Company: Rites Ltd</p> <p>Project:</p> <p><u>Grand Trunk Road Improvement Project (GTRIP) 420 km in length, estimated cost US \$ 756 million.</u></p> <p><u>Allahabad Bypass Project , 85 km in length and estimated cost US \$ 250 million.</u></p> <p>Position; Senior Bridge Engineer The responsibilities includes:-</p> <ul style="list-style-type: none"> ⇒ Procurement of civil contractors and supervision consultants. ⇒ Preparation of Pre-qualification document, evaluation of Pre-qualification documents & bid documents, preparation of evaluation report based on prescribed format of World Bank, preparation of RFP (Request for Proposal) for construction supervision consultant, evaluation of technical and financial proposal of supervision consultant. Getting approval from World Bank. ⇒ Carrying out Independent review of consultant's design, drawing and tender documents. ⇒ Preparation of Barrower's Project Implementation Plan (BPIP) and getting approval from regional World Bank officials ⇒ Preparation of appraisal reports in conformity to the guidelines of World Bank <p>Outline of the project:</p> <p>The main feature of assignment is proof checking & design review of 1020m long bridge across river Ganga (Pkg-ABP-1) and two fully access controlled road construction packages on 4 lane extendable to 6 lane Allahabad Bypass (85km). The superstructure of Ganga Bridge is designed based on precast segmental cantilever technique having two continuous span units of 510m each. The maximum length of individual span is 90m resting on long hollow piers and deep well foundations. Carried out review of rigid pavement, 121</p>



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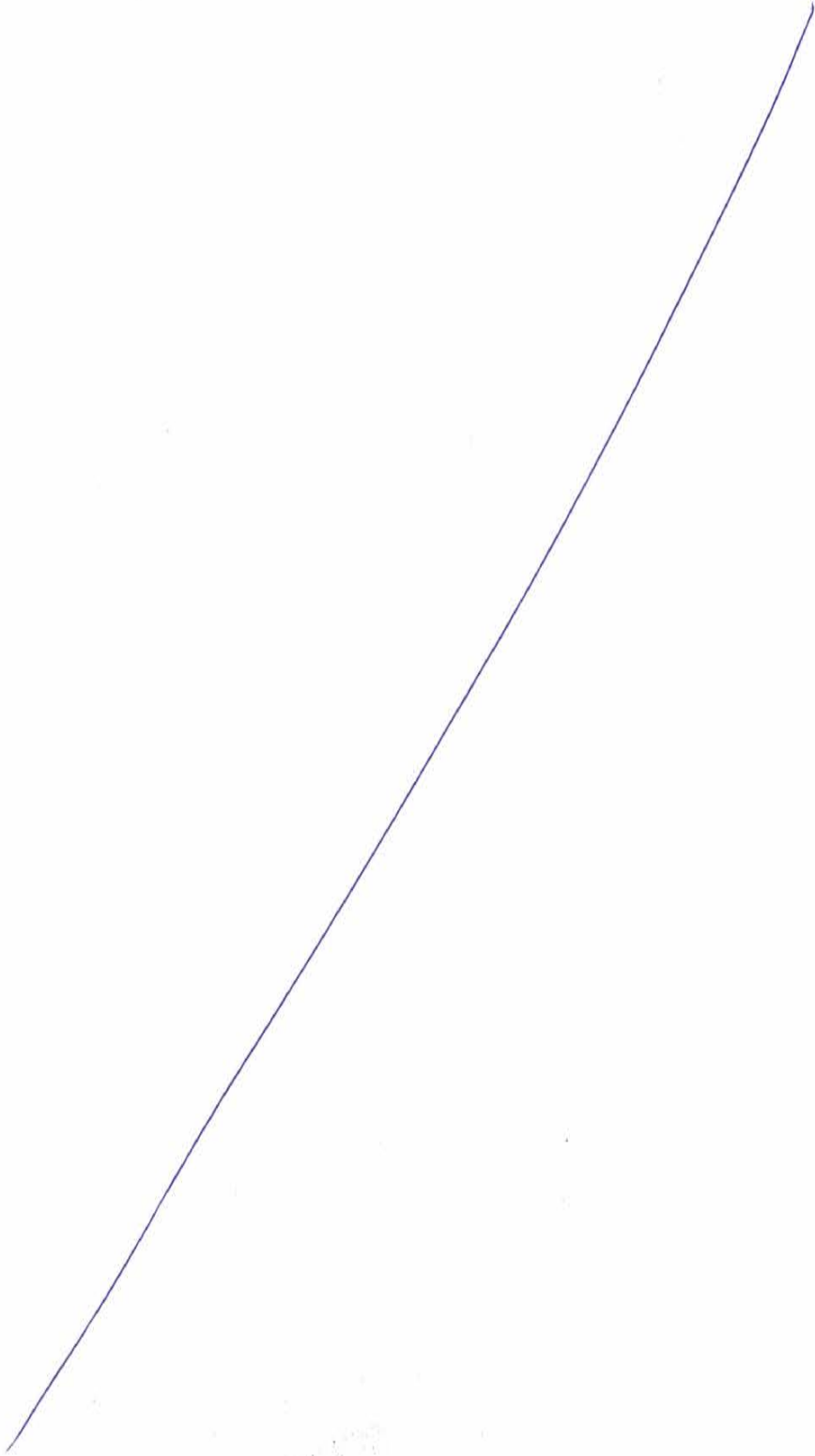
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		structures consisting of underpasses, flyovers, rail over bridges and major/ minor bridges in road packages.
March 1999	October 2003	Manager (HW) RITES Ltd
2001	2001	<p>Company: RITES Ltd Project: <u>Detailed Design for Widening to 4 lanes and Rehabilitation of Existing 2 lane carriageway of Chennai-Ranipet Section of NH-4 and Krishnagiri-Ranipet Section of NH-46 in Tamil Nadu.</u> Client: National Highway Authority of India Duration: 2000 to 2001 Location: Tamil Nadu, India Position: Outline of the project: As a Bridge Engineer, was responsible for detailed design of project consisting of 245km (2 lane to divided 4 lane carriageway) road length with estimated cost US\$ 250. Was responsible for detailed design and detailing of structural components, and road component, preparation of pre-qualification and tender documents based on FIDIC guidelines, submission of construction drawings, preparation of specifications and providing solutions during implementation. The project consist of 3 major bridges (>60m length) 619.50m long bridge across river Palar having PSC superstructure and resting on well foundation, 60 minor bridges (>6m<60m), 7 grade separators and 7 ROB,s. Project has been divided into 5 construction packages.</p>
2001		<p>Company: RITES Ltd Project: <u>Proof Checking of Design / Drawings of 3 ROB's in Agra-Bhognipur Section NH-2 (UP).</u> Client: National Highway Authority of India Duration: 2001 Location: Uttar Pradesh, India Position: Manager / Bridge Engineer Outline of the project: As a Manager / Bridge Engineer, was involved in the detailed proof checking of design and drawings for the 3 RoB's. The scheme comprises of PSC / RCC superstructure resting on pile foundation with reinforced earth approaches.</p>
2000		<p>Company: RITES Ltd Project: <u>Construction of Elevated road (2.5 km) in Ludhiana, Punjab.</u> Client: Municipal Corporation, Ludhiana, Punjab Duration: 2000 Location: Punjab, India Position: Bridge Engineer</p>



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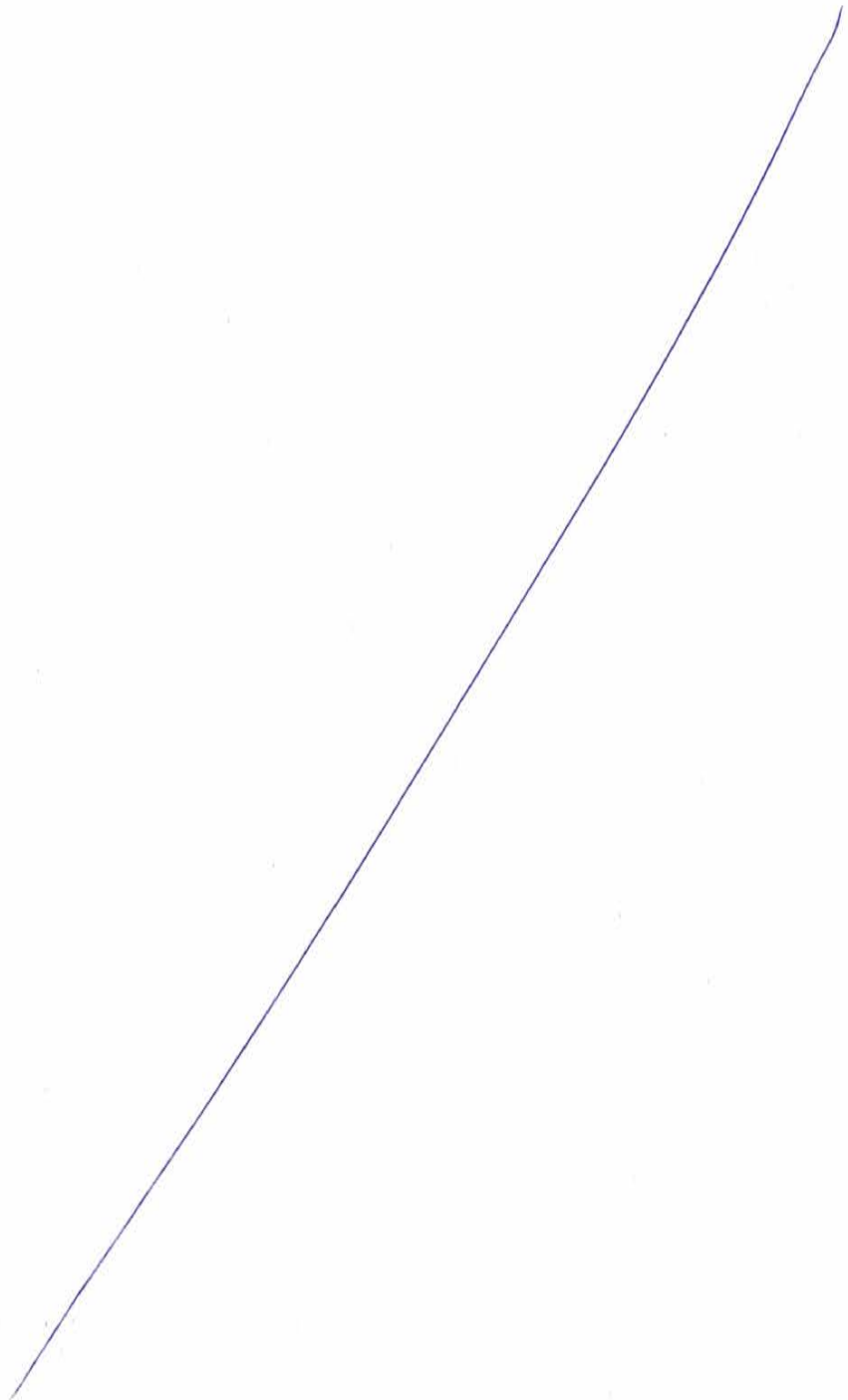
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		<p>Outline of the project: As a Bridge Engineer, was involved in Preparation of detailed engineering design, construction drawings, construction methodology and tender documentation, pre-qualification of contractor, Procurement of civil contractor, periodic construction supervision etc. The scheme consists of 4-lane facility with divided carriageway (16.47 m width) with three span continuous precast pretensioned girders integral with diaphragms resting directly on single central pier. Spans ranging from 20.0 m to 40.0 m forming a 2.5 km long elevated corridor.</p>
1999	2000	<p>Company: RITES Ltd Project: <u>Construction of Flyover (ROB), 620 m long at Dhuri Line, near Gill Chowk, Ludhiana, Punjab.</u> Client: Municipal Corporation, Ludhiana, Punjab Duration: 1999 to 2000 Location: Punjab, India Position: Bridge Engineer Outline of the project: Was responsible for Feasibility study, preparation of detailed engineering design, construction drawings, construction methodology and tender documentation, bid evaluation, procurement of civil contractors and rendering periodic supervision during construction etc.</p>
1999	2000	<p>Company: RITES Ltd Project: <u>Construction of Amravathi Bridge on Karur Bypass, 600m length, Tamil Nadu.</u> Client: National Highway Authority of India Duration: 1999 to 2000 Location: Tamil Nadu, India Position: Bridge Engineer Outline of the project: Was responsible for Detailed project preparation including design and detailing, submission of construction drawings, specifications and providing solutions during implementation for 600 m long bridge with PSC box superstructure resting on well foundations.</p>
1999	2000	<p>Company: RITES Ltd Project: <u>Preparation of Detailed project report for "Four/six laning of National Highways on North –South and East-West Corridors" involving different Packages.</u> Client: National Highway Authority of India Duration: 1999 to 2000 Location: India Position: Bridge Engineer Was involved in preparation of Detailed Project Report for "4/6 laning of National Highways on North – South and East-West Corridors"</p>



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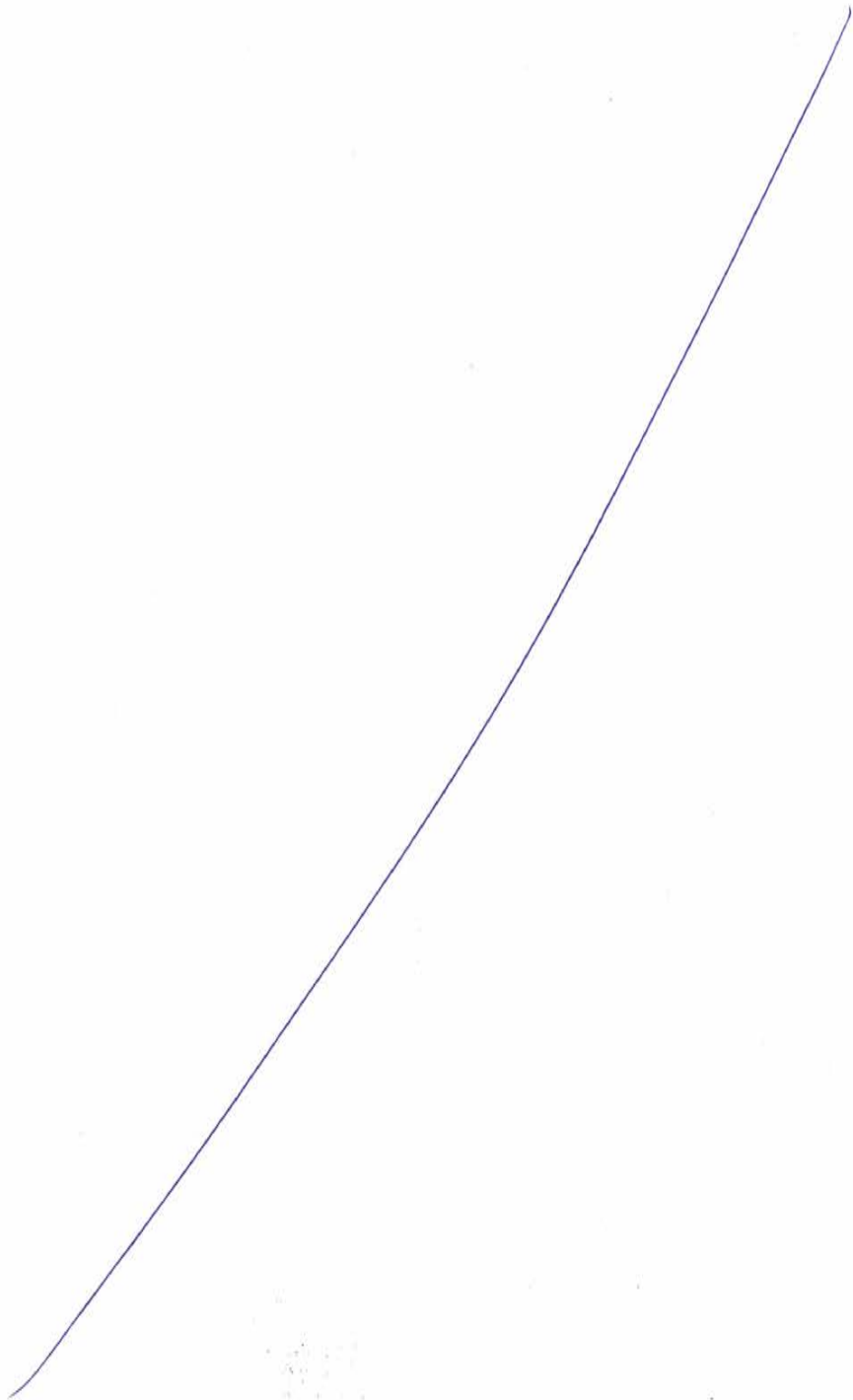
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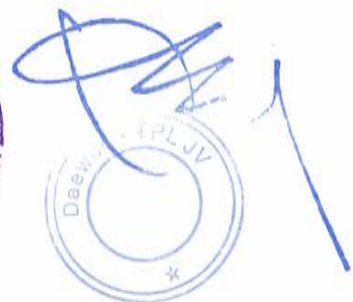
March 1996	March 1999	Assistant Manager (HW)	RITES Ltd
		<p>Company: RITES Ltd Project: <u>Detailed Project Report, Project Management and Construction Supervision of 9 bridges on Kohalapur - Mahakali Highway, NEPAL, under Aid from Republic of India to the Government of Nepal.</u> Client: Ministry of External Affairs, Govt. of India Duration: 1996 to 1999 Location: Nepal Position: Assistant Project Engineer (Bridges), As Assistant Project Engineer (Bridges), was responsible for carrying out this project from inception, detailed design and construction supervision up to completion stage. All the 9 bridges and their approaches (2 lane with paved shoulder) were new high-level bridges in place of causeways with large discharge and velocity. Severe Artesian conditions are prevalent in most of the bridge locations. Bridges had PSC superstructure, metallic bearings and well foundations. Span details are given below: Outline of the project: Manhara Bridge, 7 spans of 32 m each, Shivganga Bridge, 8 spans of 32 m each Khutia Bridge, 8 spans of 32 m each, Gaurigang Bridge, 3 spans of 32 m each, Karha Bridge, 3 spans of 32 m each, Chairala Bridge, 3 spans of 32 m each, Chorahi Bridge, 42 m span, Dhobiniya Bridge, 3 spans of 22 m each, Chaumala Bridge, 2 spans of 20 m each and 1 span of 15 m.</p> <p>Carried out detailed design and preparation of working drawing for PSC superstructure, substructure and well foundations in severe artesian condition. Involved in evaluation of tender document and procurement of civil contractor based on FIDIC guidelines for US \$ 15 million project</p> <p>Responsible for Construction Supervision, construction management, planning and controlling of day-to-day construction activities at site, carrying out of quality control measures, checking reinforcement/cable laying operations, mix design, monitoring the progress, scrutiny of variation order & verification of monthly bills submitted by the contractor. Preparation of MPR/QPR.</p>	
August 1993	March 1996	Assistant Manager	RITES Ltd
		<p>Projects Undertaken:-</p> <p>Detailed Design, Drawings and preparation of cost estimate of Barba-Adda and Barakar section of NH2 in Bihar (World Bank Funded)-1993-1994.</p> <p>Preparation of detailed design, drawings and quantity estimation for Arterial Roads in Talchar Coalfields in Orissa. 1993-1994</p> <p>Detailed design quantity estimation and analysis of rates of Ankola-Bellary Section of SH-42 in Karnataka. 1993-1994</p>	



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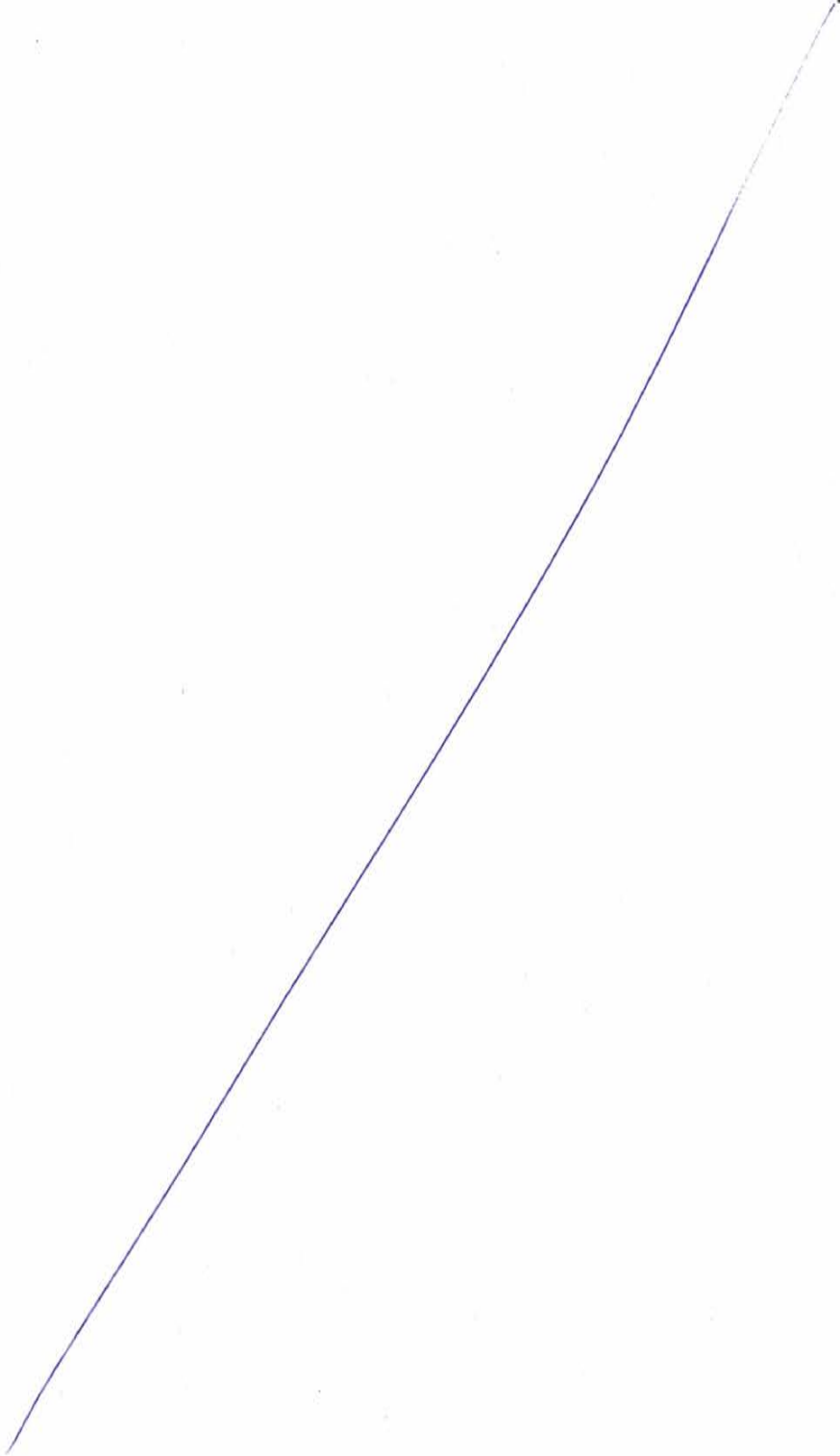


		<p>Preparation of detailed design, drawings, cost estimate and rate analysis based on National Schedule of Rates of MOST for Vijaywada-Chilakaluripet Section of NH5 in Andhra Pradesh.(OECF Funded), job includes design of 1700m long bridge across river Krishna consisting PSC superstructure, circular piers and deep well foundation- 1995-1996</p> <p>Preparation of tender documents, bill of quantities and rate analysis and Engineer's estimate for 3 bridges in Bhutan. 1995-1996.</p>
July 1989	August 1993	<p>Engineer(CIVIL) IntegrateConstruction ManagementConsultants (ICMC)</p>
		<p>Responsible for construction supervision and project management consisting of project scheduling and monitoring the work progress during execution, updating network for time-bound projects, preparation of cash flow statements and updating. Setting up a system of quality control for all construction activities and material, design of concrete mixes, controlling various parameters of concrete at the time of pouring, estimating, costing, rate analysis, preparation of condition of contract, bill of quantities and formulation of specifications, bid evaluation and procurement of civil contractor.</p>



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