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Requirement Management Plan

BBS Consortium		
	Date	**Agreed**
BBS Project Director	16/8/12	■
BBS Deputy Project Director	15.8.12	■

This document was produced electronically and requires no signature. It may not be amended manually.

	Name	**Department**	**Date**	Signature
Released by	M. Wilken	Siemens	20.07.212	■
Checked by	A. Rennie	Bilfinger Berger	27/7/12	■
Checked by	S. Rotthaus	Bilfinger Berger	14/08/12	■
Checked by	I. v. Klaveren	Siemens	20.07.12	■
Author	S. Moffatt	Siemens	23.07.12	■

Document History

Rev.	IssueDate	Description of Change	Author
A	2009/02/10	First Issue	M. Hecht
B	2010/02/16	tie comments Implemented	M. Hecht
C	2012/07/20	Aligned with Settlement Agreement	S. Moffatt

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Revision	Summary of Changes	
	Reference	Description
B	1.3	Define requirements related
B	2.2	Adjust to clarify comments
C	All chapters	Aligned with Settlement agreement
C	4	Concession process added
C	6	Close-out process added
C	Att. II	Email template concessions added
C	Att III	Flow Chart added

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LIST OF FIGURES AND TABLES

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1   INTRODUCTION

1.1   PURPOSE

As a key part of the System Engineering approach adopted by BBS and CAF, this document describes a top-down approach towards the management of Requirements to ensure that all Requirements are adequately addressed by the system design and that said Requirements are broken down and apportioned to the relevant sub-systems accordingly. This Plan enables technical Requirements to be traced over the project lifecycle, supporting safety approval and system acceptance.

The management of Process Requirements is also covered by this Plan as these Requirements are handled in a similar manner to the technical Requirements, however the responsibility for their allocation and apportionment is different to that of the technical Requirements management.

This Plan does not cover Verification & Validation Plan [RD3] or System Assurance Plan [RD7] or the matters addressed in these plans.

Following the Settlement Agreement, executed on 15 September 2011, CAF is no longer part of the Consortium. However, pursuant to the express provisions of the Tram Supply Agreement, the Tram Maintenance Agreement and the Tram Interface Agreement, and in order to ensure discharge of system integration (including tram supplier integration) obligations this Plan is applicable for CAF, in particular in relation to the interfaces with BBS. Accordingly, whilst not expressly referred throughout, this Plan seeks to satisfy the requirements for system/tram supplier integration in the Tram Supply Agreement, Tram Maintenance Agreement and the Tram Interface Agreement.

1.2   SCOPE

This Plan covers the management of all system related Requirements /RD5/. It includes the identification of all relevant applicable sources of requirements and the establishment of appropriate baselines by giving careful consideration to all possible sources of requirements.

The System Requirements will be defined as an iterative part of the System Design activities through a process of analysis, definition and capture. The System Requirements will be suitably apportioned to the various sub-systems. The Requirements Management process will support the tracing of requirements from their sources, through design and apportionment to the evidence, provided by verification and validation, that they have been demonstrably fulfilled.

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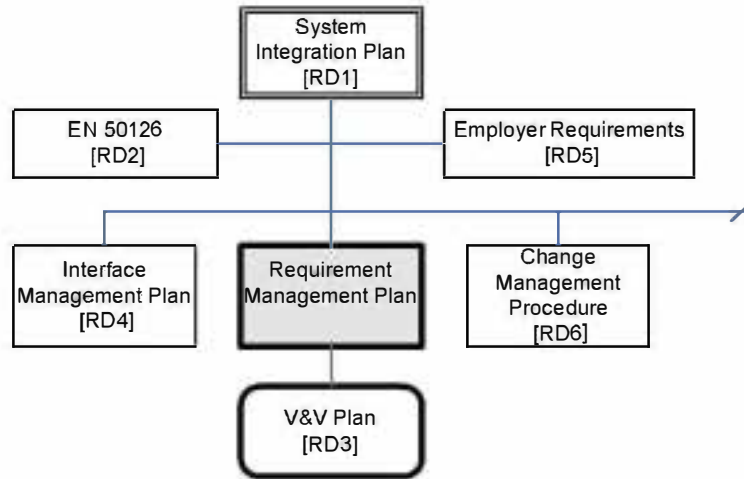## 1.3   REQUIREMENT MANAGEMENT PLAN & ENVIRONMENT

Figure 1 The document and its Environment

This Plan is part of the System Integration and fulfils the general requirements of the Infraco Contract as defined in [RD5] chapter 37.1 and 40.1.2 and the further requirements for System Integration as defined in [RD5] chapter 37.4.2 and [RD8] clause 8.1.7

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Definitions and References

1.3.1   *Reference Documents*

	Title and Reference Number	Rev.	Issue Date
RD1	System Integration Plan ETN(BSC$TE&ADB#053638	latest	
RD2	EN 50126. Railway Applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) ICS 29.280;45.020, CENELEC		Dec 1999
RD3	Verification & Validation Plan, ETN(BSC$MC&ADB#050410	latest	
RD4	Interface Management Plan, ETN(SPM$Q&ADB#050151	B	2009/0715
RD5	Employer's Requirements (Schedule Part 2) PRO-INFRACO-1399	5	2011/09/14
RD6	Change- and Claim Management, ETN(SPM$Q&ADB#050704	A	2009/04/01
RD7	BBS ETN Detailed Design Assurance Plan, ETN(BSC$TE&ADB#050058	F	2009/09/24
RD8	InfraCo Contract LONDON\THV\21368667.13 And Settlement Agreement		
RD9	RM_Manual of Data Exchange ETN(BSC$MC&ADB#050029	latest	
RD10	Requirements Management Flow Chart ETN(BBS$MB&ADB#060089	latest	
RD11			
RD12			
RD13			
RD14			

Table 1-1: Reference Documents

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1.3.2 Glossary of terms

The following table contains the definitions of those terms, abbreviations and acronyms that are used in this document. The table is supplied only for the ease of reading the document

Term	Definition
Process Requirement	ER regarding deliverables as managed in deliverable tracking tool
Technical Requirement	ER regarding non process requirements
System	Scope of BBS consortium and of Tram Supplier/Tram Maintainer
Systems	Scope of each individual BBS partner and Tram Supplier/Tram Maintainer
System Requirements	Requirements of the System
Baseline	Status of the end of a specific life cycle phase
Compliance Statement	Document that confirms the compliance of all related Requirements
Tram Supplier/Tram Maintainer	CAF

Table 1-2: Terminology

1.3.3 Abbreviations and Acronyms

Abbreviations / Acronym	Definition
ER	Employer's Requirements (Schedule Part 2 of Infraco Contract)
RM	Requirements Management
RIS	Requirement Information Sheet
V&V	Verification & Validation

Table 1-3: Abbreviations and Acronyms List

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1.3.4   Requirements Management Definition

Requirements management is closely intertwined with stakeholder management and is an important condition precedent to project (management) success. "ISO 9001:2008: 1.1 Scope] defines the requirements to be met by a quality management system in the event that an organization: "needs to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements and aims to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements. "

With respect to the basics and definitions for what is referred to as "**V**" model, the validation and verification, reference is made to DIN EN 50126:2006: "Railway applications - Specification and verification of reliability, availability, maintainability and safety (RAMS)". DIN EN 50128:2001 is a similar standard: "Railway applications – communications, signalling and processing systems-software for railway control and protection systems".

The management of requirements includes all aspects that are necessary in order to implement the requirements and keep them up to date over the entire product life cycle (from definition of the requirement to successful testing and final removal of the product from service). This particularly involves the establishment of a method of traceability between requirements, requirement sources, testing and acceptance conditions, etc. as well as a suitable change management procedure for requirements.

The essential results of a completed requirement management process include, depending on the project-specific requirement, the following.:

   o   All (i.e. not only the technical) requirements from all relevant customer and other documents are documented centrally per bid or project;

   o   The consistency and completeness of all requirements are ensured;

   o   The requirements (for example according to functional, performance, administrative etc.) are classified;

   o   All technical requirements are assigned to sub-systems, including the appropriate design, test and release specifications.

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2 REQUIREMENTS MANAGEMENT

2.1 REQUIREMENTS MANAGEMENT

Requirements Management is established with the help of a developed database system. Within this system all system Requirements will be dealt with, from the identification of Requirements up to the apportionment towards the Systems and Sub-System Level. This also contains the management of the consistency of the apportioned sub-system requirements in relation to the ability to meet the requirements on the System level. Requirements shall be captured, analysed, defined and traced throughout the project in accordance with the System Lifecycle Model [see V&V Plan RD3]. Changes to and additions of Requirements will also be controlled throughout all development phases by means of the Change Management Procedure [see RD6].
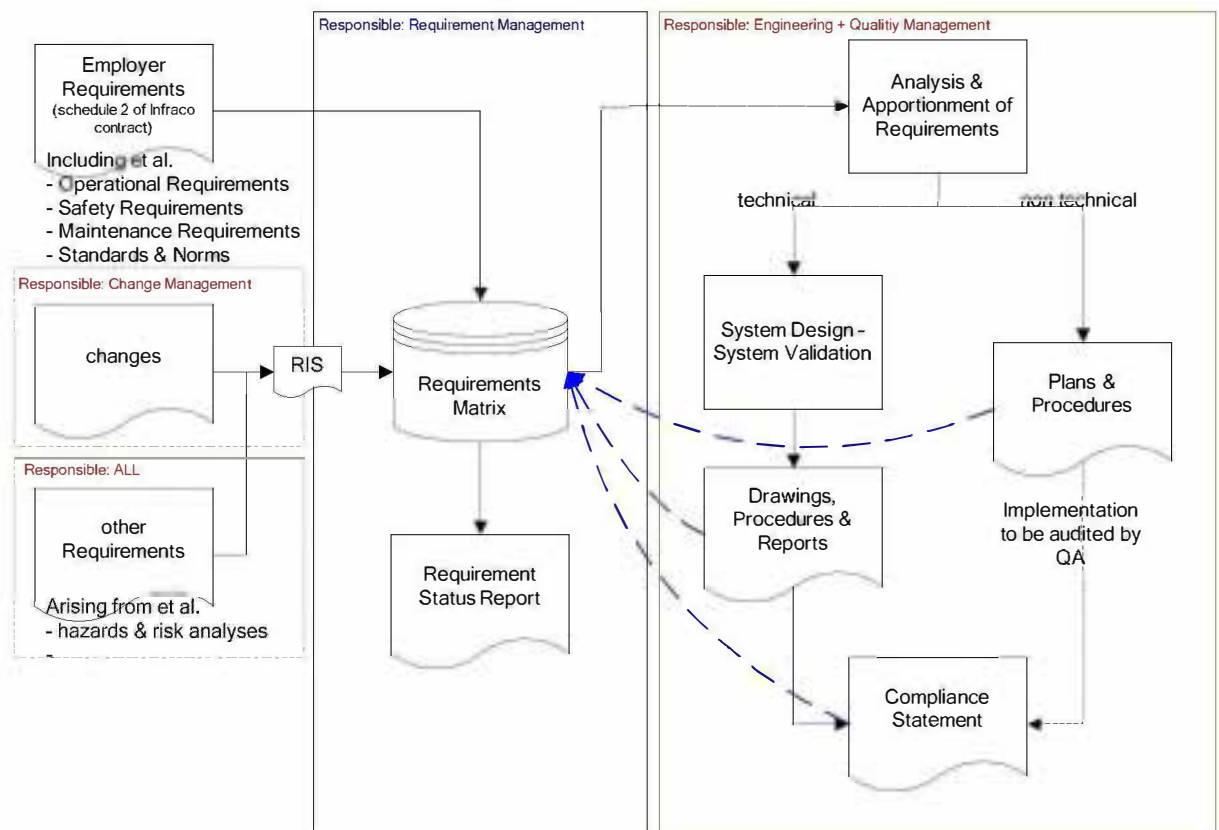

Figure 2 RM Process Overview

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2.2   STANDARDS MANAGEMENT

Each supplier of constituent Sub-systems of the BBS consortium shall have, as part of their internal Standards Management Process, a system in-place to assure Standards Compliance, as part of their overall internal Quality Management System. Each sub-system will provide a Design Assurance Statement that certifies the provision of products for the ETN, in compliance with applicable Norms and Standards. However, there will not be a compliance statement for every single Norm and/or Standard.

2.3   TRACEABILITY

It must be possible to trace each requirement to its source (stakeholder or higher-level requirement) in a suitable manner.

For each and every requirement, it must be possible to suitably trace how it is solved and how its actual fulfilment is verified. Upward traceability, of allocated Requirements and their closeouts, is to be proven by the sub-systems.

2.4   BASELINES

Specific baselines will be reported for the Systems at the end of the tender, design, installation & testing stages thereby ensuring that all requirements are clearly recorded. In the case of documented sources of requirements, the details of the document's reference, version and date of issue will be recorded within the baseline. Changes in baselined external sources of requirements will be dealt with in accordance with the Change Management Procedure [RD6].

Requirement that are considered 'Not Applicable' shall be discussed and agreed with the stakeholders. For a description of this process refer to chapter 4.

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3   SYSTEM REQUIREMENT CAPTURING

3.1   OVERVIEW OF SOURCES

The development and delivery of the ETN Systems will be influenced by the various parties. Requirements capture is the responsibility of personnel at all levels of the respective organizations. As soon as the involved person has recognized a requirement, this person has to identify whether the requirement is a change to an existing requirement or a new requirement in order to initiate the identification process.

3.1.1   ER

Means the provisions of Schedule Part 2 of the Infraco Contract[RD5] [as replicated in Schedule 2 to the Tram Supply Agreement and Schedule 2 to the Tram Maintenance Agreement.

3.1.2   Changes

During the entire project period several changes to the Infraco Works and/or Infraco Contract will occur. Each change has a potential effect on existing requirements are may even give rise to additional requirements. Hence requirements applicable to the ETN Systems will be identified and captured.

3.1.3   Other Requirements

If a requirement is raised that is already covered by the scope of the Infraco contract but not explicitly mentioned then it will be identified and captured.

3.2   IDENTIFY AND CAPTURE REQUIREMENTS

The 'capture' of the Requirements from applicable clauses, and/or documents will be done by the person or persons who identifies the relevant requirement or requirements by means of the 'Requirement Identification Sheet' (RIS) (see Attachment 1). This sheet, once completed, indentifies the assumed requirement description, the source of the requirement, the date of identification and the person or persons responsible for identification of the requirement. These details would allow the traceability of the requirement to its source. The RIS must be sent to the RM Manager.

This process is not applicable for the ER, which will be transferred to the database directly.

Each requirement will be assigned a unique identifier. The numbering scheme to be used for this purpose is defined in section 3.3.1.

However it must be remembered that there are two types of requirement as described below, namely:

o   Requirements of a technical nature (e.g. "what" is to be delivered) which will be dealt by Engineering group); and

o   Requirements of a process nature (e.g. "how" it is to be delivered) which will be dealt by Quality Management.

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3.3   REQUIREMENTS DEFINITION AND ANALYSIS

Each requirement will be given a unique reference or identification number for identification, tracing and referencing purposes. Once captured, each requirement must be fully defined by the responsible party. The database will make provision for a number of attributes to be defined for each requirement as a means of classification or categorization and as a structured means of capturing essential information about the requirement. Each requirement may be given multiple attributes appropriate to the nature of the requirement. These attributes are defined in the **V&V** Plan [RD3] and the sub-document 'RM_Manual Data Exchange' [RD9]:

3.3.1   Unique Identifier

Each requirement will be allocated its own unique identifier. The unique identifier is automatically given by the database tool and will be grouped in the folders according to the different sources. (see also [RD9])

3.3.2   Modification History

A record must be kept of all changes to requirements. This attribute must be updated upon each change with at least the following information:

- Revision;
- Modified by;
- Details of the change;
- Reason for change;

This will be ensured by DOORS, the tool implemented by Infraco as basis of the Requirements Management System. (see also [RD9])

All modification arisen from the Settlement agreement are traceable as derogations in the tool.

4   REQUIREMENT SPECIFICATIONS

All Requirements will be retained in the database as defined in the source document. After the apportionment has been finished as described in the following chapter the involved parties shall clarify their understanding of the requirement and will agree on a common understanding of the requirement. This will be done within a meeting or workshop and subsequently documented in minutes. The RM-Manager will organize clarification meetings once for each Sub-System after the apportionment. Further clarification meetings will only be organized if required by one of the systems or sub-systems. If any change in the description of a requirement is necessary the change process has to be started to implement the new wording.

4.1   CONCESSION PROCEDURE

A Request for Requirement Concessions will be dealt with during the workshops. Should a party require to discuss a concession, the **V&V** Evidence will be referenced for the particular requirement and reviewed with the client and the outcome of the discussions held during the workshop shall be reflected in the RM Workshop (comments) column in the database. Should additional actions be required they will also be noted. We have mutually agreed this process in

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an effort to reduce the amount of letters required to be generated between the parties and to proactively get the Requirements progressed in a timely fashion

The agreed concession procedure is as follows:

- On the database export of the excel list the Lead for the requirement will identify those items and mark them in RM Workshop Comments as in need of a concession. A brief explanation of the requirement for the concession may also be appropriate in order of assist the parties...

- Proposed change of the language for the Employers Requirements will be provided by the Lead.

- A reason for the change is required and all evidence referred to in support of the change will be incorporated or attached as appropriate.

- The Lead for the requirement will send an e-mail to the Client with their Concession request (this can be in advance of or subsequent to any workshops held, but in either instance a copy of this email will be required for purposes of documentation for the database).

- The Lead will ensure that an email response in agreement of the language concession is obtained from the Client.

- When this agreement has been reached, DOORS will be updated to reflect the concession. (Note: Should any concession be related to an open Variation file, not until a TCO (**tie**) Change Order is received should the update be placed into DOORS.

- A list of all concessions will be held by the Lead with a current status.

- The Lead lists will be merged together and presented to the Client in batches in order to secure formal agreement to the concessions by way of formal letter with the list(s) attached.

- The Client will, by return correspondence, formalise its agreement and those concessions will then be closed off.

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5   APPORTIONMENT OF REQUIREMENTS

The apportionment follows the hierarchical levels of responsibility within and between BBS and CAF.

This allows a clear break down of the requirements to sub-system level.. The schematic in figure 3 below displays an overview of the System break down.
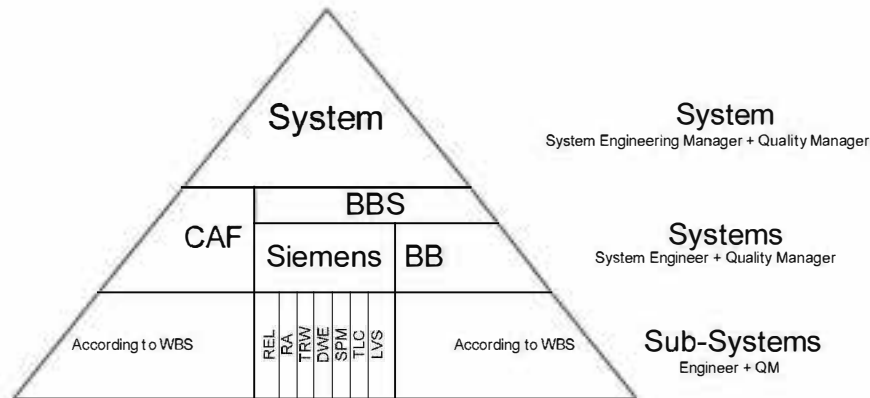

Figure 3 BBS Responsibility Structure

5.1   PROCESS OF APPORTIONMENT

With the aid of the all applicable contractual documents all Requirements will be apportioned up to the sub-systems as applicable. Technical experts representing each of the sub-systems, a system level expert and a Requirements expert should be present at meetings to determine the apportionment of the Requirements. Where appropriate, each of the System Requirements will be apportioned to the systems and sub-systems. The aim of apportioning a system level requirement is to specify what is required of each related sub-system to fulfil the system-level requirement.

In many cases, it will be necessary for two or more sub-systems to collaborate in order to fulfil a given System Requirement. In such a case, the System Requirement will be apportioned to the applicable Sub-System, and any related Interface will be defined.

Thus, in those cases where an apportioned requirement is applicable to 'sub-system A', which has an interface to a different sub-system, an Interface Control Form (ICF) is generated to control management of that interface (see Interface Management Plan [RD4]). If the above mentioned interface has its effect on the second sub-system, then the requirement will be apportioned to it also.

Where no such interface exists or is applicable between separate sub-systems in respect of a requirement and the requirement in question can be split into two (or more) sub-requirements which will be apportioned accordingly to the 'sub-system A' and 'sub-system B'.

Process requirements are managed and apportioned by the BBS Quality Manager.

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6   CONTROL OF REQUIREMENTS

After the requirements are apportioned to the level applicable to each requirement a specified **V&V** method will be defined. All relevant stakeholders should commit to the apportionment so made. After confirmation of the defined method, proof of fulfilment will be documented to allow traceability to the requirement.

All steps will be documented within the database and the content of the database will be regularly reported.

A version of the flow chart of the process can be found in attachment III. For the latest version please refer to /RD10/.

6.1   SUBMISSION AND REVIEW OF EVIDENCE

The close out of requirements will be established by the evidence documentation identified by the **V&V** method. All evidence documentation must be submitted by the requirements lead to the client within the agreed timeframes. Timeframes as listed in the Employers requirements should be followed at all times, but longer timeframes can be agreed with the client to achieve responses prior to execution of the tests. The client will review the documentation according to the review process and in conjunction with the requirements.

The requirement lead is responsible for obtaining approval for their submitted evidence. A clear reference to relevant requirements in the evidence is recommended to improve the review process.

Once approval is obtained the requirement lead submits the information including reference to the letter of approval to the requirement manager for inclusion in the database.

The status of the requirement will be changed to 'Evidence Accepted' when all submitted evidence has RoR level A or other written confirmation from the client evidence is acceptable..

6.2   CLOSE-OUT PROCESS

Key process in the requirement management process is the acceptance of evidence as listed above. Since evidence has been reviewed the formal close-out should merely be an administrative process.

Requirements can only be closed once written confirmation from the client has been received. This will be reflected in the tool by the 'Compliance Confirmed' status of the requirement.

- The requirement Lead is responsible for notifying the requirement manager all evidence for the compliance demonstration of (a group of) requirements has been submitted. This includes a reference to the submission letter.

- Periodically a list of 'Evidence Accepted' requirements will be provided to the client

- The client confirms compliance with the requirement with a written statement or submits non-compliance report based upon the contents of the agreed **V&V**.

- The compliance status will be forwarded to the requirement lead by the requirement manager.

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- The requirements lead is responsible for resubmitting information until compliance demonstration is achieved.

7   ROLES AND RESPONSIBILITIES

7.1   OVERVIEW

The following roles shall be undertaken in connection with Requirements Management

7.2   REQUIREMENT 'LEAD'

Objective:

- to manage the implementation of a specific set of requirements in such a way that compliance can be demonstrated.

Tasks / Deliverables:

- Analysis of requirement and if required explanation, interpretation on System level for the Technical Requirements. If necessary undertake studies.
- Prepare concession requests when required and obtain Client approval
- Preparation of Pass / Fail criteria on System level for the technical Requirements ("acceptance" criteria to be agreed upon with the Client). Preparation includes communication with the sub-systems involved in the implementation of the Requirements.
- Derivation of sub-system Pass / Fail criteria (improve sub-system P/F criteria and align with "acceptance" criteria).
- Review of sub-system design.
- Preparation of design on System level for the technical Requirements taking into account the design produced by the sub-systems.
- Collect correspondence related to Requirements.
- List all evidence documentation related to a Requirement.
- Submit evidence documentation
- Inform Requirement manager about acceptance status of evidence documentation
- Assist the Requirement manager in discussions with the client and third parties.

Responsibilities:

- The Engineer or Quality Manager and the Requirement Manager of the appropriate level.
- The Requirement manager will prepare the Requirements allocated to them.

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- Regularly advise the Requirement manager in order to facilitate that the DOORS database is kept current with all ongoing information and discussions amongst the parties concerning the Employers Requirements. (this may include attendance at Workshops and meetings)

7.3   SYSTEM ENGINEERING MANAGER

The System Engineering Manager is part of the System Engineering Group and will build up and lead the System Engineering Team to fulfil all tasks listed in Section 7.4.

7.4   SYSTEM ENGINEERING TEAM

Responsibilities

- Responsible for the definition and management of the technical system requirements to ensure and demonstrate the system's compliance with the system requirements.

Objective

- Guide and assist the Systems, Sub-systems and other parties of requirements to:
- Engineer a coherent system;
- Assure that all sub-systems together implement the System;
- Assure that all System requirements are defined and fulfilled;
- Continuously monitor all sub-systems engineering activities;
- Guard internal and external interfaces;
- Implement RAM, Safety and Quality in co-ordination with the appropriate teams.

Tasks

- To develop, maintain and implement the Requirements Management Plan;
- To analyze the technical System Requirements;
- To undertake System Design activities, including:
  - o System Context and Boundary definition
  - o System Architecture Design
- To apportion technical System Requirements to the sub-systems;
- To trace the System Requirements through design and verification to compliance;
- To support the sub-systems in the development of the Sub-system Interface Design Descriptions;
- To assist the sub-systems for external and internal interfaces with system wide decisions;
- To assist the sub-systems with system wide design decisions;

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- To identify and manage any non-compliance's.

Authority

- Independent decision making and acting upon ones own work;
- Final decision making on System wide engineering matters, including but not limited to
  - System Design
  - System Architecture
- All external and internal Interfaces
- Safety
- RAM
- V&V
- the right to instruct the supporting teams to support and fulfil System wide engineering decisions

7.5 QUALITY MANAGER

Responsibilities

- In regards to requirements management the Quality Manager is responsible for the definition and management of the non technical requirements to ensure and demonstrate the system's compliance with the system requirements.

Objective

- Guide and assist the Systems and other parties of requirements to assure that all System requirements are defined and fulfilled;
- Implement RAM and Safety in co-ordination with the System Engineering teams.

Tasks

- To support the development, maintenance and implementation of the Requirements Management Plan;
- To analyze the non-technical System Requirements;
- To apportion non-technical System Requirements to the sub-systems;
- To identify and manage any non-compliance's.

7.6 REQUIREMENT MANAGER

The Requirement Manager is part of the System Engineering group.

Responsibility:

- Responsible for establishing and managing systems for Identification and traceability of requirements

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- Establishing and maintaining the requirements management system to enable traceability of requirements as necessary.

- Maintaining the requirements management software tool used in the project to support the requirements management process.

Objectives

- Define processes and tool to keep the traceability on each requirement throughout the project lifecycle as appropriate in accordance with the Infraco contract.

Tasks

- To develop, maintain and implement the Requirements Management Plan in close coordination with the System Engineering Manager and the Quality Manager.

- To establish and maintain the requirement database

- To update all input provided by the Systems

- To provide the updated status of requirements on a regularly base

- To support the requirement management process

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Attachment I.   Requirement Identification Sheet (RIS)

Requirement Identification Sheet (RIS)

BILFINGER BERGER **SIEMENS**

Sheet Number
RIS XXXX

Project :   Edinburgh Tram Network

Date: YYYY/MM/DD

From:

Requirement Description:

Ref document name: ???

Ref document ID: ETN(<sender>)<receiver>=<WBS>&ABC # xxxxxx

Name   Signature

please send this sheet to the Infraco Requirement Manager

BFB00101909_0022

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Requirement Management Plan
PMP Section 25
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Attachment II.   Concession Template

Subject: 120328_ETN_Concession Request - Employers Requirements - (Absolute Number XXXXX)

Example Concession Email

Dear XXX,

We refer to the following absolute number in the Employer Requirements Database:

Absolute Number XXXXXX (taken from the Database excel list)

Requirement Lead:

Split requirement **yes/no**

The Chapter referring is:

INSERT YOUR CHAPTER REFERENCE HERE

Under heading of:

INSERT THE HEADER LANGUAGE

The original text reads:

Exact Schedule Part 2 text here

Proposed text is as follows:

INSERT YOUR PROPOSED CHANGES HERE

~~36~~ additional
Shown with strikeout of old and proposed new in red.

Reason concession is requested:

INSERT REASON HERE

Evidence referred to:
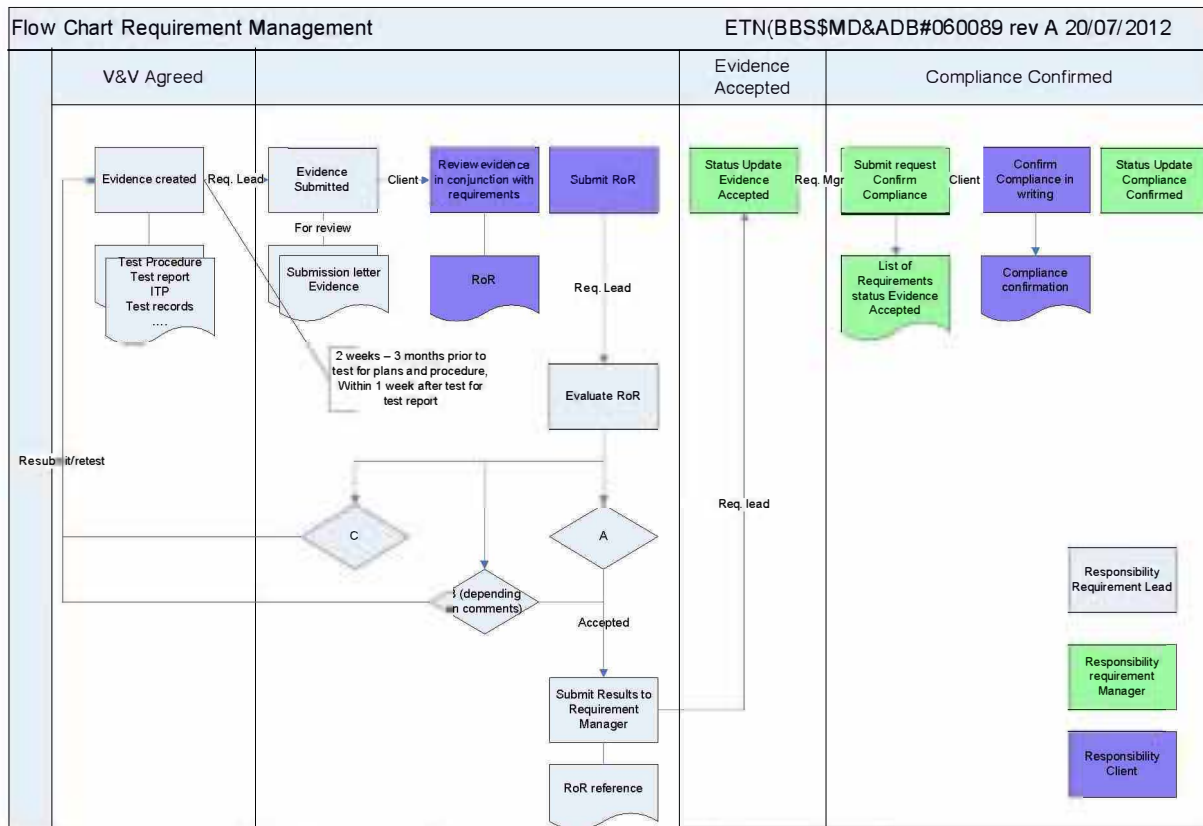

INSERT EVIDENCE HERE

If you have any additional queries, please feel free to contact me directly.

As a reminder, when responding with your comments and/or agreement to the above, please be sure to include the requirement manager for database input for status of the Concession Request.

Best regards,

120718_ETN(BSC$MCADB#050401C_Requirements Management Plan.doc

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Confidentiality: **non confidential**

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Attachment III.   Flow chart

Please note: Flow chart might be updated independent from this document

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