DATA ITEM DESCRIPTION

1. **TITLE**	2. **Identification Number**
REQUIREMENTS TRACEABILITY REPORT - REQUIREMENTS ANALYSIS (RTR-RA)	PPI-005695-3 17 August 2017

3. DESCRIPTION

The Requirements Traceability Report in Requirements Analysis (RTR-RA) describes the "is a restatement of" set of relationships between the originating requirements information input to a requirements analysis and the appearance of that information in the set of requirements that are the primary output of the requirements analysis. The input information is often in original form from users and other stakeholders, and often captured incrementally during analysis, whilst the output set of requirements is intended to have the status of having been validated, to be of an objectively adequate standard, and to be effectively organized for the purpose of communication.

Traceability is bi-directional relationship between originating requirements and "derived by analysis" requirements.

4. PURPOSE

The RTR-RA allows any stakeholder to efficiently determine whether and where their requirements have been accommodated in the system requirements specification or requirements database that drives capability development, acquisition, product development or other activity, as applicable. The RTR-RA allows a participant in a development or acquisition process to determine the ownership, original of, and recorded source of any requirement within the scope of the report.

The RTR-RA may be used in relation to any enterprise, capability or business system; physical technology item; software item; support item; service or interface that is the subject of a requirements analysis.

5. PREPARATION GUIDELINES

5.1 General Instructions

    a. **Automated techniques.** Use of automated techniques is encouraged. The term "document" in this DID means a collection of data regardless of its medium.

6. SOURCE

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5.   PREPARATION GUIDELINES (continued)

b.   **Alternative presentation styles.** Diagrams, tables, matrices, and other presentation styles are suitable substitutes for text when data required by this DID can be made more readable using these styles.

c.   **Title page or identifier.** When data are supplied in the form of a paper document or word processing file, the document should include a title page containing, as applicable: document number; volume number; version/revision indicator; security markings or other restrictions on the handling of the document; date of issue, document title; name, abbreviation, and any other identifier for the system, subsystem, or item to which the document applies; contract number if applicable; CDRL item number if applicable; organization for which the document has been prepared and name and address of the preparing organization. For data supplied in an alternative form, this information should be included on external and internal labels or by equivalent identification methods.

d.   **Table of contents.** When data are supplied in the form of a paper document or word processing file, the document should contain a table of contents providing the number, title, and page number of each titled paragraph, figure, table and annex. For data supplied in an alternative form, this information should consist of an internal or external table of contents containing pointers to, or instructions for, accessing, each paragraph, figure, table and annex or their equivalents.

e.   **Page numbering/labeling.** When data are supplied in the form of a paper document or word processing file, each page should contain a unique page number and display the document number, including version, volume, and date of issue, as applicable. For data supplied in an alternative form, files, screens, or other entities should be assigned names or numbers in such a way that desired data can be indexed and accessed.

f.   **Response to tailoring instructions.** When data are supplied in the form of a paper document, paragraphs that have been tailored out of the DID should result in the corresponding paragraph number and title in the document, followed by "Not applicable" or alternatively, paragraph numbering may be varied to allow for the missing paragraph. For data supplied in an alternative form, the "Not applicable" representation may be incorporated in the table of contents or equivalent.

g.   **Multiple paragraphs and subparagraphs.** Any section, paragraph, or subparagraph in this DID may be written as multiple paragraphs or subparagraphs to enhance readability.

h.   **Standard data descriptions.** If a data description required by this DID has been published in a standard data element dictionary, reference to an entry in that dictionary is preferred over inclusion in the data item itself.

i.   **Declarative style.** Where a non-declarative guidance style is used in this DID ("should") but a declarative style ("shall") is required by the user of the DID, the DID should be tailored accordingly.

j.   **Substitution of existing documents.** Other existing documents may be substituted for all or part of the data item if they contain the required data and are invoked in the data item as a part of the data item.

5.2 Acronyms

Acronyms used in this document shall be interpreted as follows:

DID   Data Item Description

PPI   Project Performance International

RA   Requirements Analysis

RIR   Requirement Issue Record

RTR   Requirements Traceability Report

RTR-RA   Requirements Traceability Report in Requirements Analysis

RTR-SD   Requirements Traceability Report in System Design

SD   System Design

5.3   Abbreviations

Abbreviations used in this document shall be interpreted as follows:

CapSyRS   Capability System Requirements Specification

I/S   Infrastructure

Info   Information

REQID   Requirement Identifier

SI   International System of Units

SyRS   System Requirements Specification

5.4   Foreword

Requirements traceability is of high importance in ensuring that each requirement communicated by a valid stakeholder appears in the set of requirements which is to drive subsequent action, or if it doesn't appear, that there is a valid, recorded reason as to why. Requirements traceability is also of high importance to ensure that each requirement in the set to drive subsequent action has identifiable, valid ownership, that is, that no requirement is spurious (for reason of, for example, "gold plating" – features that cost more than they are worth, and are not needed by the intended user of the system).

5.5 Content Requirements

Content requirements begin on the page 5. The numbers shown designate the paragraph numbers to be used in the document. Each such number is understood to have the prefix "5.5" within this DID. For example, the paragraph numbered 1.1 is understood to be paragraph 5.5.1.1 within this DID.

TABLE OF CONTENTS

1. INTRODUCTION AND SCOPE

1.1 Document Overview and Use

This DID states the minimum requirements for bi-directional traceability of requirements established through analysis of the problem domain (NON solution-specific), and the minimum content of a Requirements Traceability Report in Requirements Analysis (RTR-RA). This DID contrasts with DID PPI-005696: "Requirements Traceability Report in System Design (RTR-SD)" that deals with the system design, including capability development, application of requirements traceability.

In using this DID, the user of the DID may place additional requirements that correspond to need.

The RTR-SD format is not specified, as the origin of such a report may be from a requirements management tool that provides tool-specific report formats only.

This DID also lists other potential traceability (in requirements analysis) reports.

2. APPLICABLE AND OTHER REFERENCED DOCUMENTS

2.1 Applicable Documents

There are no applicable documents.

2.2 Other Referenced Documents

PPI-005696: "*Requirements Traceability Report in System Design (RTR-SD)*"

3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

3.1 Definitions

The following definitions shall apply in the interpretation of requirements in this document:

a) **Capability System** means, in the context of this document, the system comprising the interacting set of relevant technology, people, process and other elements that satisfies, or is intended to satisfy, on a whole-of-life basis, the needs of one or more humans or organizations of humans by means of satisfaction of requirements specified in a Capability System Requirements Specification (CapSyRS).

b) **May** expresses permissive guidance.

c) **Non-Requirement** means an entity designated by the originator as a requirement (originating requirement), but classified by somebody with the authority to do so as an entity not recognized as, nor to be acted upon as, a requirement.

d) **Requirement**, in the context of this document, means a characteristic that the item that is the subject of a requirements analysis is required to possess.

e) **Shall** expresses a requirement.

f) **Should** expresses a target or goal to be pursued, but not necessarily achieved.

g) **System** means an entity constructed, or destined to be constructed, of two or more interacting elements.

h) **Verification Requirement**, in the context of this document, means a requirement specifying the quality of evidence that a verification activity is to provide, the evidence being as to whether or not the system requirement to which the verification requirement corresponds has been satisfied.

i) **Will** expresses a declaration of intent by a party, usually the sponsoring or acquiring organization. "Will" does not express a requirement. "Will" may also be used in cases where the simple future tense is needed, for example, "The operating system will be supplied by the client".

3.2   Acronyms

This section should list alphabetically each acronym used in the document, together with the acronym's expanded meaning.

3.3   Abbreviations

This section should list alphabetically each abbreviation used in the document, together with the abbreviation's expanded meaning, except that abbreviations within the International System of Units (SI) should not be listed.
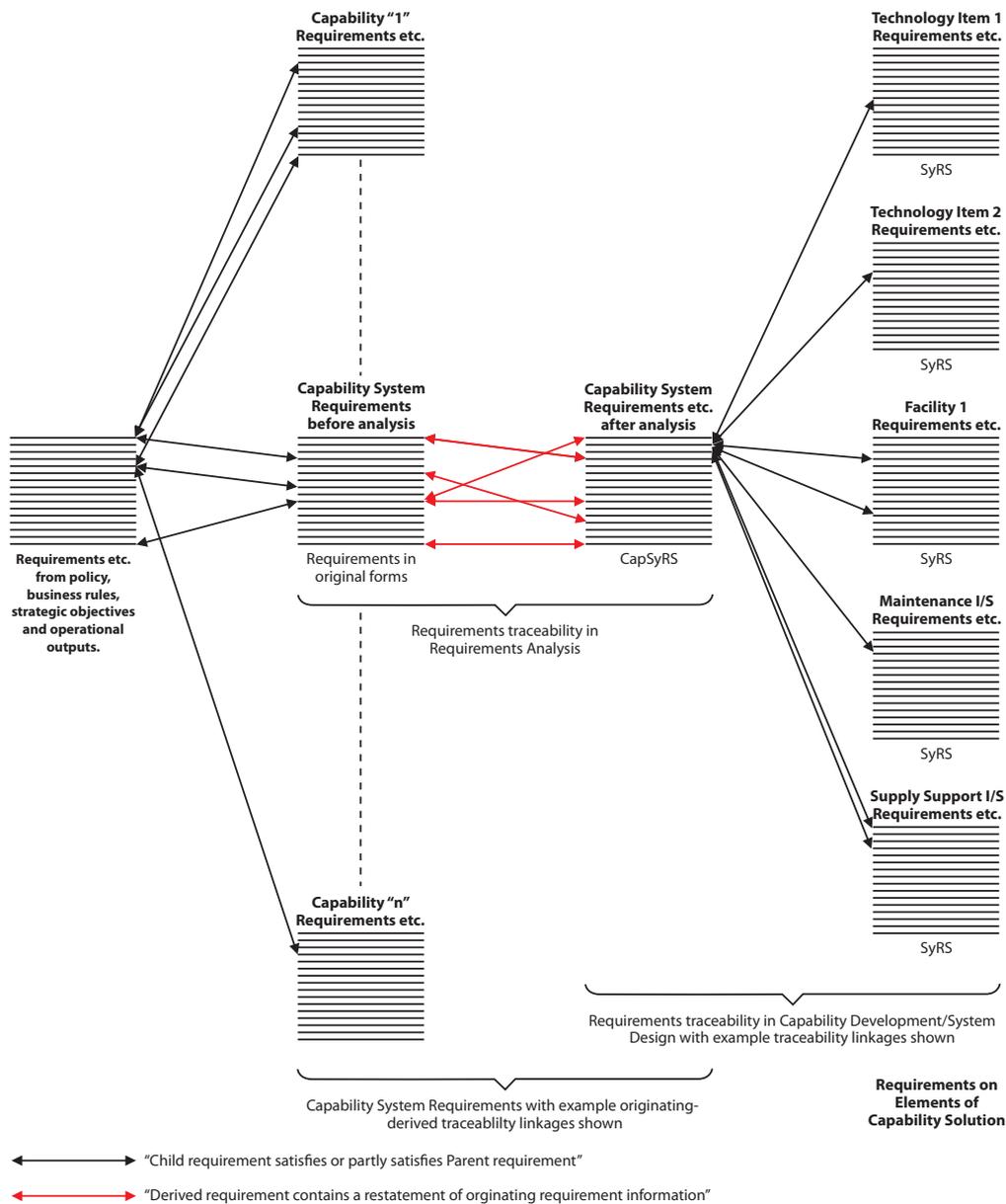
4.   BACKGROUND TO REQUIREMENTS TRACEABILITY IN REQUIREMENTS ANALYSIS

4.1   Description

The RTR-RA describes the "is a restatement of" set of relationships between the requirements information input to a requirements analysis (originating requirements) and the appearance of that information in the objectively adequate set of requirements that are the primary output from a well conducted requirements analysis (derived requirements – derived by analysis).

The input information is in original form from users and other stakeholders, and is often augmented incrementally during analysis. The report may also include for each derived (by analysis) requirement a linkage to the corresponding verification requirement.

These concepts and their relationships to requirements traceability in design are illustrated in Figure 4.1-1, using an enterprise as an example.

Figure 4.1-1 The Concepts of Requirements Traceability in Requirements Analysis and in Capability Development/System Design - Example

Requirements analysis may be performed recursively on elements of solution, through systems to subsystems, starting with those on the right-hand side of Figure 4.1-1. The entities performing various requirements analysis will often themselves vary, for example purchasing organization/contractor/subcontractor, or marketing-product management/system team/sub-system team.

Requirements traceability in its requirements analysis form should normally be maintained through initial capability development/technology item development that is the subject of a programme or project, and through the subsequent life of the potentially evolving capability/system. Thus, requirements analysis for a particular capability or technology item may be performed through successive increments. The maintenance of traceability through these increments is illustrated in figure 4.1-2.
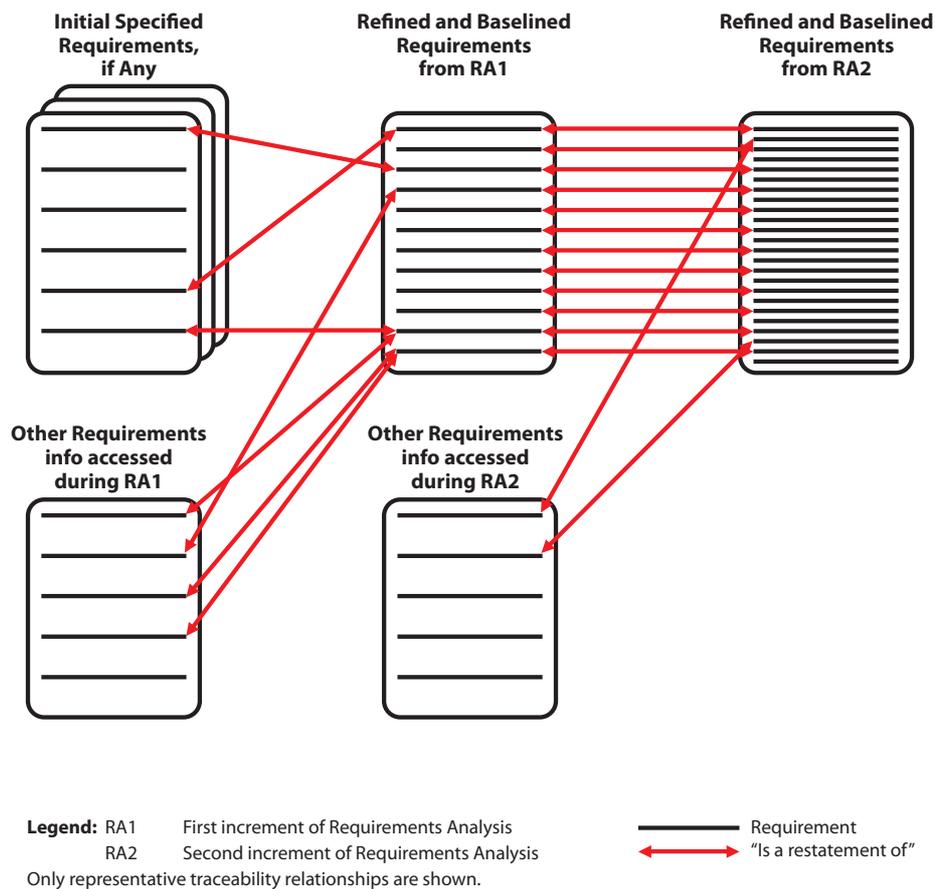
Figure 4.1-2 Maintenance of Requirements Traceability Through Incremental Requirements Analyses

This approach is most suitable where both originating and derived (by analysis) requirements sets retain important status. An example would be RA1: refinement of a set of requirements by a customer between inviting tenders or proposals and contracting, and RA2: refinement of a set of requirements during contract, either via a contractor-performed/customer-required RA activity, or by formal contract change. An alternative for traceability in incremental requirements analysis is to simply regard the incrementally performed analysis as a continuation of a single requirements analysis, with individual requirements versioned and statused. This later approach is most suitable where only the originating set and the current derived (by analysis) set of requirements have special status.

4.2 Purpose of Requirements Traceability Report in RA

The RTR-RA allows any stakeholder to efficiently determine whether and where their requirements have been accommodated in the system (or software) requirements specification that drives capability development, technology item development, acquisition or other activity, as applicable.

The RTR-RA also allows a participant in the capability/technology item development process to determine the ownership and original form and recorded source of any requirement in a system (or software) requirements specification. The RTR-RA also contributes to independently performed audit of projects.

The RTR-RA may be used in relation to at any capability system, technology item or service that is the subject of a requirements analysis.

4.3 Applicability

The RTR-RA applies to requirements ("shall" statements) and goals ("should" statements), as well as to non-requirements. The RTR-RA does not apply to permissive guidance – "may" statements, and declarations of intent or futurity – "will" statements.

4.4   System (Capability, Software, Technology Item) Requirements Attributes in Database

4.4.1   Minimum Requirements and Goals Attributes for RA Traceability

In order for a requirement to be uniquely identifiable and therefore traceable, it is to have the following minimum attributes in a requirements database.

a) REQID - The requirements identifier (REQID) is a number that **uniquely** identifies the specific requirement within a set of requirements. This number could be project-specific or programme-specific, and may have been generated automatically by a requirements management tool. The REQID may incorporate identification of the item that is the subject of the requirement.

b) Subject - This is the item that is the subject of the requirement (the Actor).

c) Requirement Statement - This is the expression of the requirement in some suitable language, and may include additional information by reference.

d) Class - either "Originating" or "Derived by Analysis", as applicable.

e) Ownership - The identification of the organization and/or person who, with appropriate authority, created or has a right to change the requirement. A requirement must have at least one owner, and may have more than one owner.

f) Importance - One of Critical, Very Important, Important, Desirable, Preferred, or some similar scale of importance.

g) Source Reference:

   i) For Originating Requirements - provides a reference to the source document or information record where the requirement comes from. This field is used to link the requirement to a specific source document when an originating requirement is provided by a stakeholder in document format, or if the requirement is the subject of a Requirement Issue Record (RIR). The Source Reference may include document number, document name, paragraph number, paragraph title, individual requirement REQID where the REQID itself communicates the source, file name, etc., as applicable. There may be more than one source document. Where the source is itself subject to requirements in the same database, the Source Reference may be one or more links to one or more originating requirements (for a requirements analysis relationship) or parent requirements (for a design relationship) present within that source.

   ii) For Derived by Analysis - a reference or link into analytical records.

h) Status:

   i) For requirement: "Incomplete Requirement" (work-in-progress), "Un-baselined Requirement", "Baselined Requirement", "Superseded Requirement", or "Non-Requirement".

   ii) For goal: "Incomplete Goal" (work-in-progress), Un-baselined Goal, "Baselined Goal", "Superseded Goal", or "Non-Goal".

i) Rationale - This attribute field must be present, however, it should be populated selectively. The rationale for the requirement can be one of the most important attributes. It provides the thinking behind the requirement and records the reasoning that was followed in the definition of the requirement. It may be the only source of corporate memory when requirements changes take place at a later stage in a project. The Rationale record ensures that the original insight and thought process are understood before changes are made.

j) Included Note - The text (if any) of any note that is to accompany the requirement in its database form and its form in a requirements specification document.

k) Comments - This attribute is used for ad-hoc comments and notes (if any) not intended to be reproduced with the requirement in a requirements specification.

l) Corresponding Verification Requirement (if any) - For a requirement, this attribute identifies and links to the corresponding verification requirement relating to system verification (not design verification). For a goal, this attribute identifies and links to any corresponding verification requirement relating to determination as to whether, or to what degree, the goal has been satisfied.

m) Verification Status - One of Not Used/Planned/Passed/Failed/Passed After Re-Verification/Not Applicable.

Not Used means that the requirement database is not being used to record verification status. It does not necessarily mean that the satisfaction of the requirement will not be verified. Planned means that verification is planned but has not yet been conducted or completed. Not Applicable means that there is no intent to conduct verification of satisfaction of the requirement.

Where "requirement" is referred to in this paragraph without any corresponding reference to goal, the reference applies to both requirements and goals.

4.4.2 Optional Requirements Attributes for RA Traceability

a) Version - For larger analyses for more critical systems, each requirement identified by its REQID may be itself versioned, allowing the evolution of a requirement through analysis to be traced. In this case, earlier versions will have the status "Superseded Requirement". Alternatively, a requirement that is the subject of a change may be superseded and replaced by a new requirement.

b) Name - The name of the requirement is a short descriptive name that can be used to refer to the requirement in addition to its REQID.

c) Type - The type of requirement can be *one* of the following:

   i) State/Mode - States the required states and/or modes of the item, or the required transition between one state and another state, one mode and another mode, mode in one state to mode in another state. A "state" is a condition of something. A "mode" is functionality related to a significant aspect of use, usually a group of functionality.

   ii) Functional - States what the item is to *do*. Functional alone is, at least technically, incomplete.

   iii) Performance - For a given function, states *how well* that function is to be performed by the item, that is, performance is an attribute of function. Performance alone is incomplete.

   iv) Functional and Performance.

   v) External Interface - States the required characteristics at a localized point, or region, of connection of the item to the outside world (e.g., location of interface, geometry of connection, inputs and outputs by name and specification, allocation of signals to pins, etc.).

   vi) Environmental - Limits the effect that the external enveloping environment (natural or induced) is to have on the item, or limits the effect that the item is to have on the external enveloping environment.

   vii) Resource - Limits the usage or consumption by the item of an *externally* provided resource, or requires the use of an *externally* provided resource.

   viii) Physical - States a required *physical characteristic* (properties of matter) of the item as a whole (e.g., mass, dimension, volume).

   ix) Other Quality - States any other required quality of the item that is not one of the above defined types, nor is it a design requirement.

   x) Design - Directs the design (internals of the item), by inclusion (build it internally this way), or exclusion (don't build it internally this way). Any requirement on a subsystem, component, part, material, etc. in a requirement set for a parent system is, by definition, a Design Requirement.

   xi) Compound - A requirement statement that expresses more than one requirement in the one expression, e.g. sentence.

Note: The same types apply also to goals (also termed design goals, targets, objectives).

Where "requirement" is referred to in this paragraph without any corresponding reference to "goal", the reference applies to both requirements and goals.

4.5 Verification Requirements Attributes for RA Traceability

4.5.1 Minimum Verification Requirements Attributes for RA Traceability

a) REQID - The verification requirements identifier (REQID) **uniquely** identifies the specific verification requirement within a set of verification requirements. This number could be project-specific or programme-specific, and may have been generated automatically by a requirements management tool.

b) Verification Requirement Statement - This is the expression of the verification requirement, which is a statement on the qualities of the evidence required that a system requirement has been satisfied: the characteristics required of any verification solution. A Verification Requirement Statement may comprise or include a statement defining a directed verification method (one of Analogy, Analysis, Analysis incorporating Test data, Certification, Demonstration, Examination/Inspection; and Test), but verification requirements are not (or should not be) just a list of verification methods.

4.5.2 Optional Verification Requirements Attributes for Traceability in RA

a) Name - The name of the verification requirement is a short descriptive name that can be used in addition to the REQID to refer to the verification requirement. Such a name will often reflect the subject matter of the system or software (etc.) requirement to which the verification requirement relates. An alternative is to use the Name attribute (if used) of the corresponding system or software (etc.) requirement.

4.6 Additional Factors to Consider in Requirements Traceability for RA

Due to the number and complexity of the relationships, requirements traceability for RA is typically implemented with computer-based requirements management tools.

Requirements traceability in RA has also a further temporal aspect, viz. that the requirements themselves and the traceability between requirements change over time, necessitating a formal change control process with respect to baselined requirements and associated requirements traceability information.

5. REQUIREMENTS FOR A REQUIREMENTS TRACEABILITY REPORT IN RA

A RTR-RA should contain the following minimum information with respect to requirements of status "Baselined Requirement" and "Un-baselined Requirement":

a) The system to which the report relates

b) For each originating requirement, the requirement REQID

c) For each originating requirement, Class "Originating"

d) For each derived (by analysis) requirement, the requirement REQID

e) For each derived (by analysis) requirement, Class "Derived by Analysis"

f) For each originating requirement, the requirement text, or a link to the requirement text

g) For each derived (by analysis) requirement, the requirement text, or a link to the requirement text

h) For each originating requirement, the one or more requirements derived from that requirement by analysis

i) For each derived (by analysis) requirement, the one or more originating requirements

j) For each requirement, the baselining status of the requirement (i.e. Baselined or Un-baselined).

For each originating Non-Requirement, the report should contain:

a) the "requirement" REQID

b) the "requirement" text, or a link to the "requirement" text

c) the reason for classification as a Non-Requirement

d) the identity of the person or persons authorizing the classification "Non-Requirement".

Note that, by definition, originating non-requirements cannot be derived (by analysis) requirements.

A RTR-RA may contain the following additional information with respect to requirements of status: "Requirement" and "Un-baselined Requirement", depending on need:

a) for each originating requirement, the one or more verification requirements that state(s) the quality of evidence that is required to adequately verify its satisfaction.

b) for each derived (by analyses) requirement, the one or more verification requirements that state(s) the quality of evidence that is required to adequately verify its satisfaction by the system.

c) for each requirement, that has been baselined, the date and time of creation of, or of any previous change to the requirement, whichever is the later.

Note that the provision for inclusion of verification requirements information for either or both of originating and derived (by analysis) requirements allows for the possibility of, for example, verifying to a customer set of requirements, but developing to an improved "derived by analysis" set of requirements.

6.   OTHER POTENTIAL REPORTS

Other reports may be generated flexibly or be included in the RTR-RA, especially:

a) list of requirements each with corresponding verification status.

b) list of requirements each with identity and text of corresponding verification requirements.

c) list of requirements, each with corresponding rationale.