



The application of ISO 29148 to requirements in NZ infrastructure projects

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Systems and software engineering — Life cycle processes — Requirements engineering

*Ingénierie des systèmes et du logiciel — Processus du cycle de vie —
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Systems and software engineering — Life cycle processes — Requirements engineering

Provides a unified treatment of processes and products involved in engineering requirements throughout the lifecycle

Covers systems and software

Aligned with ISO 15288

Provides the basis for INCOSE requirements guidance (Guide to Writing Requirements, Needs and Requirements Manual, etc)

ISO/IEC/IEEE 29148:2018(E)

Introduction

This document provides a unified treatment of the processes and products involved in engineering requirements throughout the life cycle of systems and software. It provides details for the construct of well-formed textual requirements, to include characteristics and attributes, in the context of system and software engineering. This document also provides guidance for the implementation of requirements related processes from ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207. Finally, this document identifies information items related to requirements engineering and their content.

ISO 29148

1. Scope

2. Normative References

3. Terms, definitions and abbreviated terms

1. Terms and definitions
2. Abbreviated terms

4. Conformance

1. Intended usage
2. Full conformance
3. Conformance to processes
4. Conformance to information item content
5. Tailored conformance

5. Concepts

1. General
2. Requirements fundamentals
3. Practical considerations
4. Requirement information items

6. Processes

1. Requirement processes
2. Business or mission analysis process
3. Stakeholder needs and requirements definition process
4. System [System/Software] Requirements definition process
5. Requirements engineering activities in other technical processes
6. Requirements management

7. Information items

8. Guidelines for information items

1. Requirements information item outlines
2. Business requirements specification
3. Stakeholder requirements specification
4. System requirements specification
5. Software requirements specification

9. Information item content

1. General
2. General content
3. Business requirements specification (BRS) content
4. Stakeholder requirements specification (StRS) content

Annex A (normative) System operational concept

Annex B (informative) Concept of operations

Annex C (normative) Tailoring policies

Full Conformance

4 Conformance

4.1 Intended usage

This document provides guidance for the execution of the ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 processes that deal with requirements engineering. This document also provides normative definition of the content and recommendations for the format of the information items or documentation that result from the implementation of these processes. **Users of this document can claim conformance to the process provisions or to the information item provisions, or both.**

4.2 Full conformance

A claim of full conformance to this document is equivalent to claiming conformance:

- to the provisions contained in [5.2.4](#), [5.2.5](#), [5.2.6](#), and [5.2.7](#);
- to the requirements-engineering-related processes of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207 cited in [6.1](#);
- to the information items specified in [Clause 7](#); and
- to the required content of the information items in [Clause 9](#) and [Annex A](#) of this document.

5.2.4	Requirements construct.....
5.2.5	Characteristics of individual requirements....
5.2.6	Characteristics of a set of requirements.....
5.2.7	Requirement language criteria.....

6.1	Requirement processes.....
6.1.1	Guidelines for processes

7 Information items

9 Information item content

Annex A (normative) System operational concept

Tailored Conformance

4.5 Tailored conformance

4.5.1 Processes

This document **does not make provision for tailoring life cycle processes**. ISO Annex A provides normative direction regarding the tailoring of system life IEEE 12207:2017, Annex A provides normative direction regarding the tailoring processes.

4.5.2 Information items

When this document is used as a basis for establishing a set of information items for full conformance, the clauses of this document shall be selected or modified **tailoring process prescribed in Annex C**. The tailored text, for which tailored conformance is declared. Tailored conformance is achieved by demonstrating that requirements items, as tailored, have been satisfied using the outcomes of the tailoring process.

Annex C (normative)

Tailoring policies

C.1 General

This Annex provides requirements for the tailoring of the information item contents in this document. Tailoring is not a requirement for conformance to the document. In fact, tailoring is not permitted if a claim of 'full conformance' is to be made. If a claim of 'tailored conformance' is made, then the following process shall be applied to perform the tailoring.

C.2 Information item tailoring process

C.2.1 Purpose

The purpose of the tailoring process is to adapt the information item contents of this document to satisfy particular circumstances or factors that:

- a) surround an organization that is employing this document in an agreement;
- b) influence a project that is required to meet an agreement in which this document is referenced; and
- c) reflect the needs of an organization in order to supply products or services.

C.2.2 Outcomes

As a result of successful implementation of the tailoring process, modified or new information item contents are defined to achieve the purpose of the requirements specifications provided in this document.

C.2.3 Activities and tasks

If this document is tailored, the organization or project shall implement the following activities:

- a) **Identify and document the circumstances that influence tailoring**. These influences include, but are not limited to:
 - 1) stability of and variety in operational environments;
 - 2) novelty, size and complexity;
 - 3) starting date and duration of utilization;
 - 4) emerging technology opportunities;
 - 5) profile of budget and organizational resources available;
 - 6) availability of the services of enabling systems; and
 - 7) the need to conform to other standards.
- b) **Obtain input from all parties affected by the tailoring decisions**. This includes, but may not be limited to:
 - 1) the stakeholders;
 - 2) the interested parties to an agreement made by the organization; and
 - 3) the contributing organizational functions.
- c) **Select the information item contents that require tailoring and delete them**.

NOTE 1 Irrespective of tailoring, organizations and projects are always permitted to create additional information item contents beyond those required for conformance to this document.

NOTE 2 An organization or project may encounter a situation where there is the desire to modify the information item contents. Modification is performed by deleting the information item contents (making the appropriate claim of tailored conformance) and, with careful consideration of consequences, creating information item contents that describe additional information beyond those of the tailored document.

Terminology

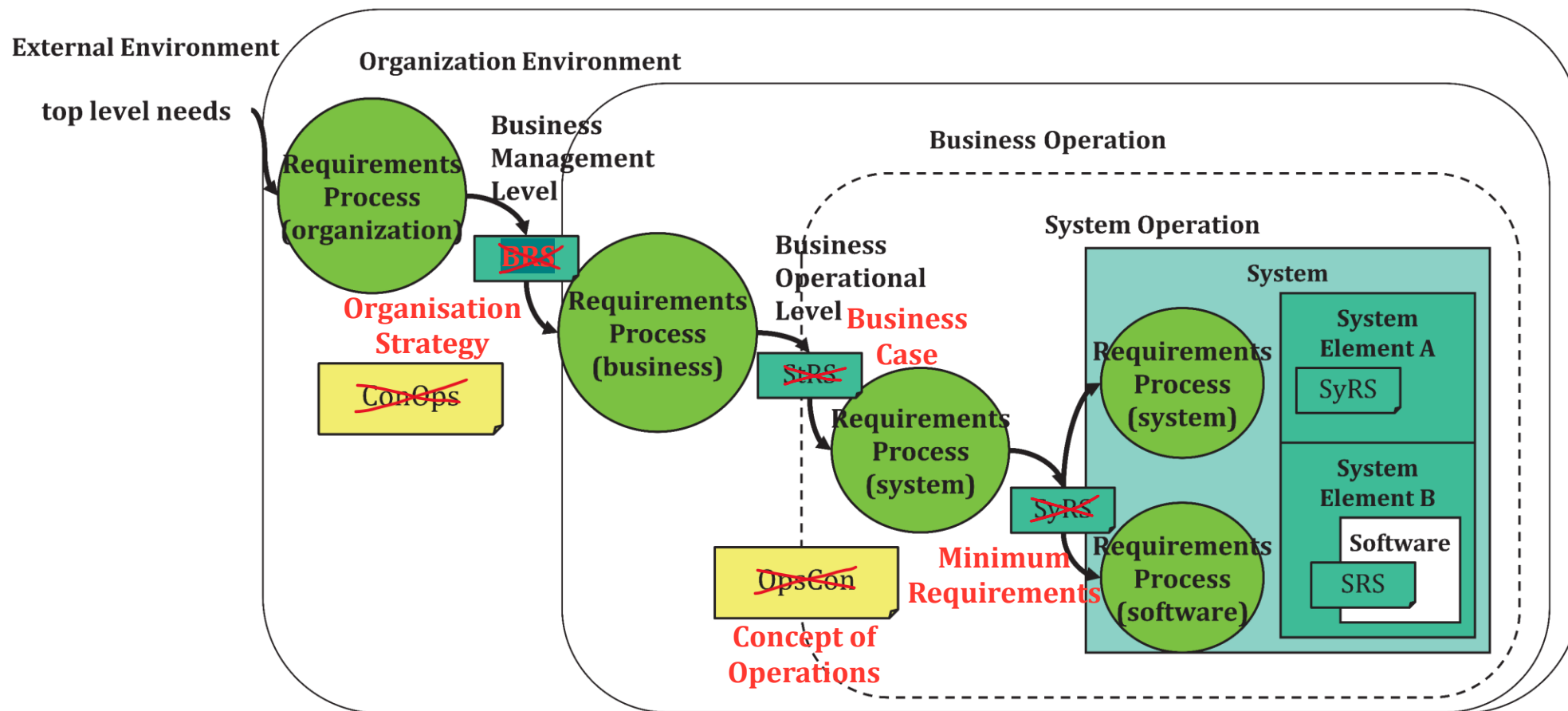


Figure 4 — Example of the relationships between requirements processes and specifications



Audit

Assessment of conformance was carried out for five recent infrastructure projects in Aotearoa.

Each project was assessed by a team member that was directly involved with the work.

Compliance was considered against each '**shall**' and '**should**' statement from the standard.

The team held regular meetings to ensure that interpretation of the statements was consistent between assessors.

Assessment against a statement included noting how the project did or did not comply, and a **Red**-**Amber**-**Green** rating of compliance.

With thanks to:

- Ryan O'Donohue
- Karim Nazli
- Kamila Pillearchchige
- Cara Berghan
- Luke Fischer

As this audit was conducted independently of project delivery, clients, and stakeholders, project specifics have been omitted from this presentation.

The intention is not to critique any specific project, but to identify general areas for improvement as an industry.



Concepts

		1	2	3	4	5
5.2.4 Requirements Construct	Well-formed stakeholder requirements, system requirements and system element requirements shall be developed.					
	If expressed in the form of a natural language, the statement should include a subject and a verb, together with other elements necessary to adequately express the information content of the requirement.					
	A requirement shall state the subject of the requirement (e.g., the system, the software, etc.), what shall be done (e.g., operate at a power level, provide a field for) or a constraint on the system.					
	All terms specific to requirements engineering should be formally defined and applied consistently throughout all requirements of the system.					
	Requirements may be ranked or weighted to indicate priority, timing or relative importance.					
5.2.5 Characteristics of individual requirements	Each stakeholder, system and system element requirement shall possess the following characteristics. (necessary, appropriate, unambiguous, complete, singular, feasible, verifiable, correct, conforming)					
5.2.6 Characteristics of a set of requirements	Each set of requirements for a system, software or service shall possess the following characteristics. (Complete, Consistent, Feasible, Comprehensible, Able to be validated)					
5.2.7 Requirement language criteria	Requirements should state 'what' is needed, not 'how'.					
	Requirements should state what is needed for the system-of-interest and not include design decisions for it.					
	Vague and general terms shall be avoided.					
	All assumptions made regarding a requirement shall be documented and validated in one of the requirement's attributes in 5.2.8 (e.g., rationale) associated with a requirement or in an accompanying document.					
5.2.8 Requirements attributes	To support requirements analysis, well-formed requirements should include descriptive attributes defined to assist in identifying relevant requirements and to help in understanding and managing the requirements.					
	The attribute information should be associated with the requirements in the selected requirements repository.					
	Each requirement should be uniquely identified (i.e., number, name tag, mnemonic).					
	The priority of each requirement should be identified.					
	The rationale for establishing each requirement should be captured.					
	The assumed difficulty for each requirement should be noted (e.g., Easy/Nominal/Difficult).					
	The kinds of quality requirements (e.g., "ilities") should be identified prior to initiating the requirements activities. This should be tailored to the system(s) being developed. As appropriate, measures for the quality requirements should be included as well.					

Concepts

🌟 The good:

- Largely well-formed requirement constructs, with properly defined terms
- Mostly 'solution-agnostic' requirements
- Support for identifiers and attributes with requirements is typical

👎 The bad:

- Not all requirements fulfil quality characteristics
- Not all requirement sets fulfil quality characteristics

😬 The ugly:

- Assumptions relating to requirements typically not being managed
- Priority and difficulty of requirements is not being assessed

Process

Business or mission analysis

		1	2	3	4	5
6.1 Requirement processes	The project shall implement the following requirements engineering processes as defined in ISO 15288: • Business or mission analysis process • Stakeholder needs and requirements definition process • System requirements definition process					
6.2 Business or mission analysis process	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Business or Mission Analysis process. • Prepare for Business or Mission Analysis					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Business or Mission Analysis process. • Define the problem or opportunity space					
	Every analysis task should begin with a concise statement of the opportunity or problem.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Business or Mission Analysis process. • Characterize the solution space					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Business or Mission Analysis process. • Evaluate alternative solution classes					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Business or Mission Analysis process. • Manage the Business or Mission Analysis					
	Requirements traceability should be established and maintained to document how the business needs and requirements are intended to meet the business problems and opportunities and how they are related to preferred alternative solution classes and stakeholder needs and requirements.					

Process

Stakeholder needs and requirements definition

		1	2	3	4	5
6.3 Stakeholder needs and requirements definition process	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Business or Mission Analysis process.					
	Prepare for Stakeholder Needs and Requirements Definition					
	Representatives from each stakeholder class should be identified and include multi-level perspectives.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Stakeholder Needs and Requirements Definition process.					
	Define stakeholder needs					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Stakeholder Needs and Requirements Definition process.					
	Develop the operational concept and other life cycle concepts					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Stakeholder Needs and Requirements Definition process.					
	Transform stakeholder needs into stakeholder requirements					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Stakeholder Needs and Requirements Definition process.					
	Analyze stakeholder requirements					
	Requirements should be analyzed for the characteristics defined in 5.2.5 and 5.2.6.					
	Requirements should be prioritized and may be classified as described in 5.2.8.					

Process

Stakeholder needs and requirements definition

		1	2	3	4	5
6.3 Stakeholder needs and requirements definition process	If stakeholder requirements from existing or legacy systems have been identified as candidates for reuse, they should be analyzed for use based on factors such as applicability, feasibility, availability, quality, cost effectiveness, value and currency. While reusing requirements, a careful consistency check of reused requirements with the system-of-interest's specific requirements should be performed in order to assure consistency.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the Stakeholder Needs and Requirements Definition process. Manage the stakeholder needs and requirements definition					
	The composition of the group that conducts the review is important (at least one representative of the acquirer should be included for an acquirer-driven project, for example) and it may help to provide guidance on what to look for in the form of checklists.					
	The agreement on stakeholder requirements may be limited to individual stakeholders only agreeing on subsets of the stakeholder requirements. There may be conflicts among the totality of stakeholder requirements. It is the business of stakeholder requirements to record the totality of stakeholder needs even if there are conflicts among these needs. Agreement among stakeholders should happen on the basis of system requirements, not necessarily on the basis of stakeholder requirements.					
	Requirements traceability should be established and maintained to document how the formal requirements are intended to meet the stakeholder objectives and achieve stakeholder agreement.					
	Consideration should be given to using a requirements management tool, especially for more complex projects. This tool should have the capability to trace linkages between requirements to show relationships.					
	The requirements repository should first be populated with the source documentation of the stakeholder needs, project constraints (such as from business policies/rules) and any other conditions that provide the basis for the total set of system requirements that will govern its design.					
	The requirements repository should also include any requirements attributes, including the priority and criticality of the requirements.					

Process

System Requirements definition

		1	2	3	4	5
6.4 System [System/Software] Requirements definition process	As far as constraints permit, the requirements should not imply any specific implementation.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the System [System/Software] Requirements Definition process. Prepare for System [System/Software] Requirements Definition					
	Organization – stakeholders should have an understanding of the organization in which the targeted system or software will be used and of the real mission or objective of that organization.					
	Environment – stakeholders should be aware of the maturity of the domain of the system-of-interest, the certainty of interfaces between the system-of-interest and other systems in the operational environment, and the role of the system-of-interest relative to other systems in the operational environment.					
	Constraints – stakeholders should consider the constraints that affect the life cycle of the system-of-interest, such as cost, schedule, political, environmental or operational.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the System [System/Software] Requirements Definition process. Define system[/software] requirements					
	The traceability should be updated and maintained to document how the formal system or software requirements, including derived requirements, are intended to meet the stakeholder requirements and objectives and achieve stakeholder agreement.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the System [System/Software] Requirements Definition process. Analyze system[/software] requirements					
	If system/software requirements from existing or legacy systems have been identified as candidates for reuse, they should be analyzed for use based on factors such as applicability, feasibility, availability, quality, cost effectiveness, value and currency. While reusing requirements, a careful consistency check of reused requirements with the system-of-interest's specific requirements should be performed in order to assure consistency.					

Process

System Requirements definition

		1	2	3	4	5
6.4 System [System/Software] Requirements definition process	The 'prepare for verification' activity of ISO/IEC/IEEE 15288, 6.4.9.3 a) or ISO/IEC/IEEE 12207:2017, 6.4.9.3 a), should be used for the definition, planning, and execution of requirements verification.					
	The level of fidelity and build quality should be based on the purpose of the prototype.					
	The project shall implement the following activities and tasks in accordance with applicable organization policies and procedures with respect to the System [System/Software] Requirements Definition process. Manage system[/software] requirements					
	Additionally, stakeholders should be prepared to reach and maintain the agreement through negotiation. Typically, the owner of the system/software requirements is responsible for leading the negotiation. Whoever is responsible should have the necessary negotiation skills.					
	Requirements tracing is concerned with recovering the source of requirements and predicting the effects of requirements change. The traceability should include interface requirements.					
	A requirement should be traceable: - to lower-level requirements (e.g., stakeholder to system to element and ultimately to hardware and software requirements); - to architecture (e.g., logical or physical); - to system elements (e.g., software and hardware elements that implement the requirement); - to verification/test entities that satisfy it, along with any supporting models and analysis; and - upwards to the parent requirements from which it was derived or to the stakeholder needs from which it was transformed.					
	Each requirement should also be traceable upwards to the requirements and stakeholders that motivated it (from a software requirement back to the system requirement(s) that it helps satisfy, for example).					
	In the case of requirements derived from trade or design studies, those derived requirements should be traceable back to the study from which they derive, and the study should be traceable back to the high-level requirements by which it was informed.					
	The requirements shall be configuration controlled.					



Process

Other processes

		1	2	3	4	5
6.5.1 Requirements activities in architecture definition	Verification and validation criteria for the system elements should be identified and recorded as derived requirements are generated.					
6.5.2 Requirements activities in verification	Verification methods should be documented.					
	As the system moves through the life cycle phases, traceability of the requirements to the work products should be added.					
6.5.3 Requirements activities in validation	Traceability should be maintained and may be documented in a Requirements Traceability Matrix (RTM) or similar information item.					
6.6.1 Management overview	Requirements that are likely to evolve should be identified and communicated to both acquirers and the technical community.					
	However, care should be exercised in making requirements changes during the life cycle.					
6.6.2 Change management	Requirements shall be configuration managed, in accordance with project and organization configuration management processes.					
	The requirements information shall be managed in accordance with the organization's information management process					
	The system operational concept and stakeholder, system, software and system element requirements are identified as information items for configuration control in the configuration management planning and should have unique identifiers.					
	As changes are made to the operational concepts and stakeholder, system, software and system element requirements, the changes need to be formally captured and in documented baselines of the requirements along with the configuration information that identifies the specific changes and associated rationale. Requirements traceability should be maintained.					
6.6.3 Measurement for requirements	The requirements measurement shall be managed in accordance with the organization's measurement process.					

Process

The good:

- All projects managed 'System' Requirements – often as 'Minimum Requirements'
- Most projects used a requirements management tool, providing traceability, attribute management and configuration control

The bad:

- Stakeholder Need source documentation is typically not linked into (stakeholder) requirements
- Verification criteria and methods are not considered early enough on most projects
- Organisational measurement processes either don't exist or aren't applicable to requirements

The ugly:

- Many projects not managing formal requirements at the 'Business' or 'Stakeholder' levels
- Smaller projects not formally managing requirements at all



Information

		1	2	3	4	5
7 Information items	The project shall produce the following information items as part of the requirements engineering processes: — Business requirement specification (BRS); — Stakeholder requirements specification (StRS); — System requirements specification (SyRS); and — Software requirements specification (SRS), if adhering to ISO/IEC/IEEE 12207.					
	The information items shall contain the content as defined in Clause 9 of this document.					
	The management of information items shall be performed by applying the Information Management process of ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 12207.					
9.2 General content	The references information should be subdivided into a ‘Compliance’ section, containing references to those cited documents containing requirements which are included by that citation and a ‘Guidance’ section, containing reference to those cited documents containing information, but no requirements.					



Information

Business requirements

		1	2	3	4	5
9.3 Business requirements specification (BRS) content	The project shall produce the following information item content in accordance with the project’s policies with respect to the business requirements specification. Business purpose; Business scope; Business overview; Major Stakeholders; Business environment; ...					
	Describe at the organization level the reason and background for which the organization is pursuing new business or changing the current business in order to fit a new management environment. In this context it should describe how the proposed system will contribute to meeting business objectives.					
	Define external and internal environmental factors that should be taken into consideration in understanding the new or existing business and eliciting the stakeholder requirements for the system to be developed or changed. The environmental factors should include possible influences to the business and consequently the system from external conditions like market trends, laws and regulations, social responsibilities and technology base.					
	Describe methods by which the business mission is expected to be achieved. The description should be concentrated on the methods supported by the system to be developed or changed with the items such as product and services, geographies and locales, distribution channels, business alliance and partnership, and finance and revenue model.					
	Describe the overall strategy for the organization level decisions on common bases for multiple information systems. It should include the following items. a) project portfolio – ...					
	Each business process should be uniquely named and numbered in the structure. The description of the individual business process should be represented as a diagram representing a sequence of activities.					
	The policies and rules shall be uniquely named and numbered, and shall be referenced in the description of the business processes.					
	Describe the proposed system in a high-level manner, indicating the operational features that are to be provided without specifying design details. The following information should be included: a) operational policies and constraints; ...					
	The scenarios should be uniquely named and numbered and should be referenced in the description of the business processes in 9.3.9.					

Information

Stakeholder requirements

		1	2	3	4	5
9.4 Stakeholder requirements specification (StRS) content	The project shall produce the following information item content in accordance with the project's policies with respect to the stakeholder requirements specification. Stakeholder purpose; ;Stakeholder scope; Overview; Stakeholders; Business environment; Mission, goals and objectives; ...					
	Describe at the organization level the reason and background for which the organization is pursuing a new business or changing the current business in order to fit a new management environment. In this context it should describe how the proposed system will contribute to meeting business objectives.					
	Define external and internal environmental factors that should be taken into consideration in understanding the new or existing business and eliciting the stakeholder requirements for the system to be developed or changed. The environmental factors should include possible influences to the business and consequently the system from external conditions like market trends, laws and regulations, social responsibilities, and technology base.					
	Describe methods by which the business goal is expected to be achieved. The description should be concentrated on the methods supported by the system to be developed or changed with the items such as product and services, geographies and locales, distribution channels, business alliance and partnership, and finance and revenue model.					
	Describe the overall strategy for the organization level decisions on common bases for multiple information systems. It should include the following items. a) project portfolio – ...					
	Each system process should be uniquely named and numbered in the structure. The description of the individual system process should be represented as a diagram representing a sequence of activities.					
	The policies and rules shall be uniquely named and numbered, and shall be referenced in the description of the business processes.					
	The context of use specified for a design (i.e., the context in which the system is to be used) should be specified as part of the user requirements specification to clearly identify the conditions under which the requirements apply.					
	Describe the proposed system in a high-level manner, indicating the operational features that are to be provided without specifying design details. The following information should be included: a) operational policies and constraints; ...					
	The scenario should be uniquely named and numbered and should be referenced in the description of the business processes in 9.3.10.					

Information

System requirements

		1	2	3	4	5
9.5 System requirements specification (SyRS) content	The project shall produce the following information item content in accordance with the project's policies with respect to the system requirements specification. SyRS overview; System purpose; System scope; System overview; Functional requirements; Usability requirements; ...					
	Define the scope of the system under consideration by: ... c) describing the application of the system being specified. As a portion of this, it should describe all relevant top-level benefits, objectives and goals as precisely as possible.					
	Interfaces among system elements should include interfaces with the human element. Interfaces with external entities should include other systems.					
	Include environmental conditions to be encountered by the system. The following areas should be addressed: natural environment (e.g., wind, rain, temperature, humidity, flora, fauna, fungus, mold, sand, salt spray, dust, radiation, chemical, airborne contaminants and immersion); induced environment ...					
	List any assumptions and dependencies applicable to the system requirements that should be taken into account in the allocation and derivation of lower-level system requirements.					

Information

The good:

- System Requirement information typically being properly captured on large infrastructure projects

The bad:

- System Requirement information only captured in 'Scope of work' or contract documents on smaller infrastructure projects
- Stakeholder Requirement information may be captured in Business Cases or Concept of Operations documents
 - May be informally incorporated into requirements on some projects

The ugly:

- Business Requirement information may be contained in organisational strategy documents, but no evidence of it being pulled through as formal requirements



System Operational Concept

	1	2	3	4	5
Annex A (normative) System operational concept	Users of this document should consider producing separate System OpsCon and SyRS documents.				
	The project shall produce the following information item in accordance with the project's policies with respect to the System Operational Concept. Operational concept document (OpsCon)				
	The information item content in A.2.7 shall be produced in the course of producing the Stakeholder Requirements Specification as referred to in 9.3.16 and 9.3.17.				
	Each version of an OpsCon document based on this guide should contain a title and a revision notice that uniquely identifies the document. Revision information may include the project name, version number of the document, date of release, approval signatures, a list of clauses that have been changed in the current version of the document, and a list of version numbers and dates of release of all previous versions of the document.				
	The approved OpsCon document should be placed under configuration control.				
	The preface should include the purpose of the document, the scope of activities that resulted in its development, who wrote the document and why, the intended audience for the document and the expected evolution of the document.				
	A table of contents, a list of figures and a list of tables should be included in every OpsCon document.				
	If related OpsCon documents for an overall system have been developed in a rank ordered structure or network manner, the position of this document relative to other OpsCon documents should be described.				
	The intended audience for the document should also be mentioned.				
	In the event that actual design constraints need to be included in the description of the proposed system, they shall be explicitly identified as required to avoid possible misunderstandings.				
	In addition to providing the background for the current system, this section should provide a brief summary of the motivation for the current system. Examples of motivations for a system might include automation of certain tasks or countering of certain threat situations. The goals for the current system should also be defined, together with the strategies, solutions, tactics, methods and techniques used to accomplish them.				
	Graphical tools should be used wherever possible, especially since OpsCon documents should be understandable by several different types of readers.				
	The description of the operational environment should identify, as applicable, the facilities, equipment, computing hardware, software, personnel and operational procedures used to operate the existing system. This description should be as detailed as necessary to give the readers an understanding of the numbers, versions, capacity, etc., of the operational equipment being used.				



System Operational Concept

	1	2	3	4	5
Annex A (normative) System operational concept	Those aspects of safety, security and privacy that exert an influence on the operation or operational environment of the current system should be described.				
	The information in this section should be organized as appropriate to the system or situation, as long as a clear description of the existing system is achieved.				
	All of the modes that apply to all classes of users should be included.				
	System processes, procedures and capabilities or functions should be related to each mode, as appropriate, perhaps using a cross-reference matrix.				
	Provide a profile of each user class for the current system. If some users play several roles, each role should be identified as a separate user class.				
	Each user class for the current system, including operators and maintainers, should be described in a separate section. Each of these should provide a description of the user class, including responsibilities, education, background, skill level, activities and modes of interaction with the current system.				
	Interactions that occur among the users of the system and between users and non-users, both within the organization and across organizational boundaries, if they are relevant to the operation of the existing system, should be described. Informal as well as formal interactions should be included.				
	If there is no current system on which to base changes, this section should so indicate and provide justification for the features of the new system.				
	This section should : a) briefly summarize new or modified aspects of the user needs, missions, objectives, environments, interfaces, personnel or other factors that require a new or modified system; b) summarize the deficiencies or limitations of the current system or situation that make it unable to respond to new or changed factors; and c) provide justification for a new or modified system: 1) if the proposed system is to meet a new opportunity, describe the reasons why a new system should be developed to meet this opportunity; 2) if the proposed system improves a current operation, describe the rationale behind the decision to modify the existing system (e.g., to reduce life cycle costs or improve personnel efficiency); and 3) if the proposed system implements a new functional capability, explain why this function is necessary.				
	Changes should be based on the current system.				
	This description should include the following, as appropriate. — Capability changes. ...				



		1	2	3	4	5
Annex A (normative) System operational concept	Each change should be classified as essential, desirable or optional. Desirable and optional changes should be prioritized within their classes. If there is no existing system on which to base changes, this section should classify and prioritize the features of the proposed system.					
	This should include all assumptions and constraints that will affect users during the life cycle of the new or modified system.					
	The level of detail should be sufficient to fully explain how the proposed system is envisioned to operate in fulfilling users’ needs and buyer’s requirements.					
	The OpsCon should not contain design specifications, but it may contain some examples of typical design strategies, for the purpose of clarifying operational details of the proposed system.					
	In addition to providing the background for the proposed system, this section should provide a brief summary of the motivation for the system.					
	The goals for the new or modified system should also be defined, together with the strategies, solutions, tactics, methods and techniques proposed to achieve those goals.					
	System processes, procedures and capabilities or functions should be related to each mode.					
	If some users play several roles, each role should be identified as a separate user class.					
	Each user class for the proposed system, including operators, maintainers and trainers, should be described in a separate section. Each section should provide a description of the user class, including responsibilities, education, background, skill level, activities and envisioned modes of interaction with the proposed system.					
	In particular, interaction among user groups, operators and maintainers should be described. Interactions that will occur among the users of the proposed system and between users and non-users, both within the organization and across interfacing organizations, if they are relevant to the operation of the proposed system, should be described. Informal as well as formal interactions should be included.					
	Scenarios should be described in a manner that will allow readers to walk through them and gain an understanding of how all the various parts of the proposed system function and interact.					
	Scenarios should be organized into sections and subsections, each describing an operational sequence that illustrates the roles of the system, its interactions with users and interactions with other systems.					
Operational scenarios should be described for all operational modes and all classes of users identified for the proposed system. Each scenario should include events, actions, stimuli, information and interactions as appropriate to provide a comprehensive understanding of the operational aspects of the proposed system.						



System Operational Concept

		1	2	3	4	5
Annex A (normative) System operational concept	Scenarios are an important element of an OpsCon and should therefore receive substantial emphasis.					
	This summary should include the below items, as applicable. In each case, the benefits should be related to deficiencies identified. — New capabilities. Additional new features or functionality. — Enhanced capabilities. Upgrades to existing capabilities. — Deleted capabilities. Unused, obsolete, confusing or dangerous capabilities removed. — Improved performance. Better response time, reduced storage requirements, improved quality, decreased system/user workload, etc.					
	Each appendix should be referenced in the main body of the document where that information would normally have been provided.					
	A glossary should be maintained and updated during the processes of concept analysis and development of the OpsCon document.					
	To avoid unnecessary work due to misinterpretations, all definitions should be reviewed and agreed upon by all involved parties.					



System Operational Concept

☀️ The good:

- Typically referred to as a Concept of Operations (ConOps) on NZ Infrastructure projects
- ConOps typically align with majority of the standard

👎 The bad:

- ConOps often produced late in the process, not driving requirements
- ConOps often separated from the requirements process

😬 The ugly:

- Not produced for all projects

Results

None of the projects were close to meeting the criteria for 'full conformance'

Most would struggle to justify a claim of 'tailored conformance'

⚠ Significant areas of non-conformance:

- Traceability to high-level 'Business Requirements'
- Linkage to 'Operational Concept' / 'Concept of Operations' documents

✅ Most large projects are using some form of requirements tool

✅ Tool usage comes under change control processes

⚠ This is necessary, but not sufficient, for good performance, it needs to be accompanied by:

- Quality characteristics in requirement / requirement set authoring
- Development and traceability to ConOps documents



Conclusions / Next steps

The New Zealand infrastructure industry is trending in the right direction, with improvements project-upon-project.

Demanding full conformance to ISO 29148 may be too big a step in the short term.

Setting targets for tailored conformance on future projects may be beneficial.

Specific tailoring of the standard to New Zealand infrastructure should be considered.

The process of auditing our projects revealed several insights and areas for improvement.

Lessons learned have been applied to our most recent requirements project and shown benefits.

Questions?