Stretto di Messina

Concessionaria per la progettazione, realizzazione e gestione del collegamento stabile tra la Sicilia e il Continente Organismo di Diritto Pubblico
(Legge n° 1158 del 17 dicembre 1971, modificata dal D.Lgs. n°114 del 24 aprile 2003)

EurolinK

PONTE SULLO STRETTO DI MESSINA

PROGETTO DEFINITIVO

EUROLINK S.C.p.A.

IMPREGILO S.p.A. (MANDATARIA)
SOCIETÀ ITALIANA PER CONDOTTE D'ACQUA S.p.A. (MANDANTE)
COOPERATIVA MURATORI E CEMENTISTI - C.M.C. DI RAVENNA SOC. COOP. A.R.L. (MANDANTE)
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Unità Funzionale	OPERA DI ATTRAVERSAMENTO	PG0030_F0
Tipo di sistema	ATTIVITA' DI CARATTERE GENERALE	
Raggruppamento di opere/attività	MANUALE DI ESERCIZIO E GESTIONE E DELLE EMERGENZE	
Opera - tratto d'opera - parte d'opera	Operation and Maintenance	
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INDICE

Abbreviations

ANAS	-	Azienda Nazionale Autonoma delle Strade
ARD		European Agreement concerning the International Carriage of Dangerous Goods by Road
BMS	-	Bridge Management System
EDMS	-	Electronic Document Management System
H&S	-	Health and Safety
I&M	-	Inspection and Maintenance
LCC	-	Life Cycle Costs
M&E	-	Mechanical and Electrical Systems
OCC	-	Operational Control Centre
O&E	-	Operation and Emergency
O&M	-	Operation and Maintenance
ORA	-	Operational Risk Analysis
RCM	-	Reliability Centred Maintenance
RDS-TMC		Radio Data System - Traffic Message Channel
RFI	-	Rete Feroviaria Italiana
RID		Reglement concernant le transport International ferroviare des merchandises Dangereuses par chemin de fer
SCADA	-	Supervision, Control and Data Acquisition
SdM	-	Stretto di Messina
TETRA	-	Terrestrial Trunked Radio
VMS	-	Variable Message Sign
VTS	-	Variable Text Sign

1 Executive Summary

The present report describes the basis for the O&E Manual in terms of O&E concepts and principles. This basis will be used for the elaboration of procedures and instructions to be contained in the O&E Manual. Thus the present report will serve a background document for turning the preliminary O&E Manual (cf. *CG1000-P-MI-D-P-GE-M7-00-00-00-00-01-A*) into the final O&E Manual - a work to be carried out in the final design phase.

1.1 Scope

The scope of the Operation and Emergency (O&E) Manual is to provide a system of procedures and instructions for efficient and safe operation of the bridge and its traffic.

The O&E Manual will provide the SdM organization as well as external agencies, authorities and SdM subcontractors with procedures and instructions for carrying out tasks to take care of normal, abnormal or emergency operational events for the suspension bridge.

It may be noticed that the O&E Manual includes the general O&M organisation and the interaction between Operation & Emergency (O&E) and Inspection & Maintenance (I&M).

The O&E Manual will be based on the tender specifications and the tender design accepted by SdM. The O&E Manual will exclude the description of the organisation and procedures for railway operational management, which is assumed to be the responsibility of RFI. However, interfaces of and interaction with RFI will be defined, described and handled in the context of the O&E Manual.

Physical elements contained in scope of O&E Manual are within the physical marked area on: *Drawing PG-2D-B0-106-_3N120 no. 1, rev. 0* and *Drawing f PG-2D-B0-106-_3N121 no. 1, rev. 0.* O&E procedures regarding specific physical elements (structures and technological systems) of SdM which are not contained in the bridge design of EUROLINK will be outside the scope.

Description of O&E procedures will comprise operation associated with traffic and works on bridge together with tasks of toll works and O&E works in the Operational Control Centre.

The O&E Manual for the suspension bridge will together with the equivalent documentation for the SdM Land Works form the SdM basis for the operation of the Messina Link.

1.1.1 Intended Use of Manual

The O&E Manual will contain the agreed procedures & instructions to be applied for the suspension bridge by the staff and external parties solving tasks in bridge operation and handling emergencies on the bridge. It is anticipated that the O&E Manual will be used in the following way:

- As a basis for training of personnel.
- As source for reading forms and instructions as check-lists and basis for specific tasks.
- As reference for occasional look-up on procedures which are rarely used or are complicated.
- As a basis for audits and drills.
- As a written documentation which can be cross-checked for consistency with respect to other documents handling operation and emergency (operational concept and safety concept).
- At least all emergency instructions and procedures shall be implemented as on-line instructions in the SCADA system.

1.2 Operational Concept - Overall

The operational concept is outlined in the following and will be further elaborated as the different operation and emergency events are analysed further in the final design phase. As part of the operational concept of the bridge a safety concept will be elaborated to ensure overall consistency in the design of structures, systems and manuals.

1.2.1 Principles

The O&E Manual is driven by needs and events of each scenario. Some will be very trivial routines with modest consequences at stake, others will cover rare events with large potential consequences if not handled correctly. The operational scenarios representing different events are divided into three types of operational modes:

- A **normal operational mode**, where operation is as planned and represents planned pro-active actions.

- An **abnormal operational mode**, which requires routine actions due to incidences and minor accidents. The actions will comprise actions with the objective of returning to normal operation mode as soon as possible.
- An **emergency mode**, which requires actions due to an emergency.

O&E Manual shall support the personnel having operation and emergency tasks. This includes:

- Interaction with Inspection and Maintenance personnel and associated contractors and suppliers. Procedures and instructions of the O&E organisation will supplement the technical instructions and procedures of the Inspection and Maintenance manual and should always be consistent with the tasks for carrying out inspection and maintenance.
- External authorities and agencies. Coordination and interaction with external agencies and authorities will be described in the O&E procedures such that responsibilities, tasks and goals are defined consistently. The O&E procedures and instructions are assumed to be adapted by the external agencies and authorities.

1.2.2 O&E Procedures - Operational Analysis

An operational analysis of the events corresponding to normal, abnormal and emergency mode of operation will be carried out in detail as a basis for the writing of the O&E Manual. The operational analysis comprises all three modes of operation: Normal, abnormal and emergency modes of operation. This analysis will comprise:

- Identification of operational and emergency events and actions.
- Identification of interfaces and actors in the tasks on all events and actions.
- Further development of operational concept in conjunction with developed safety concept.
- Development of required response times.
- Development of procedures and instructions

O&E Manual covers a number of work processes of the operation and maintenance of the bridge excluding the Management Process: *O&E Administration, Operational Control, Bridge Safety & Security, Toll works, Inspection & Maintenance works, Environmental Control, Road Traffic, Rail Traffic, Marine Traffic, Airplane Traffic.*

OVERALL STRUCTURE OF O&M MANUALS

The O&E Manual will have the following list of contents: *1. Indices of Manual, 2. Scope, 3. Management Principles and Organisation, 4. Operatonal Plan, 5. Emergency Plan, 6. Operational Procedures, 7. Emergency Procedures. 8. Instructions and 9. Appendices.*

1.3 O&M Organisation

Confer Figure 4-2 in report. It shows the organisation of Operation and Maintenance:

- Operation & Emergency (O&E) is described by the present O&E Manual. The O&E is supported by operational on-line information from the technological systems. O&E organisation interacts on an operational level with external agencies and authorities.
- Inspection & Maintenance (I&M) is further described by the *Inspection & Maintenance Manual (CG1000-P-MI-D-P-GE-A9-00-00-00-00-01-A)*.

Further, O&M is generally supported by a number of management systems. SCADA system is the shell of the systems and supports the O&E with a user interface showing alarm data, environmental parameters, traffic parameters, visual surveillance and allowing on-line control of the operation of the bridge.

1.3.1 Interaction with External Agencies and Authorities

Common to external agencies (RFI & ANAS) and authorities and SdM is that the design of the O&E Manual will require a close dialogue to clarify the interfaces and the interaction:

- Clarification of needs and requirements of external agencies and authorities.
- Discussion of O&E proposal for operational concept and safety.
- Operational and safety concept for approval by SdM and external agencies and authorities.
- Detailing of operational concept and safety concept with outline of O&E procedures and instructions.
- Start of operation of bridge with regular adjustment of operational and safety concept.
- Regular emergency drills and updating of O&E Manual based on experiences.

- Special operational and emergency drills shall be carried out before opening the bridge.

1.3.2 SdM O&E Procedures and Instructions

A procedure comprises instruction for more than on party/actor/personnel and describes the combined interactions for solving the overall tasks of the procedure. The contents are:

- **Owner**: Owner and therefore overall responsible for the procedure.
- **Title:** A heading describing the contents of procedure.
- **Purpose:** Overall purpose of the procedure outlining the overall task and intended result and **When** to do it.
- **Assumption:** Definition of the conditions on which the instruction shall be applied.
- **Tasks:** Explain the scope and responsibility of the parties required for carrying out the procedure: Who, What to do and How-to-do-it, cf. O&E Report.
- **References:** References to Instructions and informative documents, including any relevant references.
- **Enclosures:** Enclosures of attached documents needed for carrying out the procedure.

An instruction will be dedicated to a single actor/party/personnel and describe the required task step-by-step. Instructions are replaced by standard manuals in case a suited manual exists for the user interface to a system or piece of equipment.

2 Introduction

The present report describes the basis for the O&E Manual in terms of O&E concepts and principles. This basis will be used for the elaboration of procedures and instructions to be contained in the O&E Manual. Thus the present report will serve a background document for turning the preliminary O&E Manual (cf. *CG1000-P-MI-D-P-GE-M7-00-00-00-00-01-A*) into the final O&E Manual - a work to be carried out in the final design phase.

2.1 Scope

The scope of the Operation and Emergency (O&E) Manual is to provide a system of procedures and instruction for efficient and safe operation of the suspension bridge and its traffic.

The O&E Manual will provide the SdM organization as well as external agencies, authorities and SdM subcontractors with procedures and instructions for carrying out tasks to take care of normal, abnormal or emergency operational events. It may be noticed that the O&E Manual includes the general O&M organisation and the interaction between Operation & Emergency (O&E) and Inspection & Maintenance (I&M).

The O&E Manual will together with the O&M Manuals for the SdM Land Works form the SdM basis for the operation of the Messina Link.

The O&E Manual shall comply with the following criteria for success:

- O&E system has to be user-friendly, logical and easy to use so it earns the users natural respect and acceptance.
- O&E system has to be simple and robust with respect to failure of the operational conditions. This includes independency on specific persons and the presence of fallback alternatives in case of failure of technical systems and failure of communication ways.
- O&E system has to be adaptive to experiences and acquired data and changes with SdM and external parties.

2.2 Limitation of Scope

The O&E Manual will be based on the tender specifications and the tender design accepted by SdM.

The O&E Manual will not comprise description of the tasks of general SdM executive management, but will only consider the organisation and description of operational tasks of bridge operation and emergency.

The O&E Manual will be designed under the implicit assumption that SdM executive management process comprises a systematic management approach with application of a quality management system e.g. according to *ISO 9001: 2008*, a health and safety management e.g. according to *OHSAS 18001:2004* and a environmental management e.g. according to *ISO 14001*.

The O&E Manual will also exclude the description of the organisation and procedures for railway operational management, which is assumed to be the responsibility of RFI. However, interfaces of and interaction with RFI will be defined, described and handled in the context of the O&E Manual.

The O&E Manual will not consider special challenges related to applying subcontractors in the SdM organisation as the SdM subcontracting policy is not known. Subcontractors are assumed to act as being part of the SdM organisation.

Physical elements contained in scope of O&E Manual are within the physical marked area on:

Drawing PG-2D-B0-106-_3N120 no. 1, rev. 0

Drawing PG-2D-B0-106-_3N121 no. 1, rev. 0.

O&E procedures regarding specific physical elements (structures and technological systems) of SdM which are not contained in the suspension bridge design of EUROLINK will be outside the scope of the O&E Manual.

Figure 2-1 shows the anticipated O&E framework for the Sdm network. Apart from the O&E Manual designed in present contract, the O&E framework consists of:

- A Operational Control Centre, which is outside the scope and the design is placed in another contract.

- A toll station, which is only included in the present scope with respect to procedures and instructions whereas the design is not contained in present contract.
- Supportive technological systems, monitoring and management systems, which for the suspension bridge is designed within the present design contract whereas the similar systems for the land works infrastructure is contained in other design contracts with Eurolink. Eurolink coordinates the interaction between the systems.
- Electrical & mechanical systems and in particular road related equipment for the suspension bridge is designed within the present design contract whereas the similar equipment for the land works infrastructure is contained in other design contracts with Eurolink. Eurolink coordinates the application and interaction between systems and equipment.

Description of O&E procedures and instructions will comprise operation associated with the traffic and works on the suspension bridge together with the tasks of toll works and the O&E works in the Operational Control Centre. The adjacent land Works and facilities not contained in the above are not be part of the scope and are not be described in the present O&E Manual.

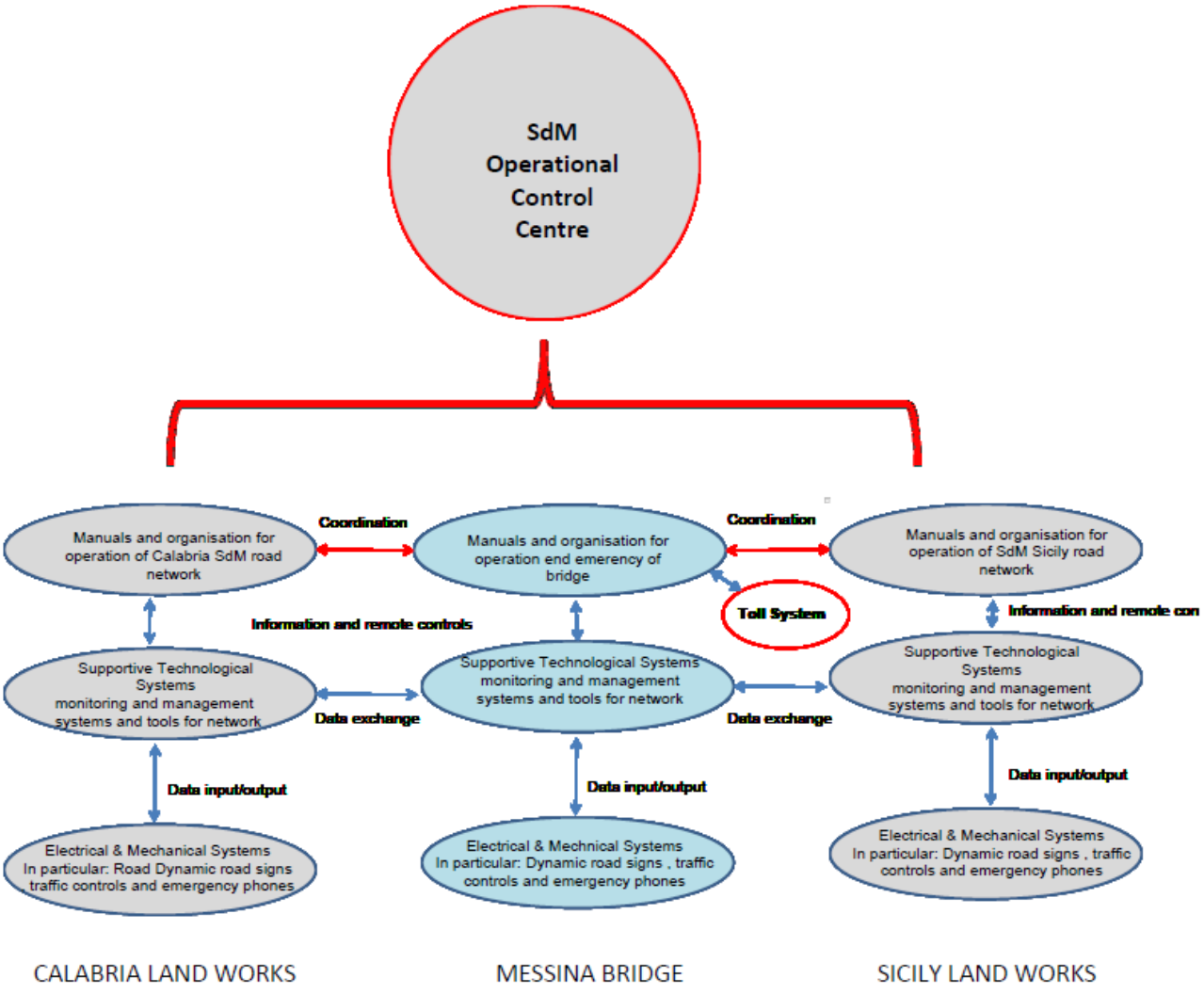


Figure 2-1 Anticipated O&E framework for the SdM network.

2.3 Intended Use of O&E Manual

The O&E Manual will contain the agreed procedures & instructions to be applied for the bridge by the staff and external parties solving tasks in bridge operation and handling emergencies on the bridge.

It is anticipated that the O&E Manual will be used in the following way:

- As a basis for training of personnel
- As source for reading forms and instructions as check-lists and basis for carrying out specific tasks.
- As reference for occasional look-up on procedures and instructions which are rarely used or which are complicated
- As a basis for audits and drills
- As a written documentation which can be cross-checked for consistency with respect to other documents handling operation and emergency (operational concept and safety concept).
- At least all emergency instructions and procedures shall be implemented as on-line instructions in the SCADA system. It is urgently important that procedures and instructions for tasks in rare emergency events with critical response times are readily available to the O&E staff.

2.4 Basis

2.4.1 SdM Tender Documents

1 GCG.F.06.05, Linee guida per la preparazione del manual di esercizio e di gestione delle emergenze, Revision 0 (2004).

2 GCG.F.06.01, Sistema di gestione e controllo, Revision 0 (2004).

3 GCG.F.06.04, Linee guida per preparazione del programma di ispezione e manutenzione e della documentazione d'uso e manutenzione, Revision 0, (2004).

4 GCG. F.06.03, Linee guida per l'analisi quantitative di rischio, Revision 0, (2004).

2.4.2 EUROLINK Tender Proposal

COWI has provided the following tender proposals on behalf of EUROLINK:

1 59012B-TD-1315 Tender Design Report for Operation and Emergency Management Manuel, issue 0, 13.4.2005

2 59012B-TD-1314 Tender Design Report for Inspection and Maintenance Manual, issue 0, 11.4.2005.

3 59012B-TD-1316 Tender Report for Operation and Maintenance Organisation, issue 0, 14.4.2005

2.4.3 Basic Definitions

Accident is an event with unwanted consequences such as injured or killed persons, loss or damage of vehicles, equipment or structures, interruption of road or rail traffic or environmental damages.

Caretaking is trivial daily maintenance by SdM employees or contractors.

Dangerous goods may be transported by rail or road. Goods by rail shall comply with RID, and goods by road shall comply with ADR.

Emergency is a situation that poses an immediate *risk* to health, life, equipment, structures or environment.

Evacuation is the controlled egress of passengers, drivers, personnel and others from train, road vehicle or bridge.

Hazard is a possible situation or condition with the potential for unwanted consequences such as injured or killed persons, loss or damage of vehicles, equipment or structures, interruption of road or rail traffic or environmental damages.

Health & safety (H&S) concerns the *safety* of the employees of SdM and employee of the contractors and other working under the management of SdM.

Operation covers the normal work process handling ordinary tasks and events associated with the operation of the bridge.

Incident is an event deviating from the planned pattern of operational events.

Inspection is inspection of equipment and structures by trained employees or contractors to investigate the condition or state of a part or a piece of equipment of the bridge.

Maintenance is non-trivial maintenance/repair by SdM employees/contractors.

Personnel in the SdM organisation comprise employees of SdM or of a contractor with reference to SdM. Personnel in the RFI and ANAS organisation will refer to the RFI and ANAS managements.

Risk is the combination of a frequency of occurrence of an *accident* and the magnitude of the consequences of the *accident*

Rescue is to transfer people, vehicles or equipment involved in an accident from an unsafe situation to a safe situation.

Safety is the condition of being protected against accidents. The safety level is described by the level of *risk*. The smaller the risk level the larger the safety level.

Security is the condition of being protected against accidents caused by malicious acts intended to cause damage.

Special transport is vehicle on road or rail with dimension, weight or speed deviating from normal vehicles on road or rail.

2.4.4 Assumed roles of external agencies and authorities

The elaboration of the O&E Manual shall be based on a dialogue with external agencies and authorities. It has not yet been possible to hold such meetings and consequently the following roles of external agencies and authorities have initially been assumed as a basis for the design of the O&E Manual:

AUTHORITIES

- *Polizia* provides actions on crimes, traffic offences and emergencies. *Polizia* will in the development of the O&E Manual be detailed into the different Polizia authorities, e.g. Forze dell'Ordine, Polizia Stradale.
- *Vigili del fuoco* provides action of fire fighting, towing of cars and rescue and evacuation of people.
- *Servizio di Pronto* provides ambulance services
- Aviazione Civile is assumed to handle all requirements and task regarding the management of air traffic in operation and emergency.
- Autoritá Marittime is assumed to handle all requirements and task regarding the management of maritime traffic in operation and emergency. This includes control of VTS (Vessel Traffic System).
- Protezione Civile is assumed to handle major emergencies related to e.g. earthquake, volcano eruption, flooding, train disasters etc.
- Prefetture is assumed to be involved in the control of major emergencies.

EXTERNAL AGENCIES

RFI is the infrastructure manager of the railway and operates and maintain the railway and will have responsibility for the railway across the bridge.

ANAS provides the overall administration of the Italian highway network. O&E Manual assumes ANAS to be the external agency to deal with regarding the road network interfacing with the SdM road network However, there may also be local road authorities, which shall be consulted.

A number of train operators will be contracted to drive trains on the railway. They will operate under the rules and the operational control of RFI. No direct interface between SdM and the operator is envisaged.

3 Operational Concept - Overall

The operational concept is outlined in the following and will be further elaborated as the different operation and emergency events are analysed further in detailed design phase.

As part of the operational concept of the bridge a safety concept will be elaborated to ensure overall consistency in the design of structures, systems and manuals.

3.1 Principles

Operations actions comprise carrying out tasks for:

- Normal operation (planned tasks & events)
- Abnormal operation representing unplanned, unintended events, incidence and minor accidents,
- Emergency events.

O&E Manual shall support the personnel having operation and emergency tasks. This includes:

- Interaction with Inspection and Maintenance personnel and associated contractors and suppliers
- External authorities and agencies.

The O&E Manual is anticipated to be a supplementary documentation to SdM management systems (quality, health and safety and environment). Figure 3-1 shows the overall anticipated structure of documentation for SdM.

Figure 3-1 Overall anticipated documentation structure for SdM Management

3.1.1 Defined Response Time as a Goal

The response time on operational actions will depend on the criticality of an event with respect to traffic flow, safety and costs. For each event in each procedure and instruction, a goal on response time must be defined as basis for the elaboration of procedures. This may lead to an iteration with revision of the organisation, equipment and adjustment of design in the detailed design phase where the majority of the procedures and instructions will be elaborated.

Note: Italy currently has a response time standard for urban areas of eight minutes or less for life threatening emergencies according *EMS Benchmarking in Europe:http://www.geographie.unimuenchen.de/eed/assets/presentations/EED_Benchmarking.pdf.*

The definition of response time in an overall emergency context is assumed to be the duration from the time of alarm to emergency services to the time they arrive on the emergency site. The response time in the context of specific requirements to SdM's procedures and instruction may be defined as the duration from the moment of incoming call to OCC to the first OCC induced action imposing a mitigating change on the emergency event. The overall emergency context shall apply

for the combined actions of SdM and emergency services whereas the specific SdM requirements applies to the actions required by SdM.

3.1.2 Documentation of Events and O&E actions

Events and the results of O&E actions shall be documented to the extent that events and actions have consequences with respect to traffic flow, safety, costs and maintenance condition of the bridge.

3.1.3 Coordination with Inspection and Maintenance

Procedures and instructions of the O&E organisation will supplement the technical instructions and technical procedures of the Inspection and Maintenance manual and should always be consistent with the tasks for carrying out inspection and maintenance.

3.1.4 Coordination with External Agencies and Authorities

Coordination and interaction with external agencies and authorities will be described in the O&E procedures such that responsibilities, tasks and goals are defined consistently. The O&E procedures and instruction are assumed to be adapted by the external agencies and authorities.

3.1.5 Updating O&E to be Efficient and Safe

Annually and after major emergencies, the O&E shall be evaluated, and if considered necessary revised.

O&E approach shall also be updated to changes in the SdM organisation, SdM Management defined policies, interfaces to external parties and the gained experiences on the performance of the O&E organisation as well as the technological systems supporting O&E.

The gained experiences shall consider the operational performance based on the documented results on the tasks carried out with an evaluation of e.g. response times and the quality of the tasks carried out.

Each part of the O&E Manual shall have an owner who will be the responsible for the updating. The overall responsible for updating of the O& E Manual will be the SdM Management.

The updating of O&E shall use the results from training, audits and emergency drills.

3.2 Concept for Operation

The operational scenarios representing different events are divided into three types of operational modes:

- A **normal operational mode**, where operation is as planned and represents planned pro-active actions
- An **abnormal operational mode**, which requires routine actions due to incidences and minor accidents. The actions will comprise actions with the objective of returning to normal operation mode as soon as possible.
- An **emergency mode**, which requires actions due to an emergency.

The O&E Manual is driven by needs and events of each scenario. Some will be very trivial routines with modest consequences at stake, others will cover rare events with large potential consequences if not handled correctly.

3.2.1 Events in Normal or Abnormal Operational Mode

Pro-active actions in normal mode and actions on abnormal events will be described to the extent that they have a significant impact on the goal of a safe and efficient operation of the bridge. Events with only marginal importance will not be described as the solution of the required tasks will be assumed to be more effectively carried out based on ad hoc decisions by personnel in charge of operational control.

3.2.2 Events in Emergency Mode

A number of unwanted events cannot be ruled out to occur as shown in the operational risk analysis (ORA) for the bridge. These events will be hazards causing an emergency. Such hazards concern human losses, damages to the bridge, financial/socio-economical losses due to closure of the bridge, and also environmental impacts.

The operational risk analysis (ORA) will focus on the major hazards and will define these events in detail as events to be handled by the O&E Manual. This may include assumptions on design

requirements and requirements to O&E procedures and instructions. In addition more emergency events, which has not been detailed by the ORA may exist and will be defined as part of the operational analysis for the O&E Manual of the bridge.

Finally it may be noticed the O&E Manual will also rely on input from ORA input carried out for the Land Works, which is outside the present scope of the ORA of the bridge. This ORA input is assumed to be provided by EUROLINK.

The O&E Manual will cover the events identified in the ORA except for insignificant events with both a small frequency of occurrence and limited consequences.

3.3 Concept of Procedures and Instructions

The O&E Manual contains a number of procedures and instructions for the tasks to keep the bridge safe and efficient in normal/abnormal operational modes and to handle emergencies.

Table 3-1 shows concept of procedures and instructions.

Procedures describe the overall tasks whereas an instruction exists when there is need for a detailed step-by-step guidance to solve the task or sub tasks. A procedure gives the overview of responsibility, tasks and actions for persons/bodies involved in the response on a certain task.

Instructions only exist when they are needed to carry out certain tasks as the response of certain well-defined events. The instruction is dedicated to personnel supposed to carry out the special tasks described in the instruction.

Dedicated manuals or user interfaces for a certain system or piece of equipment may replace the need for an instruction.

Table 3-1 When-who-how procedure-instruction concept

Procedure *task description*	**When**	Event driven or pro-active action				
	Who	*nn1*	*nn2*	*..*	*..*	*nn_N*
	How	*Do x*	*Do y*	*..*	*..*	*Do z*
	Instruction *a detailed step-by-step guidance*	*Step 1..3*	*Step 1..3*	*….*	*..*	*Step 1..3*

4 Organisation and Communication

4.1 Overall SdM Organisation

Figure 4-1 shows the overall SdM organisation. The figure shows that SdM operation and maintenance (O&M) will be divided into Operation & Emergency (O&E) and Inspection & Maintenance (I&M) with a number of external relations to authorities and agencies.

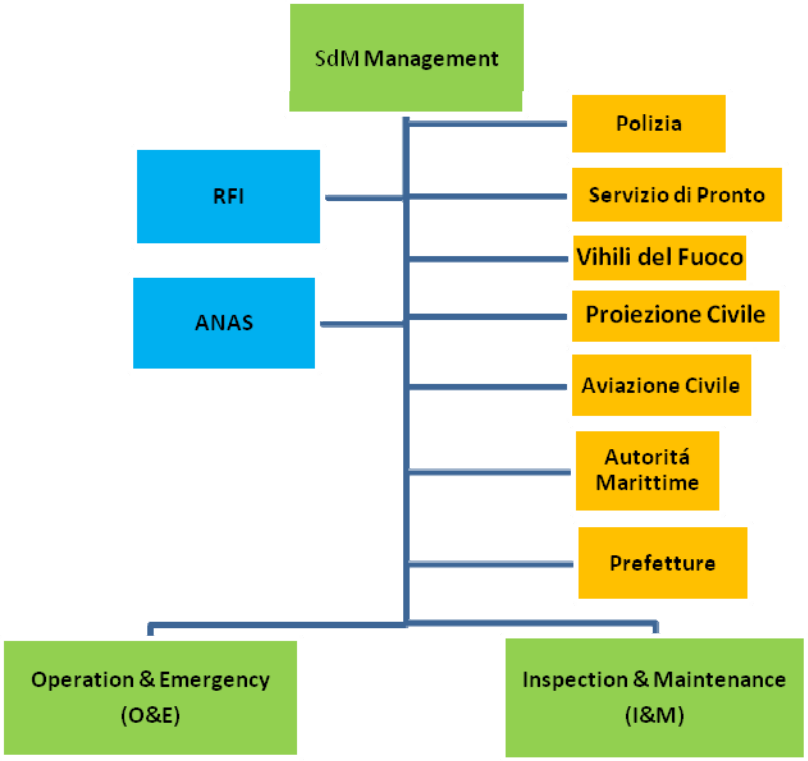


Figure 4-1 Overall assumed SdM organisation with external interfaces.

4.1.1 SdM Management

O&E and I&M will refer to the SdM Management. It is outside the scope of the O&E Manual to describe the SdM Management but it is assumed to handle:

- Finance
- Human resources
- Legal matters (incl. compliancy with law and agreements and contractual handling)
- Quality management
- Environmental management
- Health and Safety management

- Public relations
- Marketing
- Executive reporting
- IT support for SdM in general.

The O&E Manual focus will entirely be on the operational and emergency management to control an efficient and safe bridge traffic under the constraints of an overall SdM management.

SdM will have close corporation regarding the operation and maintenance of the railway by RFI and the road before and after the Messina Bridge area operated and maintained by ANAS. ANAS for road will comprise associated toll road consortiums on toll roads interfacing with the SdM road system.

4.2 O&M Organisation

Figure 4-2 shows the organisation of Operation and Maintenance comprising O&E and I&M:

Operation & Emergency (O&E) is described by the present O&E Manual. The O&E is supported by operational on-line information from the technological systems. O&E organisation interacts on an operational level with external agencies and authorities. Interaction agreements and management report is handled on a general management level. The interaction with these external parties is further described in Chapter 3.4.

Inspection & Maintenance (I&M) is further described by the Inspection & Maintenance Manual. Inspection & maintenance comprises systematic in-depth inspection and non-routine maintenance.

The interaction between O&E and I&M is further described in Chapter 3.3.

Further, O&M is generally supported by a number of management systems based on technological systems which also shall be maintained by I&M.

4.2.1 O&E Organisation

O&E is suggested to comprise the following organisation and responsibilities:

Table 4-1 O&E organisation - staff and responsibilities

- **O&E Management**
  - Staff:
    - Operational Manager
    - Assistant Operation Manager (back-to-back)
    - Safety & Educational Controller
  - Responsibilities:
    - Management of O&E work teams
    - Planning of operation and handling of emergencies
    - Report to SdM Management
    - Safety logging, reporting & planning of safety induction, drills
    - Coordination with external authorities and agencies
    - Coordination with I&M work plans and follow-up on caretaking.
    - Participation in evaluation and revision of O&E+I&M manuals
- **Operational Control:**
  - Staff (3 shifts, 24 hours):
    - Team Leader 1, 2, 3, 4 and 5.
  - Responsibilities:
    - Control and command of operation & emergency of the bridge
    - Coordination of all parties with actions interfering with bridge
    - Logging of the operation and emergencies.
- **Toll Unit:**
  - Staff (3 shifts, 24 hours):
    - Team Leader 1, 2, 3, 4 and 5.
  - Responsibilities:
    - Operation of toll system
    - Logging and reporting on operation
- **Road Patrol:**
  - Staff (3 shifts, 24 hours):
    - Team Leader 1, 2, 3, 4 and 5.
  - Responsibilities:
    - Surveillance patrols on road
    - Assistance and control on road to traffic
    - Assistance and control on road to I&M works
- **Caretaker Units:**
  - Staff (1 day work with 24 hours on call):
    - Team Leader 1, 2 and 3.
  - Responsibilities:
    - Routine maintenance on bridge
    - Reporting of needs for inspection and (non-routine) maintenance
- **Security Unit:**
  - Staff (3 shifts, 24 hours):
    - Team Leader 1, 2, 3, 4 and 5.
  - Responsibilities:
    - Patrol of fences, doors and gates
    - Follow-up on alarms and intruders
    - Report on incidents

4.2.2 I&M Organisation

I&M comprises the following units and responsibilities of main tasks:

Table 4-2 I&M organisation - staff and responsibilities (proposal)

- **I&M Management**
  - Staff:
    - Technical Manager
    - Assistant Technical Manager (back-to-back)
    - Data and Documentation Controller
  - Responsibilities:
    - Management of I&M work teams
    - Planning of I&M
    - Report to SdM Management
    - Training of personnel
    - Management of data and documentation
    - Coordination with external authorities and agencies
    - Coordination with O&E work plans and follow-up on caretaking.
    - Participation in evaluation and revision of O&E Manual
- **O&M Technological Systems (inc. BMS):**
  - Staff (day work/24 hours on call):
    - System Manager
  - Responsibilities:
    - Routine adjustment of systems
    - Manage maintenance and development of systems
    - Administration of user help function
- **Equipment & Supply:**
  - Staff:
    - Yard Manager:
  - Responsibilities:
    - Management of O&M equipment and spare parts
- **Inspection:**
  - Staff:
    - Team Leader 1,2 and 3
  - Responsibilities:
    - Planning of inspection activities
- **Inspection (non-routine)**
  - External consultant *(assumed to be applied due to the amount of inspection work to be carried out or due to requirements on special competencies).*
- **Maintenance (non-routine)**

External contractor *(assumed to be applied due to the amount of inspection work to be carried out or due to requirements on special competencies).*

SdM O&M Organisation

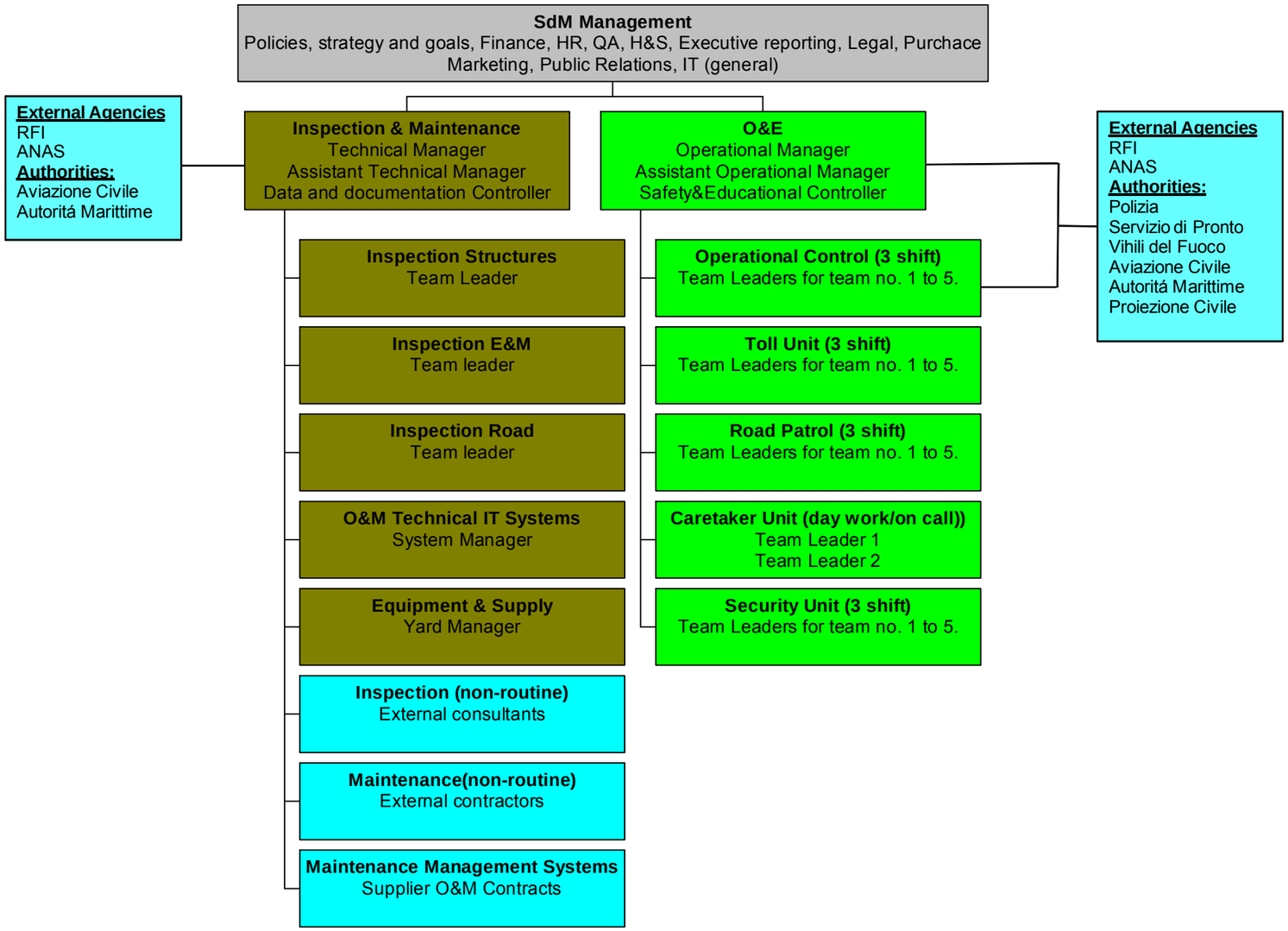


Figure 4-2 O&M organisation in with external interfaces (proposal)

4.3 Interface between O&E and I&M

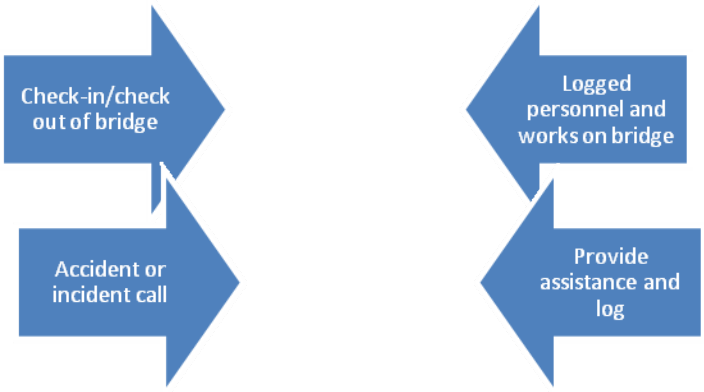
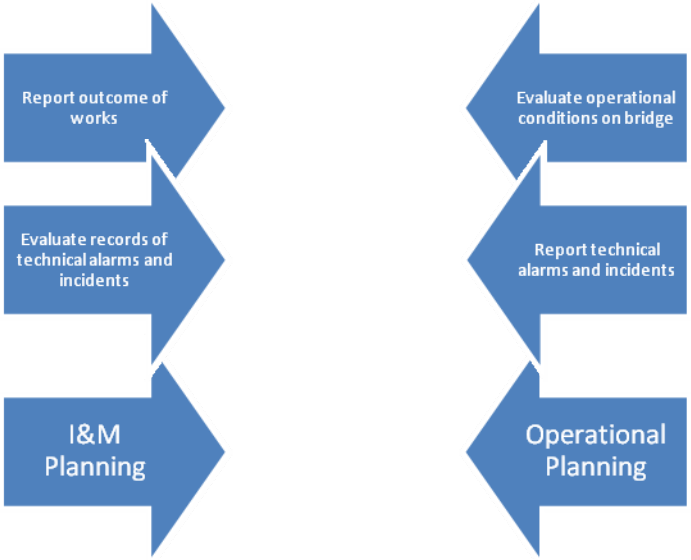
Table 4-3 shows the interfaces between O&E and I&M branches of the O&M organisation. The interaction with I&M is foreseen to comprise normal operational mode and abnormal mode in connection with accidents and technical problems.

The O&E and I&M interacts with respect to:

- Operational O&E procedures for carrying out I&M works on the bridge
- Ordering of I&M to carry out repair works to get bridge back into normal operation after an incident.
- Coordination of which maintenance works is part of the operational caretaking and which part is part of non-routine maintenance work covering the long term conditions of the bridge.
- These two interfaces will be coordinated between I&M and O&E Manuals to obtain efficient and safe procedures with an unambiguous organization of tasks and communication with no overlap.

The organisation and the manuals will be designed independently on whether some tasks may be sub-contracted. The reason is that the SdM requirements to procedures are considered to be independent on whether the tasks are carried out within or outside the SdM organisation.

Table 4-3 Examples of interaction between O&E and I&M

Interaction between I&M and O&E	**O&E Procedures/instructions**
	O&E safety induction procedure.
	O&E work permit instruction
	O&E safety instruction for bridge works
	O&E inspection and maintenance procedure

4.4 Interaction with External Agencies and Authorities

Table 4-4 shows the expected overall interaction with external agencies and authorities. There will a significant interaction with the external agencies and authorities for the normal, abnormal and emergency modes of operation.

External agencies comprise:

- RFI will be operating and maintaining the railway. It is assumed that a number of RFI rules and procedures will be the basis with some adaption to crossing of the bridge. There will be interfaces to SdM with respect to caretaking, inspection and maintenance work on the bridge as well as in case where emergencies interact with the railway traffic.
- ANAS (contracted consortiums) will be operating and maintaining the roads outside the Messina Bridge area and SdM road network. Here ANAS rules for operation and maintenance will apply and it is envisaged that SdM will seek to adapt to these but the presence of the bridge may also induce special procedures for ANAS and local road authorities (Sicily and Calabria).

Authorities are:

- Polizia who will let bridge area be contained in normal Polizia work regarding traffic, crime and emergencies. Furthermore Polizia and SdM will interact regarding the needs to handle special events on the bridge. It is noticed that Polizia shall in the development of instructions and procedures be detailed into the different Polizia authorities, e.g. Forze dell'Ordine, Polizia Stradale and probably more.
- Similar relations will comprise the Servizio di Pronto and Vigili del Fuoco but only with respect to emergencies.
- Aviazione Civile (Civil Air Force) and Autorita´Marittima (Maritime Authority) will interact with SdM with respect to warning light on the bridge and to the extent that emergencies in air or sea may cause a threat to bridge or vice versa, the bridge may expose air or sea traffic to a threat.

- Protezione Civile and Prefetture are both primarily envisaged to be involved in major emergencies on the bridge, when a disaster has occurred or is threatening to occur.

Common to external agencies and authorities and SdM is that the design of the O&E Manual will require a close dialogue and discussions to clarify the interfaces and the interaction.

Table 4-4 does not show the special interactions, which will exist between external agencies (RFI and ANAS) and the authorities. These parties will together with SdM have to define these interactions in detail.

It is envisaged that the required future process for corporation will comprise:

- Meetings with SdM and external agencies and authorities to clarify basis of needs, interfaces, responsibilities and requirements with respect to operational concept and safety concept.
- Detailing of operational concept and safety concept with outline of O&E procedures and instructions interacting with external agencies and authorities.
- Further meetings with discussion of O&E proposal for operational concept and safety concept.
- Operational and safety concept for approval by SdM and external agencies and authorities.
- Start of operation of bridge with regular subsequent meetings with adjustment of operational and safety concept.
- Regular emergency drills and updating of O&E Manual based on experiences from drill and operation.
- Especially special operational and emergency drills shall be carried out in a period before opening the bridge.

In the final O&E Manual an overview of emergency procedures with external parties with interfaces to the O&E of the bridge. The O&E Manual should at all times involve and be known by the external agencies and authorities, and the O&E Manual should be consistent with procedures and instructions with these parties.

Table 4-4 Interaction between SdM and external parties (overall)

RFI => O&E Interaction	RFI <= O&E Interaction	Procedures
Apply for safety certificate to bridge Provide safety induction for railway Apply for work permit on bridge Provide work permit for railway Check-in-check-out of bridge Log check-in/check-out Report works Report incident/accident on railway Stop trains Apply for special transport Participate in emergency drill	Provide safety induction Apply for safety certification to rail Provide work permit on bridge Apply for work permit on railway Log check-in/check-out Check-in/check-out railway work Report works Provide assistance Report incidence/accident on bridge Confirm special transport Arrange emergency drill	To be clarified by dialogue with SdM and RFI.
ANAS=>O&E Interaction	**ANAS<=O&E Interaction**	
Coordination of traffic (traffic queue, traffic restrictions, emergency, special vehicle transports) Coordination of maintenance	Coordination of traffic (traffic queue, traffic restrictions, emergency, special vehicle trans.) Coordination of maintenance	To be clarified by dialogue with SdM and ANAS
Polizia=> O&E Interaction	**Polizia<= O&E Interaction**	
Coordination on traffic management Request for check point at toll Priority toll gate for emergency Assistance Assistance Assistance Participate in emergency drill	Coordination on traffic management Facilities for Polizia Make toll gate available Request for assistance due to traffic offenses Request for assistance to security threat Request for emergency assistance Arrange emergency drill	To be clarified by dialogue with SdM and Polizia
Vigili del Fuoco/Servizio di Pronto Intervanto=>	**<=O&E**	
Provide assistance	Request assistance on: Accident assistance (road, rail) Fire assistance (road vehicle, rail vehicle, bridge, building) major emergency assistance Spill of hazardous substance Arrange emergency drills	To be clarified by dialogue with SdM and Vigili del Fuoco//Servizio di Pronto Intervento
Aviazione Civile Autoritá Marittime=>	**<=O&E**	
Require aerial and naval lights Inform on required precaution Inform and act on aerial/maritime threats	O&M aerial and naval lights Adapt to flight/naval accidents (traffic restriction /emergency, pollutions) Adapt to aerial/maritime threats (close bridge)	To be clarified by dialogue with SdM and the authorities.
Protezione Civile / Prefetture =>	**<=O&E**	
Co-arrange plan for major emergencies Co-arrange drills for major emergencies Interaction in major emergencies	Co-arrange plan for major emergencies Co-arrange drills for major emergencies Interaction in major emergencies	To be clarified by dialogue with SdM and Proiezione Civile

4.5 Communication

The lines of communications and methods of the communications will be elaborated in detailed design phase of the manual.

The following will have to be detailed further:

- Lines of communication within O&E organisation and with respect to the external agencies and authorities. Very precise and robust procedures for communications will have to be elaborated in corporation with these parties.
- Handling of communication with private persons, e.g. vehicle drivers etc.
- General methods of communications (radio system, telephone, mobile telephone, email, letter-in-writing etc) should be reviewed with respect to application in different situations for normal, abnormal and emergency events.
- Needs for logging of communication in connection with accidents and emergency events.
- Recommendation: At least for emergency events, automatic communication via SCADA should be considered.

5 O&E Procedures - Operational Analysis

An operational analysis of the events corresponding to normal, abnormal and emergency mode of operation will be carried out in detail as a basis for the writing the O&E Manual.

The operational analysis comprises all three modes of operation: Normal, abnormal and emergency modes of operation.

This analysis will comprise:

- Identification of operational and emergency events and actions.
- Identification of interfaces and actors in the tasks on all events and actions.
- Further development of the operational concept in conjunction with the developed safety concept.
- Development of required response times.
- Development of procedures and instructions based on the results of the operational risk analysis, the general bridge layout and its facilities on the bridge.

In the following is presented the preliminary results of the operational analysis.

5.1 Preliminary Operational Analysis of Events

Table 5-1 lists preliminarily required operational tasks and events which shall be covered by procedures and instructions for the O&E Manual of the bridge. The lisiting shall be applied as a basis for elaborating procedures and instructions but may be modified during this elaboration to obtain an optimal structure and contents of procedures and instructions.

The O&E Manual covers a number of work processes of the operation and maintenance of the bridge excluding the Management Process:

- O&E Administration
- Operational Control
- Bridge Safety & Security

- Toll works
- Inspection & Maintenance works
- Environmental Control
- Road Traffic
- Rail Traffic
- Marine Traffic
- Airplane Traffic.

Procedures for each process describe tasks involving several actors/parties or personnel.

Instructions are only aimed to be applied by a single actor/party/personnel and contain a step-by-step instruction with a narrow perspective of carrying out a certain sequences of well defined actions.

Instructions are supplemented by user manuals/guidelines dedicated for the user interface of certain systems or piece of equipment.

The tasks contained in a procedure or a instruction are always triggered by an event, which may be due to planned operational decision or an unwanted event such as realized hazard.

Each O&E task is categorizes into:

- Normal operation (green)
- Abnormal operation (yellow)
- Emergency operation (red).

And the table shows the number of parties anticipated to be involved in a certain task. The parties comprise internal parties of the entire SdM O&M organization and external parties of authorities, rail and road agencies and others.

Expected frequency of events and propopsed response times of acting on events have been given. A number of events/actions will be scheduled and are thus not associated with a response time. These are marked with "Sch" for scheduled.

The response time is here defined as the duration from the moment of incoming call to OCC to the first OCC induced action imposing a mitigating change on the emergency event. In other words the response times stated refers primarily to the requirements of SdM.

Table 5-1 Listing of operation and emergency tasks for work processes in operation and maintenance of the suspension bridge.

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autoritá Marittime	Protezione Civile	Prefetture
Management processes	Outside of scope																												
Administration O&E works (supportive process)																													
Planning																													
	Monthly work planning	●	12	Sch		X	X				X					X						X							
	Weekly work planning	●	52	Sch		X	X				X					X						X							
	Daily Work planning	●	365	Sch		X	X				X					X						X							
	Visitor request bridge excl. railway	●	12	Sch		X	X									X													
	Visitor request railway	●	4	Sch		X	X									X						X							
Operational reporting																													
	Weekly traffic report - road	●	52	Sch		X										X							X						
	Weekly traffic report - railway	●	52	Sch		X										X						X							
	Weekly Technical report	●	52	Sch		X					X					X						X							
	Mntly H&S logging and reporting	●	12	Sch		X										X						X							
	Mnthly. Safety logging & reporting	●	12	Sch		X										X						X							
	Mnthly Security report	●	12	Sch		X				X						X						X		X					
Long-term updates																													

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autorità Marittime	Protezione Civile	Prefetture
	Review of O&E	●	1	Sch		X																X	X	X	X	X	X	X	X	X
	Education and training	●	1	Sch		X																								
	Exercises and drills	●	1	Sch		X																X	X	X	X	X	X	X	X	X
	Liaising & corporation with authorities and agencies	●	2	Sch		X																X	X	X	X	X	X	X	X	X
Operational O&E works (supportive process)																														
Control of M&E Systems																														
	Weather forecast	●	52	Sch			X		X													X								
	Road Traffic forecast	●	52	Sch			X		X														X	X						
	Road Traffic information	●	365	Sch			X	X	X															X						
	Video surveillance	●	-	Sch			X			X																				
	Logging of O&E	●	-	Sch			X																							
	Logging of road traffic	●	-	Sch			X																							
	Logging of train traffic	●	-	Sch			X															X								
	Request for maintenance caretaking - road	●	1000	30			X				X	X	X	X		X	X	X	X	X										
	Request for maintenance caretaking on railway by road	●	52	30			X									X						X								
Technical Alarms																														
	Loss of communication	●	0,5	15			X							X		X						X								
	Loss of power (black out)	●	1	15			X					X				X						X								
	Loss of technological system	●	1	500			X							X		X						X								
	Loss of lighting	●	1	500			X					X				X						X								

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autorità Marittime	Protezione Civile	Prefetture
	Loss of traffic signs	●	1	500			X					X				X						X								
	Loss of roadside phone system	●	1	500			X							X		X						X								
	IT system failure	●	1	500			X							X		X						X								
	Control system failure	●	1	500			X							X		X						X								
	Excessive vibrations	●	0,2	60			X				X					X						X								
	Visual disturbances to traffic	●	12	15			X				X					X														
Work on Bridge																														
	Acceptance of work plans	●	365	Sch			X				X					X														
	Logging of activity	●	365	Sch			X				X					X														
	Communication equipment	●	365	Sch			X				X					X														
Security alarms																														
	Intruder alarm	●	12	2			X			X														X						
Emergencies																														
	Personnel accident	●	12	15			X				X					X						X								
	Security threat warning (e.g. warning of bomb etc).	●	0,2	2			X																	X						
	Fire on bridge	●	0,01	2		X	X		X	X														X	X	X				
	Fire in building	●	0,01	2		X	X																	X	X	X				
	Terrorism action/act of violence	●	0,01	2		X	X																	X						
	Seismic hazard	●	0,01	5		X	X	X	X	X						X	X	X	X	X		X	X	X	X	X			X	X
	Evacuation of building	●	0,2	2		X	X																	X	X	X				
	Evacuation of bridge	●	0,02	2		X	X															X		X	X	X				
	Closure of Bridge	●	5	15		X	X	X	X	X												X	X	X	X	X			X	X
Bridge safety & security process (supportive process)																														

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autorità Marittime	Protezione Civile	Prefetture
	Check of fencing	●	365	Sch			X			X												X		X						
	Intruder alarm follow-up	●	12	15			X			X												X		X						
	Object from Video surveillance	●	12	15			X			X												X		X						
	Vehicle redirection need	●	12	15			X			X														X						
Toll works (supportive process)																														
Normal operation																														
	Normal mode	●	-	Sch				X																						
	Malfunction	●	-	Sch				X																						
Incidence																														
	Vehicle Queue	●	52	15			X	X	X	X																				
	Minor Vehicle accident (no hazard)	●	52	15			X	X	X	X														X	X	X				
	Vehicle turnabout	●	6	2			X	X	X	X														X						
Polizia assistance																														
	Non-payer	●	28	2			X	X																X						
	Speeding	●	365	2			X	X																X						
	Drink/drug driving	●	28	2			X	X																X						
	Illegal vehicle	●	28	2			X	X																X						
Emergency																														
	Request for accident assistance	●	12	2			X	X																X	X	X				
I&M works (supportive process)																														
	Application for work	●	365	Sch			X				X	X	X	X			X	X	X	X										

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autorità Marittime	Protezione Civile	Prefetture
	Check-in for start of work	●	365	Sch			X				X	X	X	X			X	X	X	X										
	Check-out for end of work	●	365	Sch			X				X	X	X	X			X	X	X	X										
	Incidence reporting	●	52	500			X				X	X	X	X		X	X	X	X	X		X		X	X	X				
	Accident reporting	●	12	500			X				X	X	X	X		X	X	X	X	X		X		X	X	X				
Environmental control works																														
	Approval of chemical substances O&M	●	12	Sch		X										X						X								
	Pollution on bridge	●	0,2	15		X	X						X									X		X		X				
	Risk of sea pollution	●	0,02	15		X	X		X	X			X			X						X		X		X		X	X	X
Road traffic (main process)																														
General																														
	Special Road vehicles	●	52	Sch			X	X	X	X						X							X	X						
Traffic incidence																														
	Traffic diversions	●	52	15			X	X	X	X														X						
	Priority of vehicles event	●	28	5			X	X	X	X														X						
	Slow traffic/queue	●	52	15			X	X	X	X														X						
Weather hazard																														
	Wind hazard	●	12	5			X		X															X						
	Visibility hazard	●	12	5			X		X															X						
	Rain hazard	●	12	5			X		X															X						
Vehicle hazard																														
	Garbage collection	●	1000	15			X		X				X																	
	Major Maintenance work on road	●	2	Sch			X		X							X	X		X			X								
	Major Maintenance work on rail	●	2	Sch			X		X							X	X		X			X								
	Vehicle at halt hazard	●	1000	15			X		X																					

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autorità Marittime	Protezione Civile	Prefetture
	Queue hazard	●	52	15			X		X															X						
Emergencies																														
	Vehicle in wrong direction hazard	●	1	2			X		X	X														X						
	Dropped object hazard	●	365	15			X		X	X			X											X						
	Person on road hazard	●	12	2			X		X															X						
	Traffic accident	●	20	2			X		X	X	X													X	X	X				
	Vehicle fire	●	2	2			X		X	X	X												X	X	X	X				
	Dangerous/harmful effusions on road pavement	●	0,5	2			X		X		X													X	X	X				
Train traffic (main process)																														
Road=>Rail incidence																														
	Bridge/road maintenance work	●	0,1	Sch			X		X				X			X			X				X							
Rail=>Road incidence																														
	Railway maintenance	●	0,1	Sch			X		X				X			X							X							
	Road assistance to train at halt	●	0,1	15			X		X	X													X							
Emergencies																														
	Road vehicle/object on railway	●	0,01	15			X		X				X						X											
	Rail vehicle/object on road	●	0,01	15			X		X	X						X			X				X							
	Rail accident	●	0,01	2			X		X	X													X							
	Train hits person	●	0,01	2			X		X	X	X		X										X		X	X	X			
	Railway vehicles accidence	●	0	2			X		X	X						X	X						X		X	X	X			X	
	Train evacuation	●	0	15		X	X	X	X	X						X							X		X	X	X			X	X

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	Estimated Frequency (per year)	Proposed Response Time (minutes)	**OPERATION & EMERGENCY**	O&E Planning & Safety	Operational Control	Toll Unit	Road patrol	Security	Caretaker unit Structures & land works	Caretaker unit M&E	Caretaker unit Road	Caretaker unit Communication &	**INSPECTION &MAINTENANCE**	I&M Technical Manager	I&M Structures & land works	I&M M&E	I&M Road	I&M Communication & Systems	**AUTHORITIES & AGENCIES**	RFI	ANAS	Polizia	Servizio di Pronto Intervento	Vigili del Fuoco	Aviazion Civile	Autorità Marittime	Protezione Civile	Prefetture
	Train fire	●	0	2			X		X	X												X		X	X	X			X	
	Dangerous effusions on railway track	●	0	15			X		X	X												X		X	X	X			X	
Marine traffic (external process)																														
	Special ship - height	●	1	Sch			X																					X		
	Special ship - contents	●	1	Sch			X																					X		
	Accidents	●	0	15			X																					X	X	
	Pollution	●	0	15			X																					X	X	
	Bridge Restriction to marine traffic	●	0	15			X																					X		
	Threats	●	0	2		X	X			X												X		X				X		
Airplane traffic (external process)																														
	Bridge Restrictions to air traffic	●	1	2		X	X					X				X		X									X			
	Accident interacting with bridge	●	0	2		X	X			X												X		X	X	X	X		X	X
	Threats	●	0	2		X	X			X												X		X			X			

5.2 O&E Supportive Technological Systems

A number of technological systems of the bridge support O&E management of the bridge. The use of these will be implemented in procedures and instructions.

5.2.1 SCADA

SCADA system is the shell for the technology systems and supports the O&E with a user interface showing alarm data, environmental parameters, traffic parameters, visual surveillance and allowing on-line control of the operation of the bridge.

Technological systems which are used as supportive tools for carrying out O&M are:

- Traffic Management System (TMS)
- Control Monitoring System (CMS)
- Structural Health Monitoring System (SHMS) (including weather, seismic and structure)
- Safety, Security and Surveillance (SSS) System
- Telecommunication systems (monitored through CMS)
- Railway Traffic Management System - monitoring data input/output SdM and RFI.

In the OCC (control room) there are planned to be three system displays as support for the operating staff operational management of the bridge:

- Traffic Management System display
- SCADA System display
- Safety, Security and Surveillance System display

The SCADA system shall contain the O&E Manual and other manuals allowing a more easy on-line access to all procedures and instructions.

Figure 5-1 shows the envisaged interaction between the operator of OCC and the technological management systems.

provide an overview of the facilities provided by the technological management systems.

Figure 5-2 to Figure 5-5 show (based on tender drawings) the overview of the technology systems of the bridge providing important on-line data for operation and control of the bridge and its traffic.

Table 5-3 and Table 5-4 show the anticipated application of the management and monitoring systems in the operation of the bridge. The tables provide the preliminary interaction between the required operational tasks and events and the available management and monitoring systems. This interaction shall be used as part of the basis for elaboration of procedures and instructions although it may be modified during this elaboration to obtain an optimal structure and contents of procedures and instructions.

5.2.2 Telecommunication Systems

An internal telephone system will exist. This will include emergency phones and internal phone system within the SdM organisation. The latter may also be available on the bridge.

5.2.3 Radio System

A radio system will be used on the bridge based on TETRA standard. It shall be mandantory to be equipped with radios when working on the bridge. Mobile phone will exist in parallel with radio system but it may be foreseen that mobile phones may only function on the bridge deck and not inside the bridge structures.

5.2.4 Logging of Operational Data

Logging of events, historical data and experiences should be implemented in routines - interface with technical systems. This requires clarification.

The technological systems will contain databases containing logged data. This will presumable be part of the SCADA system.

In addition the operational control will have to log all major events and decided actions by the operational control.

Communication including oral communication may need to be logged to the extent this is requirement by authorities and agencies.

Video surveillance systems with a security purpose may require a recording of events within a certain time span. This requirement is assumed to be part of the specifications to the technological systems.

5.2.5 Access to As-Built Data

The as-built documentation is the current valid drawings and associated technical manuals (user manual, O&M manuals, commissioning reports, design reports etc.).

Listing of as-built documentation will be available from the Bridge Management System (BMS).

The complete as-built document shall also comprise toll area and facilities and elements of the land works.

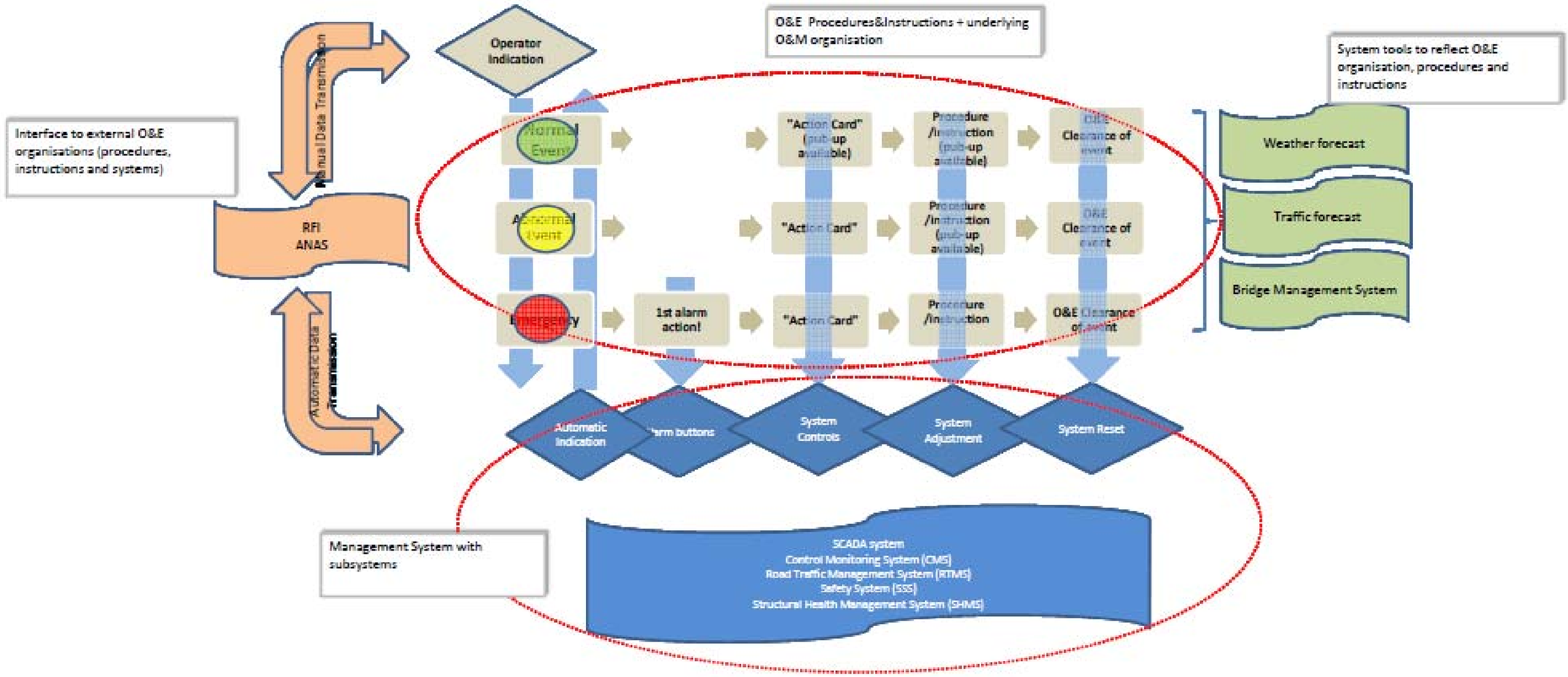


Figure 5-1 Interaction between OCC and technological management systems in the control room of OCC.

Table 5-2 Overview of system facilities incorporated in the technologicial management systems available in the control room for the OCC operational management.

OCC systems\System facilities	Manual system interpretation	Automatic alarm indication	Automatic alarm action	Automatically logged data	Remote control	Data reporting
Traffic Management System (TMS) display in OCC	Incoming communication CCTV Video surveillance Systems parameters -traffic speed -traffic volume -traffic accidents -in weight motion system	CCTV Automatic Incidence monitoring Vehicle weight	None	All parameters Stored video data Id of emergency phone calls position In weigh motion data Toll station registrations?	Emergency traffic gates Dynamic traffic signs Retractable barriers (to railway crossovers) Variable message signs (text and lane control signal)	Standard system reports supplemented with manual reports.
SCADA System display in OCC -Control monitoring system (CMS) -Structrural health monitoring system (SHMS) -Fire detection system -Telecommunication -Railway monitoring	Video surveillance Systems parameters	Technical Alarms (inc. warning on air/naval lights) Fire alarms Structural alarms Climatic alarms SOS stations & emergency phones Railway traffic data input/output	Fire	Traffic data (weight) Climatic data SHMS data Monitored train data (train id, arrival/exit times) RFI train data (weight, goods registration) Failiure and alarm log	Power mode & distribution Lighting Dehumidification	Standard system reports supplemented with manual reports.
Safety Security and Surveillance System (SSS) display in OCC -Safety and antisabotage	Video surveillance Intruder detection on bridge perimeter (on land)	Intruder alarms	None	Stored video data Alarm locations Id of suspicious vehicles (licence plates) Detection of intruders on land Detection of vehicles at halt Id of objects in air and sea	Access control	Standard system reports supplemented with manual reports.
Computer system facilities in OCC						
Weather forecasting	Meteo input combined with local model.					Standard report
Traffic forecasting	ANAS input+work planning+experience					Standard report
Bridge management system (BMS)	As built drawings Work orders.					None

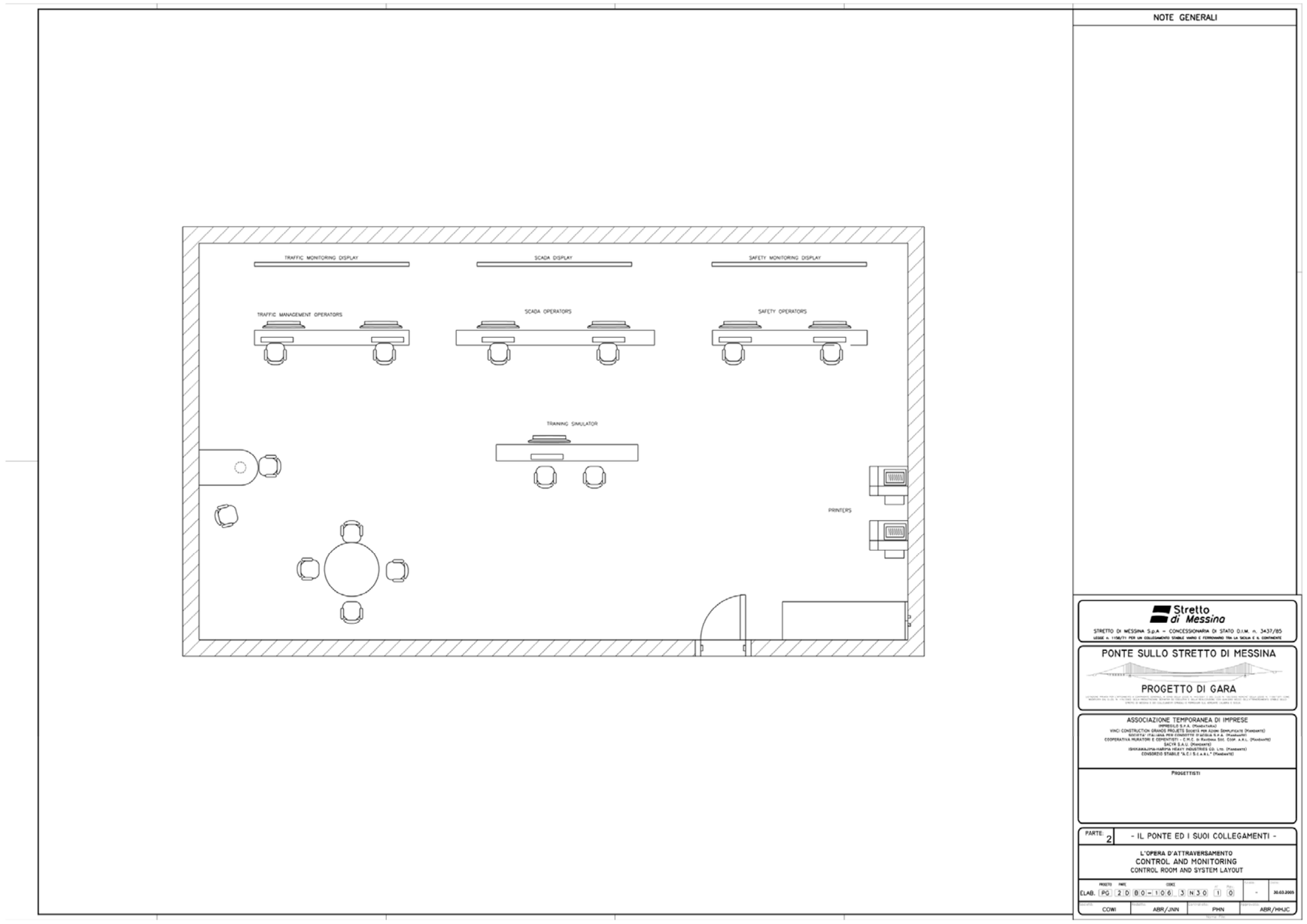


Figure 5-2 Control room of OCC and system layout Drawing no. PG-2D-BC-106-3N30 (tender design 2005).

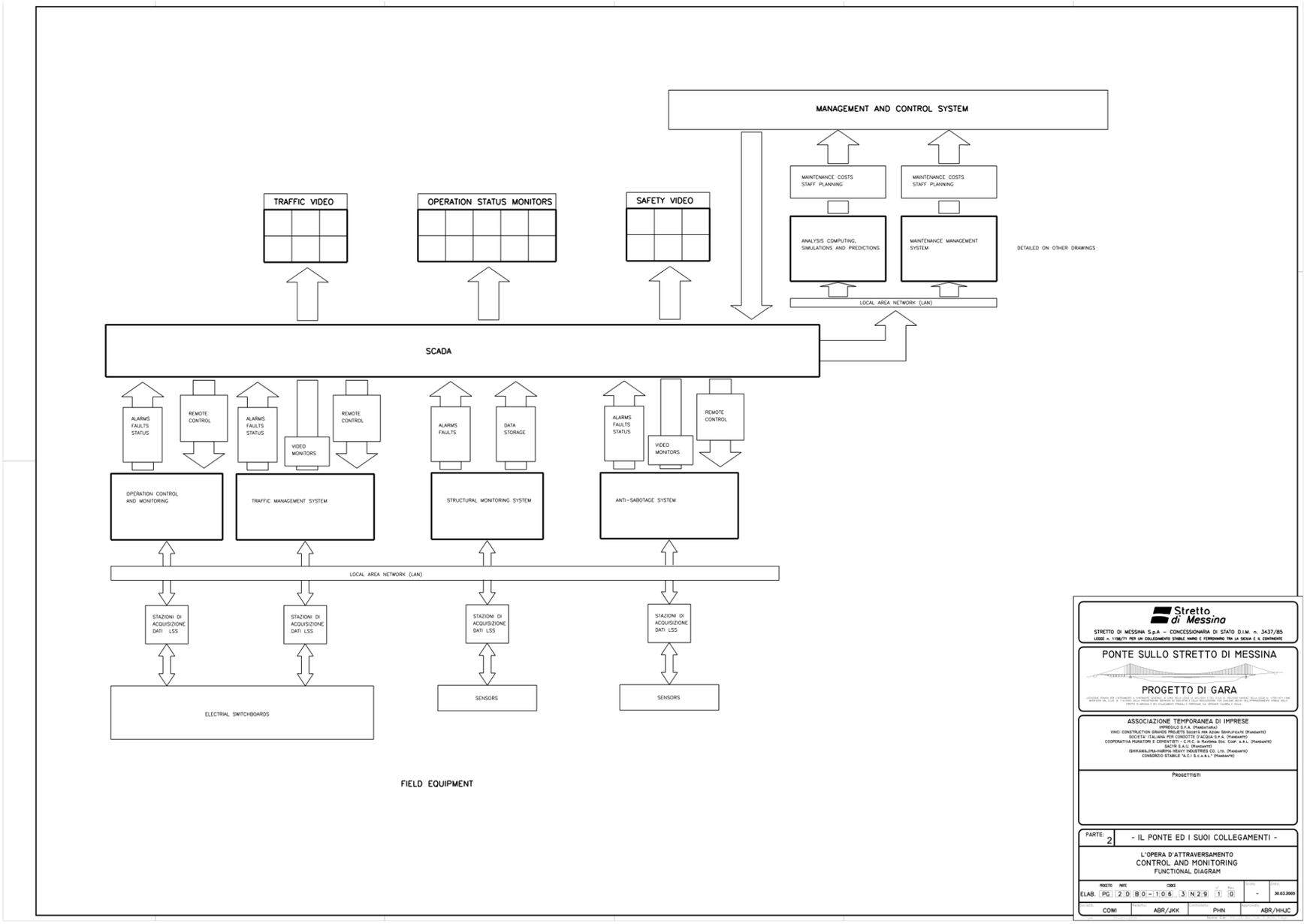


Figure 5-3 Control and monitoring - functional diagram Drawing no. PG-2D-BC-106-3N24 (tender design 2005).

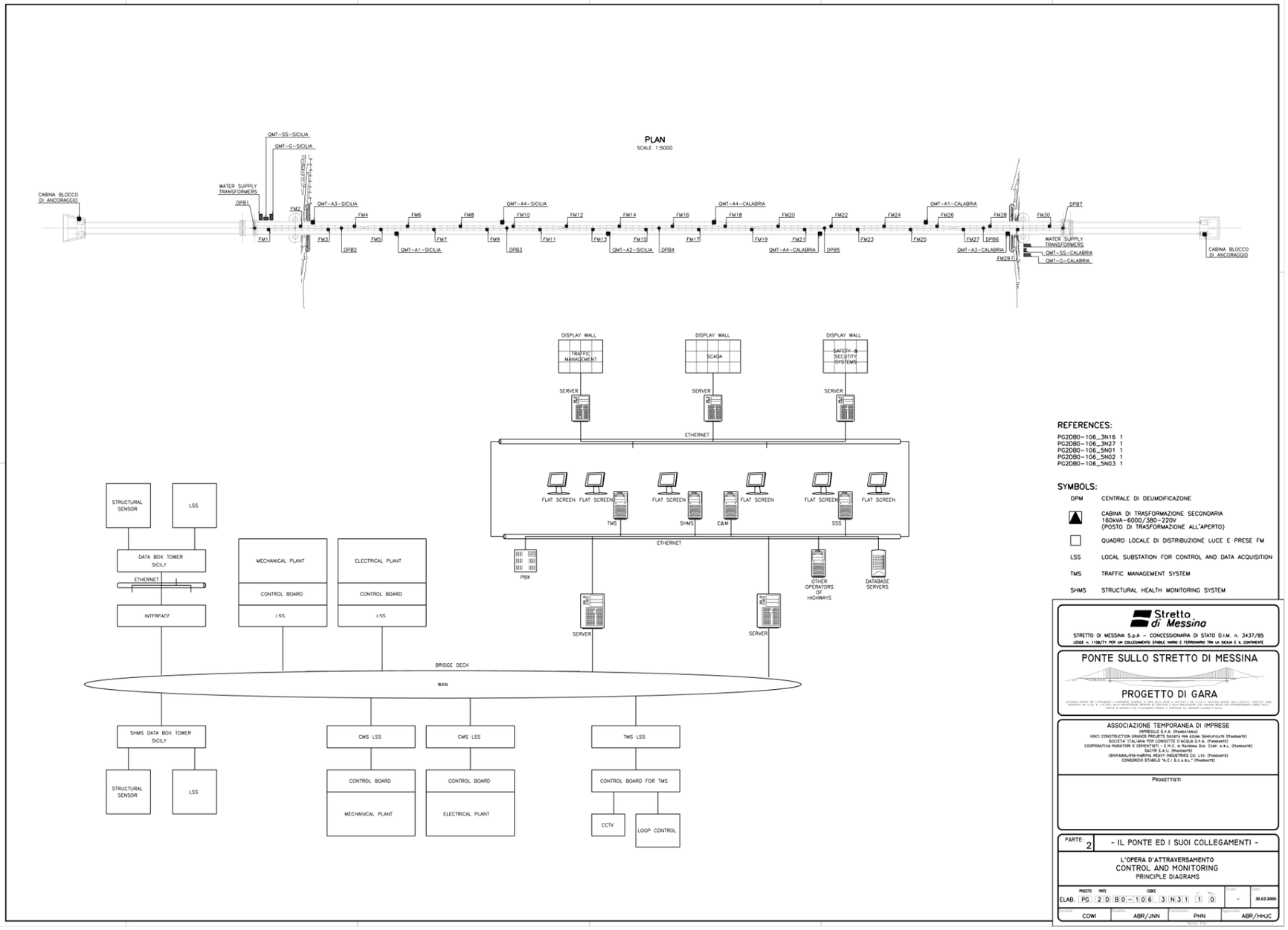
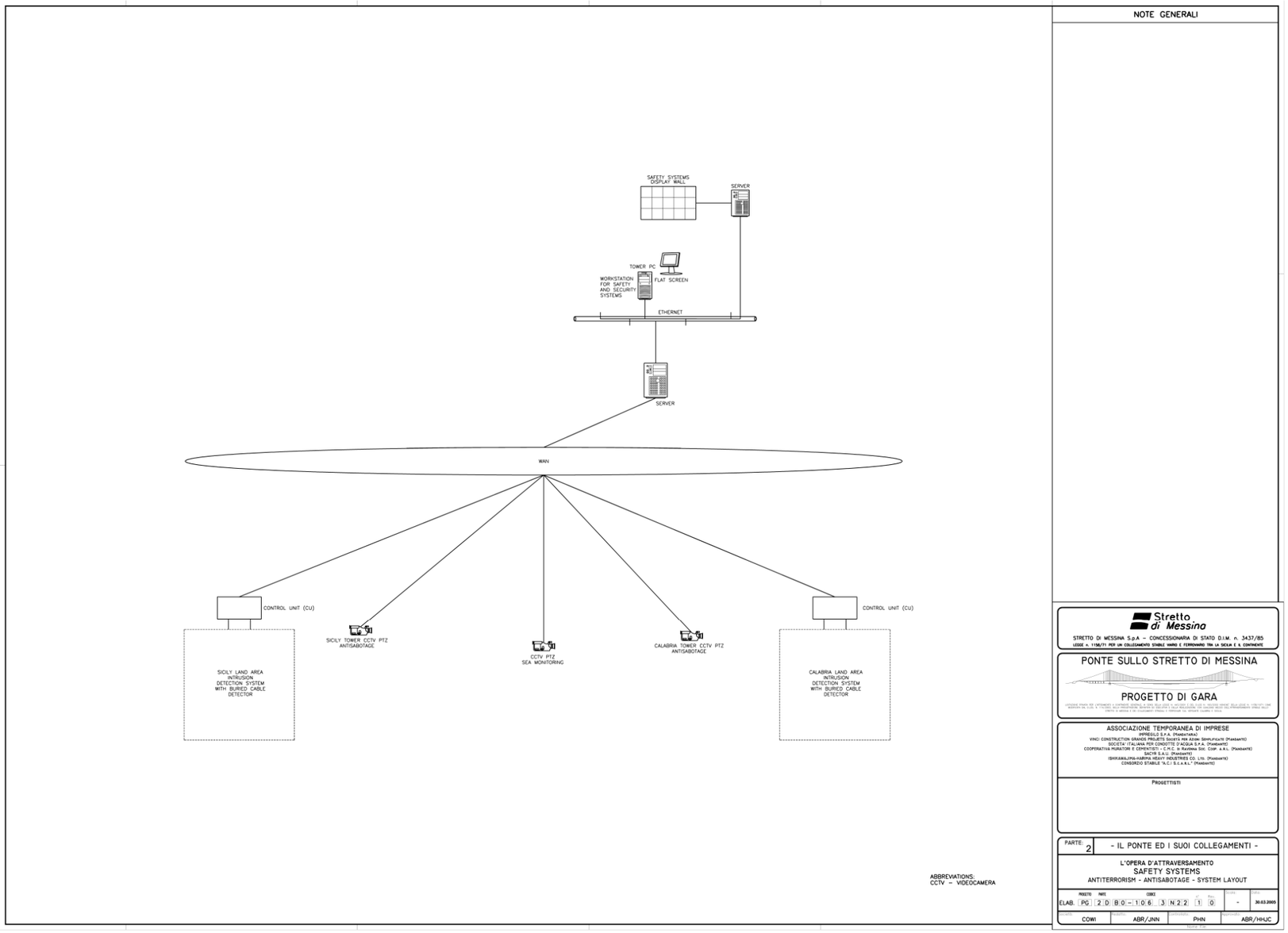


Figure 5-4 Control and monitoring - principles diagrams Drawing no. PG-2D-BC-106-3N31 (tender design 2005).



NOTE GENERALI

Stretto di Messina

STRETTO DI MESSINA S.p.A. – CONCESSIONARIA DI STATO D.I.M. n. 3437/85
LEGGE n. 1158/71 PER UN COLLEGAMENTO STABILE MARINO E FERROVIARIO TRA LA SICILIA E IL CONTINENTE

PONTE SULLO STRETTO DI MESSINA

PROGETTO DI GARA

ASSOCIAZIONE TEMPORANEA DI IMPRESE
IMPREGILO S.P.A. (MANDATARIA)
VINCI CONSTRUCTION GRANDS PROJETS SOCIETÀ PER AZIONI SEMPLIFICATE (MANDANTE)
SOCIETA' ITALIANA PER CONDOTTE D'ACQUA S.P.A. (MANDANTE)
COOPERATIVA MURATORI E CEMENTISTI – C.M.C. DI RAVENNA SOC. COOP. A R.L. (MANDANTE)
SACYR S.A.U. (MANDANTE)
ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES CO. LTD. (MANDANTE)
CONSORZIO STABILE "N.C.I. S.c.a.r.l." (MANDANTE)

PROGETTISTI

PARTE: 2 – IL PONTE ED I SUOI COLLEGAMENTI –

L'OPERA D'ATTRAVERSAMENTO
SAFETY SYSTEMS
ANTITERRORISM - ANTISABOTAGE - SYSTEM LAYOUT

PROGETTO	PARTE	CODICE												REVISIONE	DATA
ELAB.	PG	2	D	B	0	–	1	0	6	3	N	2	2	1	0	–	30.03.2005

AUTORE	VISTO	VISTO	VISTO
COWI	ABR/JNN	PHN	ABR/HHJC

Figure 5-5 Safety systems - anti terrorism - anti sabotage - system layout Drawing no. PG-2D-BC-106-3N22 (tender design 2005).

Table 5-3 The available management and monitoring systems to the O&E processes.

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor loggin	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managrmnt System
Management processes	Outside of scope																																	
Administration O&E works (supportive process)																																		
Planning																																		
	Monthly work planning	●																													X	X		
	Weekly work planning	●																													X	X		
	Daily Work planning	●																													X	X	X	
	Visitor request bridge excl. railway	●																				X												
	Visitor request railway	●																				X												
Operational reporting																																		
	Weekly traffic report - road	●						X	X		X			X										X								X		
	Weekly traffic report - railway	●						X	X					X										X	X									
	Weekly Technical report	●											X			X	X	X																X
	Mntly H&S logging and reporting	●																				X												
	Mnthly. Safety logging & reporting	●						X	X				X	X	X	X	X					X			X									
	Mnthly Security report	●																					X					X	X	X				
Long-term updates																																		

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor loggin	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Review of O&E	●						X										X												X				
	Education and training	●																																
	Exercises and drills	●																																
	Liaising & corporation with authorities and agencies	●																																
Operational O&E works (supportive process)																																		
Control of M&E Systems																																		
	Weather forecast	●			X												X														X		
	Road Traffic forecast	●			X			X									X						X								X	X	
	Road Traffic information	●			X	X	X																											
	Video surveillance	●		X										X												X							
	Logging of O&E	●						X				X		X		X	X	X				X	X						X	X			
	Logging of road traffic	●		X	X			X																X									
	Logging of train traffic	●																							X								
	Request for maintenance caretaking - road	●		X										X								X				X							X
	Request for maintenance caretaking on railway by road	●		X										X								X			X	X							X
Technical Alarms																																		
	Loss of communication	●											X																					X

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor loggin	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Loss of power (black out)	●											X						X															X
	Loss of technological system	●	X									X	X	X													X			X		X			X
	Loss of lighting	●											X							X															X
	Loss of traffic signs	●				X							X	X																					X
	Loss of roadside phone system	●											X																						X
	IT system failure	●											X																						X
	Control system failure	●											X																						X
	Excessive vibrations	●		X											X	X											X								X
	Visual disturbances to traffic			X											X												X								
Work on Bridge																																			
	Acceptance of work plans	●																			X														X
	Logging of activity	●																			X														X
	Communication equipment	●																			X														X
Security alarms																																			
	Intruder alarm	●		X											X						X						X	X	X	X					
Emergencies																																			
	Personnel accident	●																				X	X												
	Security threat warning (e.g. warning of bomb etc).	●		X		X	X		X						X						X		X				X	X	X	X					
	Fire on bridge	●		X	X	X	X						X		X						X		X				X								
	Fire in building	●		X	X	X	X						X		X						X		X				X								
	Terrorism action/act of violence	●		X			X		X				X		X						X		X				X	X	X	X					

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor loggin	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Seismic hazard	●														X					X		X											
	Evacuation of building	●																			X		X											
	Evacuation of bridge	●		X	X	X	X														X		X											
	Closure of Bridge	●		X	X	X	X														X		X											
Bridge safety & security process (supportive process)																																		
	Check of fencing	●		X					X						X						X		X				X	X	X					
	Intruder alarm follow-up	●		X					X						X						X		X				X	X	X					
	Object from Video surveillance	●		X					X						X						X		X				X	X	X					
	Vehicle redirection need	●		X	X	X	X		X						X						X						X							
Toll works (supportive process)																																		
Normal operation																																		
	Normal mode	●																																
	Malfunction	●		X									X	X	X												X							
Incidence																																		
	Vehicle Queue	●		X									X	X	X												X							
	Minor Vehicle accident (no hazard)	●		X	X	X	X		X																									
	Vehicle turnabout	●		X	X	X	X		X						X												X	X						
Polizia assistance																																		

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor loggin	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Non-payer	●		X	X	X	X		X						X												X							
	Speeding	●		X	X	X	X		X						X												X							
	Drink/drug driving	●		X	X	X	X		X						X												X							
	Illegal vehicle	●		X	X	X	X		X		X				X						X			X			X	X	X					
Emergency																																		
	Request for accident assistance	●		X	X	X	X		X						X												X							
I&M works (supportive process)																																		
	Application for work	●																				X												X
	Check-in for start of work	●																				X												X
	Check-out for end of work	●																				X												X
	Incidence reporting	●																				X												X
	Accident reporting	●																				X												X
Environmental control works																																		
	Approval of chemical substances O&M	●																				X												
	Pollution on bridge	●		X	X	X	X		X			X	X		X							X					X	X						
	Risk of sea pollution	●		X	X	X	X		X						X							X					X	X						
Road traffic (main process)																																		
General																																		

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor loggin	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Special Road vehicles	●		X	X	X	X		X		X			X	X	X								X	X		X							
Traffic incidence																																			
	Traffic diversions	●		X	X	X	X							X	X									X			X							
	Priority of vehicles event	●		X	X	X	X							X	X												X							
	Slow traffic/queue	●		X	X	X	X							X	X												X							
Weather hazard																																			
	Wind hazard	●		X	X	X	X								X	X	X															X	X	
	Visibility hazard	●		X	X	X	X								X	X	X			X												X	X	
	Rain hazard	●		X	X	X	X								X	X	X			X												X	X	
Vehicle hazard																																			
	Garbage collection	●		X	X	X	X		X					X	X							X												
	Major Maintenance work on road	●		X	X	X	X								X							X					X						X	X
	Major Maintenance work on rail	●		X	X	X	X								X							X			X		X							X
	Vehicle at halt hazard	●		X	X	X	X		X					X	X												X						X	
	Queue hazard	●		X	X	X	X		X					X	X												X						X	
Emergencies																																			
	Vehicle in wrong direction hazard	●		X	X	X	X		X					X	X												X						X	
	Dropped object hazard	●		X	X	X	X		X					X	X												X						X	
	Person on road hazard	●		X	X	X	X		X					X	X												X						X	
	Traffic accident	●		X	X	X	X		X					X	X												X						X	
	Vehicle fire	●		X	X	X	X		X					X	X												X						X	

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor login	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Dangerous/harmful effusions on road pavement	●		X	x	X	X		x					x	x						x			x			X						x	
Train traffic (main process)																																			
Road=>Rail incidence																																			
	Bridge/road maintenance work	●		X	X	X	X						X	X						X				X		X								X
Rail=>Road incidence																																			
	Railway maintenance	●		X	X	X	X							X						X				X		X								X
	Road assistance to train at halt	●				X	X							X						X				X		X								
Emergencies																																			
	Road vehicle/object on railway	●		X	X	X	X		X					X						X				X		X								
	Rail vehicle/object on road	●		X	X	X	X		X					X						X				X		X								
	Rail accident	●		X	X	X	X		X					X						X				X		X								
	Train hits person	●		X	X	X	X		X					X						X				X		X								
	Railway vehicles accidence	●		X	X	X	X		X					X						X				X		X								
	Train evacuation	●		X	X	X	X		X					X						X				X		X								
	Train fire	●		X	X	X	X		X					X						X				X		X								
	Dangerous effusions on railway track	●		X	X	X	X		X					X						X				X		X								
Marine traffic (external process)																																			
	Special ship - height	●		X									X													X								

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**TMS Display**	Traffic Video	Traffic parameters	Traffic signs (VMS+LCS)	Traffic Restriction (mov. barriers)	Data Analysis	Automatic Incident Detection	Incident Management	Weigh-in system?	**SCADA Display**	Technical Alarms (CMS)	Traffic alarms	Video surveillance	Structural alarms (SHMS)	Weather Parameters (SHMS)	Data analysis	Remote control power (CMS)	Remote control Lighting (CMS)	Remote control access (CMS)	I&M Logging	Visitor login	Special Vehicle Logging	Railway Traffic Management	**SSS Display**	Safety Video	Sabotage alarms?	Intruder Alarms	Data analysis	**Computer System facilities**	Weather forecasting	Traffic forecasting	Bridge Managmrnt System
	Special ship - contents	●		X											X												X	X						
	Accidents	●		X											X												X	X						
	Pollution	●		X											X												X	X						
	Bridge Restriction to marine traffic	●		X											X												X	X						
	Threats	●		X		X	X		X						X								X				X	X	X	X				
Airplane traffic (external process)																																		
	Bridge Restrictions to air traffic	●																																
	Accident interacting with bridge	●		X	X	X	X																											
	Threats	●		X	X	X	X		X						X								X				X	X	X	X				

Table 5-4 Interaction between O&E processes and the available facilities of the management systems.

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
Management processes	Outside of scope																										
Administration O&E works (supportive process)																											
Planning																											
	Monthly work planning	●	X																								
	Weekly work planning	●	X																								
	Daily Work planning	●	X																								
	Visitor request bridge excl. railway	●	X																								
	Visitor request railway	●	X																								
Operational reporting																											
	Weekly traffic report - road	●	X						X		X						X								X		
	Weekly traffic report - railway	●	X						X		X						X								X		
	Weekly Technical report	●	X						X		X						X		X						X		
	Mntly H&S logging and reporting	●	X						X								X								X		
	Mnthly. Safety logging & reporting	●	X						X		X						X		X						X		X
	Mnthly Security report	●	X						X								X								X		X
Long-term updates																											

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Review of O&E	●	X						X		X								X								X
	Education and training	●	X																								
	Exercises and drills	●	X						X		X						X		X						X		X
	Liaising & corporation with authorities and agencies	●	X						X		X						X		X						X		X
Operational O&E works (supportive process)																											
Control of M&E Systems																											
	Weather forecast	●	X		X						X		X						X								
	Road Traffic forecast	●	X		X						X		X						X								
	Road Traffic information	●	X		X						X								X								
	Video surveillance	●			X	X			X		X		X								X						X
	Logging of O&E	●	X					X	X		X					X	X		X						X		X
	Logging of road traffic	●			X	X		X	X		X																
	Logging of train traffic	●											X	X		X	X		X								
	Request for maintenance caretaking - road	●			X	X			X				X	X			X										
	Request for maintenance caretaking on railway by road	●			X	X			X				X	X			X										
Technical Alarms																											
	Loss of communication	●					X	X					X	X			X				X	X			X		

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Loss of power (black out)	●											X	X	?												
	Loss of technological system	●												X		X		X									
	Loss of lighting	●			X	X			X					X		X		X									
	Loss of traffic signs	●			X	X			X					X		X											
	Loss of roadside phone system	●				X			X					X		X											
	IT system failure	●												X	X	X											
	Control system failure	●												X		X											
	Excessive vibrations	●												X					X								
	Visual disturbances to traffic								X																		
Work on Bridge																											
	Acceptance of work plans	●	X																								
	Logging of activity	●	X																								
	Communication equipment	●	X																								
Security alarms																											
	Intruder alarm	●																		X	X	X	X	X	X		
Emergencies																											
	Personnel accident	●			X							X								X							
	Security threat warning (e.g. warning of bomb etc).	●								X										X	X	X	X	X	X		
	Fire on bridge	●			X	X	X	X	X	X		X	X	X	X	X				X	X	X	X	X	X		
	Fire in building	●			X	X	X	X	X			X	X	X	X	X				X	X	X	X	X	X		
	Terrorism action/act of violence	●			X	X	X	X	X	X										X	X	X	X	X	X		

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Seismic hazard	●			X	X	X	X	X	X			X	X	X	X	X										
	Evacuation of building	●																			X	X	X	X	X	X	
	Evacuation of bridge	●			X	X	X	X	X	X											X	X	X	X	X	X	
	Closure of Bridge	●			X	X	X	X	X	X											X	X	X	X	X	X	
Bridge safety & security process (supportive process)																											
	Check of fencing	●																			X	X	X	X	X	X	
	Intruder alarm follow-up	●																			X	X	X	X	X	X	
	Object from Video surveillance	●																			X	X	X	X	X	X	
	Vehicle redirection need	●			X	X	X	X	X	X											X	X	X	X	X	X	
Toll works (supportive process)																											
Normal operation																											
	Normal mode	●			X	X		X	X	X																	
	Malfunction	●			X	X		X	X	X																	
Incidence																											
	Vehicle Queue	●			X	X		X	X	X																	
	Minor Vehicle accident (no hazard)	●			X	X			X																		
	Vehicle turnabout	●			X	X			X																		
Polizia assistance																											

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Non-payer	●			X	X			X																		
	Speeding	●			X	X			X																		
	Drink/drug driving	●			X	X			X																		
	Illegal vehicle	●			X	X			X	X											X	X			X		
Emergency																											
	Request for accident assistance	●			X	X			X	X																	
I&M works (supportive process)																											
	Application for work	●	X						X								X										
	Check-in for start of work	●	X						X								X										
	Check-out for end of work	●	X						X		X						X		X								
	Incidence reporting	●							X								X										
	Accident reporting	●							X								X										
Environmental control works																											
	Approval of chemical substances O&M	●	X																								
	Pollution on bridge	●			X				X	X	X		X				X		X		X				X		
	Risk of sea pollution	●			X				X	X	X		X				X		X		X				X		
Road traffic (main process)																											
General																											

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Special Road vehicles	●	X		X				X	X																	
Traffic incidence																											
	Traffic diversions	●							X	X																	
	Priority of vehicles event	●							X	X																	
	Slow traffic/queue	●			X	X	X	X	X	X																	
Weather hazard																											
	Wind hazard	●			X	X	X	X	X	X																	
	Visibility hazard	●			X	X	X	X	X	X																	
	Rain hazard	●			X	X	X	X	X	X																	
Vehicle hazard																											
	Garbage collection	●							X																		
	Major Maintenance work on road	●	X						X	X																	
	Major Maintenance work on rail	●	X						X	X																	
	Vehicle at halt hazard	●				X			X	X																	
	Queue hazard	●				X			X	X																	
Emergencies																											
	Vehicle in wrong direction hazard	●				X			X	X																	
	Dropped object hazard	●				X			X																		
	Person on road hazard	●							X																		
	Traffic accident	●							X	X																	
	Vehicle fire	●							X	X																	

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Displav**	Manual System Interetation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Dangerous/harmful effusions on road pavement	●							X	X																	
Train traffic (main process)																											
Road=>Rail incidence																											
	Bridge/road maintenance work	●	X						X	X																	
Rail=>Road incidence																											
	Railway maintenance	●	X						X	X																	
	Road assistance to train at halt	●							X	X																	
Emergencies																											
	Road vehicle/object on railway	●			X				X	X																	
	Rail vehicle/object on road	●			X				X	X																	
	Rail accident	●			X	X			X	X																	
	Train hits person	●			X	X			X	X																	
	Railway vehicles accidence	●				X			X	X																	
	Train evacuation	●							X	X																	
	Train fire	●							X	X																	
	Dangerous effusions on railway track	●							X	X																	
Marine traffic (external process)																											
	Special ship - height	●	X		X				X																		

Processes	Operational Event (triggering a task described by a procedure/instruction)	**Operational mode** ●/●/●	**Scheduled Task**	**TMS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SCADA Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manual logged data	Remote Control	Data reporting	**SSS Display**	Manual System Interpretation	Automatic Alarm indication	Automatic alarm action	Automatical logged data	Manuall logged data	Remote Control	Data reporting
	Special ship - contents	●	X		X				X																		
	Accidents	●			X				X																		
	Pollution	●			X				X																		
	Bridge Restriction to marine traffic	●	X		X				X																		
	Threats	●			X					X											X	X	X	X	X	X	
Airplane traffic (external process)																											
	Bridge Restrictions to air traffic	●	X		X				X																		
	Accident interacting with bridge	●			X	X			X	X			X	X													
	Threats	●			X					X											X	X	X	X	X	X	

5.3 SdM O&E Procedure

A procedure comprises instruction for more than on party/actor/personnel and describes the combined interactions for solving the overall tasks of the procedure.

The contents of an SdM O&E procedure are:

- **Owner**: Owner and therefore overall responsible for the procedure.
- **Title:** A heading describing the contents of procedure
- **Purpose:** Overall purpose of the procedure outlining the overall task and intended result and **When** to do it.
- **Assumption:** Definition of the conditions on which the instruction shall be applied.
- **Tasks:** Explain the scope and responsibility of the parties required for carrying out the procedure:
- **Who**, **What** to do and **How-to-do-it**
- **References:** References to Instructions and informative documents, , including any relevant references
- **Enclosures:** Enclosures of attached documents needed for carrying out the procedure.

SdM **O&E-ProXXX**

Owner: Staff Role /Service Name *Procedure Name*

PURPOSE	Overall purpose of the procedure outlining **When** to carry out a procedure with the aim of obtaining a certain **Result**	
ASSUMPTION	Basic assumptions about the application of the procedure	
TASK	Description of the overall task in detail. Insert process diagram/illustrations appropriate.	
WHO	**WHAT TO DO**	**HOW-TO-DO-IT**
Responsible 1	✓ Responsibility for Sub task 1	✓ Step by step instructions or reference to separate SdM O&E Instruction.
Responsible 2	✓ Responsibility for Sub task 2	✓ Step by step instructions or reference to separate SdM O&E Instruction.
Responsible 3	✓ Responsibility for Sub task 3	✓ Step by step instructions or reference to separate SdM O&E Instruction.
References:	References to interface documents and informative documents.	
Enclosures:	Enclosures of attached documents needed for carrying out the procedure. E.g. a step-by step instruction or a reporting form to be filled out.	

Prepared	nnn		Date	xxxx
Checked	mmm		Revision	x
Approved	aaa		Page	1 of 1

5.4 SdM O&E Instruction

Special SdM O&E Instructions will be prepared according to a standard table of contents.

An instruction is dedicated to a single actor/party/personnel and describe the required task step-by-step. Instructions are replaced by standard manuals in case a suited manual exists for the user interface to a system or piece of equipment.

The contents of an instruction are:

- **Owner**: Owner and therefore overall responsible for the instruction.
- **Title:** A heading describing the contents of the instruction.
- **Purpose:** Overall purpose of the instruction outlining the overall task and intended result and **When** to do it.
- **Assumption:** Definition of the conditions on which the instruction shall be applied.
- **Tasks:** Explain the task of the instruction step-by-step:
- **References:** References to Instructions and informative documents, including any relevant references
- **Enclosures:** Enclosures of attached documents needed for carrying out the instruction.

SdM **O&E-Instruction XXX**

Owner: Staff Role /Service Name *Instruction Name*

PURPOSE	Overall purpose of the instruction outlining **When** to carry out a procedure with the aim of obtaining a certain **Result**
ASSUMPTION	Basic assumptions about the application of the instruction
TASK	Description of the overall task in detail Step 1: Step 2: Step 3: Insert illustrations as appropriate.
References:	References to interface documents and informative documents.
Enclosures:	Enclosures of attached documents needed for carrying out the procedure. E.g. a sketch or a reporting form to be filled out.

Prepared	nnn		Date	xxxxx
Checked	mmm		Revision	x
Approved	aaa		Page	1 of 1

5.5 Development of Procedures and Instructions

The development of procedures and instructions will be carried out in a systematic and transparent way:

- Basis shall be an event tree showing which events or events the procedure covers, cf. Figure 5-6.
- The event tree shall be taken from the long-listing of events for normal, abnormal or emergency events. An event is a state describing an operational situation or condition.
- Some events representing important hazards will have been analysed in the operational risk analysis where assumptions regarding design and O&E procedure and instruction may have been defined. O&E procedures and instruction will comply with these assumptions.
- The remaining events will be analyzed in detailed as part of the development of the operational concept.
- As general basis a safety basis will ensure consistency between design of structures, systems and manuals.

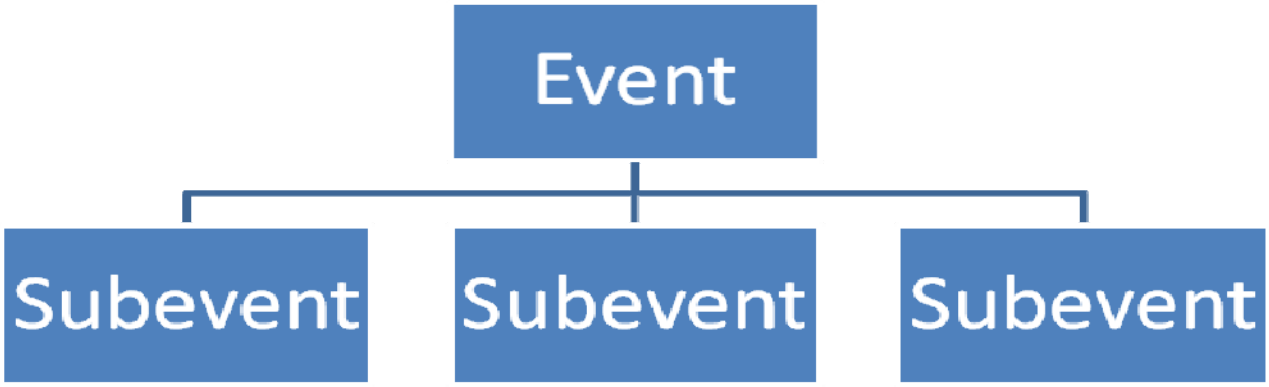


Figure 5-6 Event three shall be the basis for development of procedures and instructions.

- Background and assumptions for procedure shall be listed.
- A process diagram shall be specified showing the order of tasks and interaction between different parties and will thus provide the structure and order of separate tasks and commands, cf.

Figure 5-7 A procedure/instruction will be design based on a description of a process of tasks and commands.

- Paradigms for procedures and instructions will be followed and provide the framework of procedures and instructions.
- Language in procedures and instructions shall be simple and short sentences with imperative statements. Concepts shall be sufficiently defined to ensure an unambiguous translation from English to Italian.
- The procedures and instructions shall be kept short and concise.
- New issues/question coming up as a result of the development of a procedure/instruction shall be listed and raised to clarification.
- The procedure/instruction shall be given a document number when the number system has been decided.

RESULT OF THE DEVELOPMENT OF A PROCEDURE/INSTRUCTION WILL BE:

- Background documentation: Event tree marking, process diagram, background data, assumptions, risk/operational analysis, clarifications of raised issues/questions.

- Completed O&E procedure/instruction.