Drafting and Design Presentation Standards Manual
Volume 1: Chapter 1 - Introduction

August 2019

Queensland Government

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Amendment Register

Issue / Rev no.	Reference section	Description of revision	Authorised by	Date
1	-	First Issue	Steering Committee	January 2006
2	-	Signatures/Names on Drawings	Steering Committee	July 2006
3	-	• Certifying and Approving of drawings • Use of Coloured Drawings	Steering Committee	February 2007
4	-	• Signatures on scheme drawings • Legislative requirements • Main Roads design requirements • Signatures in the title block	Don Hicks	February 2008
5	-	• Updated to reflect current Transport and Main Roads policies and standards • Drawing management, requirements and costing	Don Hicks	February 2010
6	-	• Unusual features • Critical aspects of design • As Constructed drawings	Don Hicks	June 2010
7	1.6.2 and 1.8.1	Signatures of an overall nature, Standard Title block and Geospatial information	Don Hicks	February 2011
8	Chapter 1	Contents updated to reflect current departmental policies, standards and requirements: • Table of Contents • Design Certification • Requirements for Submission of Drawings for Registration • As Constructed	Owen Arndt	January 2013
9	Chapter 1	Contents updated to reflect current TMR policies, standards and requirements: • Submission of Drawings for Registration • As constructed process and drawing revisions	Owen Arndt	December 2013
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	Chapter 1	Update to Corporate Template		

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11	1.1	Minor updates to introduction	Director (Road Design) Geospatial, Design and Capability (E&T)	October 2016
	1.4.5	Update to the use of coloured drawings		
	1.6.3.1	Update to Figure 1.6.3.1		
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	1.7.1	Update to section Construction Drawings Development Process		
	1.9	• "Copyright" section removed • Added new "Survey Presentation" section		
	1.10	Update to references		
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	1.7.1	Use of numerical revision identifiers for version of drawings at preconstruction stages prior to Issued For Construction		
	1.7.1.2	Use of revision identifier inside a triangle positioned next to the revision clouds		
	1.7.1.3	Clarification of responsibilities and signature requirements for the factual representation of works constructed statement on As Constructed drawings		
	Figure 1.6.2.3	Update to Figure 1.6.2.3 - Scheme scope and approval statement		
	Figure 1.6.3.1	Update to Figure 1.6.3.1 - Standard title block signature requirements		

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1 Introduction

1.1 General

This manual provides the drafting and design presentation standards to produce all drawings and project electronic models delivered as outputs of the planning and/or design activity of road infrastructure projects performed for the Department of Transport and Main Roads (TMR) Queensland. Volume 1 provides general guidance for presentation. It also specifies departmental requirements for civil design drawings. Volume 2 details expectations for specific road planning and design drawings. Structural drafting standards are detailed in Volume 3 which stipulate departmental requirements for these drawings. For additional structural requirements refer to other bridge and structures technical publications.

There is no requirement for projects not performed for the department to adhere to these standards although designs for such projects within a state-controlled road reserve would be subject to review for acceptability. Although, the expectation is that the final 'As Constructed' revision of these drawings are to be submitted to the department's Plan Room where it is required under the *Public Record Act* to keep and maintain a true and accurate record of its road assets. This also includes when external parties undertake works on departmental assets not in conjunction with Transport and Main Roads. The drawings will be allocated a departmental drawing number upon submission and will be scanned and registered by the Plan Room.

For projects performed for Transport and Main Roads it is important to understand that drawings and/or project electronic models form only a part of the overall project documentation provided to tenderers and constructors of road infrastructure projects. Generally, these instructions comprise:

- Engineering drawings and project electronic models.
- Specifications, including supplementary specifications.
- Schedules of work to be performed, quantities of materials.
- Test instructions.
- Intent of the design, including critical / unusual design issues.
- Visualisations for:
  - stakeholder engagement, and general communication of project impacts
  - visual checking of the design
  - showing the design intent.

The primary purpose of these instructions is to specify "the design" of the proposed road and to convey the engineering "requirements for tendering and construction" of road infrastructure.

The content and requirements covered in this chapter apply when presenting the design at any stage of the preconstruction and construction delivery processes, however there is specific focus in this chapter on the production of:

- certified engineering drawings for approval, tendering and construction purposes, and
- project electronic models for approval, tendering and construction purposes.

Where drawings are produced for stakeholder and community display purposes it is important for them to present the information in a way suitable for the group concerned. In this respect the drawing would have a focus on clearly showing project intent and impacts rather than design/construction detail.

1.2 Computer software for road design and presentation

The department has adopted 12d Model, AutoCAD, and other CADD software as its standard for the delivery of all departmental projects from survey through planning, design, tendering, construction, as constructed and archival activities.

The primary function of road design and presentation software is to support the design development process, including the production of:

- Geometrics / shapes / profiles
- quantities
- cross road drainage design and presentation
- project drawings
- the project electronic model.

Production of the project electronic model assists in:

  - checking all aspects of the design in a three-dimensional project electronic model
  - validation of the design through traffic simulation activities to confirm the required traffic performance outcomes are being achieved
  - visualising the proposal in the community engagement process
  - verification to confirm design aspects on a progressive basis
  - supplying accurate construction information, including electronic information for Global Navigation Satellite System (GNSS) guided road plant
  - production of contract drawings, including visualisation
  - production of cross sections at any scale, frequency or skew
  - integration of design variations during construction, and
  - production of As Constructed drawings from the project electronic model.

For straight forward restoration projects with minimal survey input it may not be appropriate to create a project electronic model.

1.3 Requirements for tendering and construction

A set of project drawings must contain the engineering information that supports the key functions of:

- setting out the works
- ordering material and component parts
- identify available work areas
- support tendering processes for constructors
- planning construction methods and to seek opportunities to optimise construction activities and processes

- working of materials
- inspect and control construction quality and reliability
- traffic management during construction as appropriate (on major projects this will be part of the tendering process)
- determine costs
- facilitate construction material quantity calculations.

1.4 Project drawings

The primary purpose of project drawings is to clearly represent the design that is required to be constructed. It is important that the shapes and location of the different materials together with their interfaces are clearly articulated. The information shown must be adequate for the tendering and construction contractor to be able to calculate any construction information from the drawings.

A prerequisite to the tendering and construction stages of project delivery is that construction companies will have suitable experienced staff with appropriate / modern systems. To avoid costly construction errors pre-tendering and pre-construction meetings are essential to develop a common understanding of requirements between the client and the contractor.

The project electronic model removes the need for contractors to interpret drawings and to manually transfer data from the drawings to their construction equipment.

It is important at pre-construction meetings to remind the contractor that the As Constructed revision of project drawings representing final works constructed are submitted to the client for future asset management and archive.

1.4.1 Drawing responsibilities

The key person responsible for preparing the various drawings and design activities and their presentation is required to include their name in ‘text’ in the relevant parts of the drawing.

This ensures the legibility of the person’s name allowing ready identification where there is a need for further information, additional design, or to correct an error or omission. This information together with the claims history and the consultant performance reports may be used in consultant prequalification assessment processes.

1.4.2 Specifying the design

The drawings must precisely detail those parameters that specify the design:

- locating the project job site
- the precise location of the project on the ground
- the road component shapes
- the road structure (materials)
- full details of turnouts, intersections, interchanges etc.
- the type, size, shape and full detail of structures (bridges, retaining walls, culverts), including their precise location within the project
- portray a clear visual understanding of the project and its environs.

Satisfying these requirements will allow the constructor to readily generate accurate information from the drawings for setting out and control of the works in their own construction support systems.

1.4.3 Providing tendering and construction information

From the project electronic model individual constructors can produce a range of information to suit their particular requirements e.g. cross sections from the project electronic model at any chainage, interval, scale (including distorted scales), or at any skew angle, all on command.

There is no requirement to produce cross section drawings for inclusion in scheme documents on the basis it is what construction crews actually require. Construction contractors can produce the cross sections or any other information they actually require to suit their own operational processes whether it be for tendering or construction purposes.

1.4.4 Functional drafting

Functional drafting refers to a technique that eliminates all unnecessary detail while maintaining the full clarity, completeness and accuracy of the finished drawing without being subject to variable interpretation. The use of rectified aerial photography as the backdrop for engineering survey used in the planning and/or design process is one method of achieving this approach. This is because the impacts of the design process (either immediate or surrounding) are instantly recognisable without the need for further detailing. This manual exploits the functional drafting approach in the text and example figures/drawings throughout this manual.

Functional drafting should be an output from the project electronic models.

1.4.5 Use of coloured drawings

Coloured drawings may be used where it is necessary to provide improved readability of the drawings. The use of standard line styles and features will in most cases avoid the need for colour drawings.

However, in cases of very complex details then the use of colour drawings can be considered as colour significantly enhances features and readability.

Colour is an effective means of directing the reader’s attention to important details. Colour provides additional means of separating types of functional detail or objects. Colour in conjunction with different line weights assists the reader in distinguishing between materials and elements / shapes. Effective use of colour improves drawing clarity and improves the reader’s understanding of the drawings. Examples of drawings where colour has proved to be very effective in improving drawing readability and clarity include traffic management plans and construction staging plans.

If colour is used, it must be ensured that the colours used can be reproduced clearly in black and white copies and that the intended information on the plans is not lost through this process. This is mandatory for all plans that are required to be submitted to plan room for registration and archive.

1.5 Preserving the design intent during construction

The department is tasked with maintaining the integrity of design after financial approval has been provided. Changes can be made to the design with departmental approval during construction and maintenance operations for efficiency of those operations. Without approval, changes have potential to degrade the design intent to an unacceptable level. Ease of construction is not necessarily a valid reason to change the design and especially without reference to the original designer or approved experienced designer.

Figures 1.7(a) and 1.7(b) describe the lifecycle of an engineering drawing through the Issued For Construction stage to finalisation at the As Constructed phase. The lifecycle details the RPEQ certification requirements for Issued For Construction (including Design Revision versions); the lifecycle also details the drafter / designer verification requirements for Drafting or Design Revisions and for the As Constructed version signoff.

1.5.1 Design changes

Design changes made after the scheme drawings have received financial approval will require engineering certification by a Registered Professional Engineer Queensland (RPEQ) in the revision area located in the bottom left hand corner of the title block, see Figure 1.6.3.1. This certification must ensure that the original design intent has not been degraded, unless specifically approved otherwise by the client. The RPEQ is fully responsible for the consequences of the design change. See Figures 1.7(a) and 1.7(b).

The process required to create the Design Revision drawings is described in Section 1.7.1.2.

1.5.2 Critical aspects of design

It is very important that all critical aspects of the design are explained to the construction contractor to avoid compromising the integrity of the design intent during construction. These requirements must be highlighted in the drawings, project electronic model, and/or supplementary specifications and they must be addressed at the pre-tendering and pre-construction meetings so that the contractor clearly understands these issues and requirements. Typical examples of critical aspects of design are:

- Varying the crossfall of road pavements to manage surface drainage, including aquaplaning potential. On a multi lane facility the lane crossfall may be different in adjacent lanes.
- Product durability.
- Traffic performance.
- Safety.
- Functionality.

1.5.3 Design responsibilities and accountability

The overall responsibility for quality of the project design and documentation lies with the organisation carrying out the design. This responsibility is identified in the submission statement “Scheme Submitted” on the first drawing of any set of project drawings.

However, the relevant RPEQ remains responsible for the overall provision of engineering services in terms of compliance with the *Professional Engineers Act 2002*.

1.5.4 Project electronic models and engineering drawings

The attributed project electronic model is becoming a standard method to check the design together with its interfaces with the site and various design elements, and between design disciplines, e.g. civil, structural, electrical, and so on. Once the design has been checked via the project electronic model, the projects engineering drawings can then be produced directly from this model. This process is designed to achieve a good engineering output avoiding errors in the project electronic model and engineering drawings.

Visualisations can also be produced to assist tendering and constructors to identify what they have to build.

1.6 Departmental requirements

1.6.1 Use of consultant's logo

The consultant responsible for preparing the drawings shall include their logo on the drawings, provided the logo does not occupy an area on the drawing greater than that occupied by the Queensland Government logo. In addition, where the consultant decides to include its logo on the drawing then it must be inserted in the top right hand corner of the drawing sheet.

1.6.2 Signatures and names on scheme drawings

Signatures on scheme drawings play a very important role in the legitimisation of scheme documents and the authorisation for the scheme to progress through the various process steps.

Signatures are required for the following purposes:

- Engineering certification of the concept design and design development, for tender and during construction including its presentation on drawings for each area of engineering concerned. It also verifies all names and signatures on the drawings relating to engineering matters. This certification also includes the appropriate application of relevant departmental standards, specifications and project supplementary specifications.
- Where a design amendment has been approved after financial approval has been made then the same certification requirements apply to that design change.

1.6.2.1 Signatures of an overall nature

Signatures are required to cover the entire scheme drawings and are included on the first sheet of the drawing set under a listing of all the drawings appropriately identified (including document version and date). Refer to Figure 1.6.2.3 for the signature box required which includes:

- Scheme Submitted, and
- Scheme Scope and Financial Approval.

Where the scheme drawings listing requires more than one sheet, the statement will appear only on the first sheet of the drawing listing.

1.6.2.2 Scheme Submitted to the client

The person duly authorised by the service provider (engineering consultant or internal business unit) shall formally (under a covering letter – see below) submit the contract materials (scheme documents) to the client.

The meaning of ‘Scheme Submitted’ is:

- the scheme satisfies the requirements of the client's brief / functional specification
- the client has been progressively involved in the evolution of the design, including peer review
- the engineering design has been certified by the relevant RPEQ(s), and that all signatures in the drawing title block are bona fide.

Scheme submission is a commercial response to a brief. The submission is by a single signature under a listing of all scheme drawings on the first drawing of the drawing set. The organisation or internal business units approving officer must sign under the words ‘Scheme Submitted’ and indicate their organisation.

In addition, the submission covering letter shall state that the scheme has been prepared in accordance with the (name of organisation) fully certified quality system and other relevant organisational standard process and practices, and departmental technical requirements published in various departmental documents, including manuals.

1.6.2.3 Scheme scope and financial approval

The Regional Director (or delegate) shall approve a scheme for tendering purposes. Approved means the relevant Regional Director (or delegate) is satisfied that:

- The scheme satisfies departmental priorities in relation to:
  - Investment Strategies
  - Functional Road Hierarchy
  - Traffic Operation Function
  - Corridor Development Plans
  - The need to be satisfied by the project.
- The scheme satisfies the requirements of the QTRIP in terms of:
  - Prioritisation
  - Scope, and
  - Cost.
- The appropriate level and extent of external communication has been undertaken.

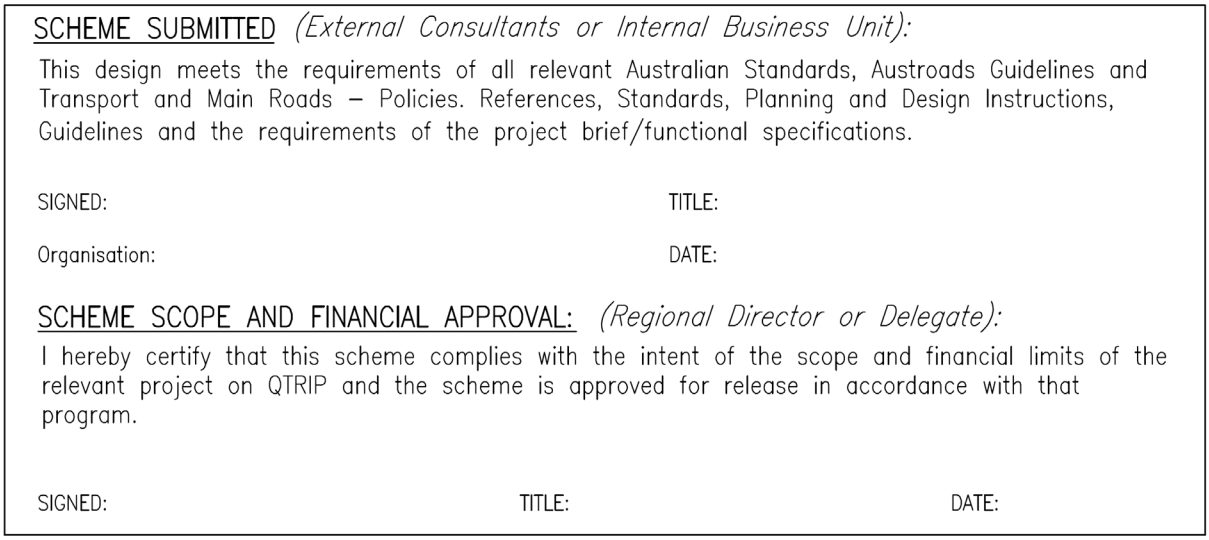
Scheme scope and financial approval is by a single wet blue signature under a listing of all scheme drawings on the first drawing of the drawing set.

The required scheme submitted and scheme scope and financial approval statements are to be included on the front sheet of a project set of scheme drawings in accordance with the details shown in Figure 1.6.2.3.

The “scheme submitted and scheme scope and financial approval statement” can be obtained as a block from the TMR AutoCAD Customisation.

The names, signatures and dates on the “scheme submitted and scheme scope and financial approval statement” on the Issued For Construction (Revision A) drawing are to be transcribed in AutoCAD text onto any subsequent revision drawing including the As Constructed drawing. Refer Sections 1.7.1.2 and 1.7.1.3.

Figure 1.6.2.3 - Scheme scope and approval statement



1.6.3 Other names on drawings and responsibilities

Names and signatures on engineering drawings play a very important role in the legitimisation of scheme documents.

In this context each engineering drawing must include the names and signatures, as relevant of the person responsible for:

- producing the engineering drawing
- carrying out the design considering all areas of engineering, and
- certifying the design for each area of engineering, as relevant.

1.6.3.1 Names and signatures in the title block

Every drawing must have a standard departmental title block that requires a range of names and signatures to be applied in order to complete the drawing.

Names in AutoCAD text are required for Drawn, Designed, and Engineering Certification by a RPEQ.

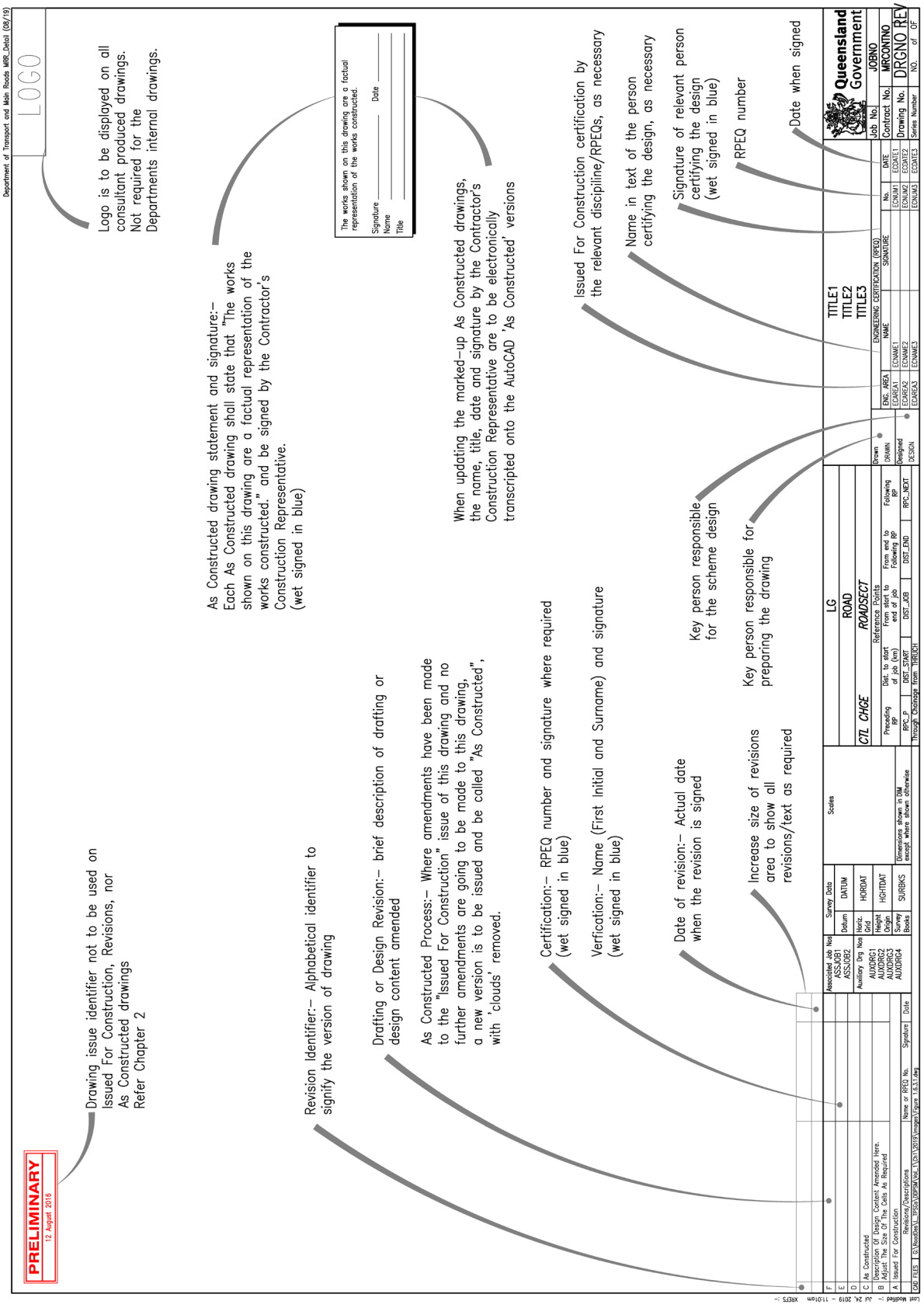
Actual hand-written signatures for Engineering Certifications and Verifications are to be completed in blue to facilitate identification of original drawings and to satisfy the department's responsibilities in accordance with the *Public Records Act* and the *Evidence Act*.

All dates to be in AutoCAD text.

The names, signatures and dates on previous revision drawings are to be transcribed in AutoCAD text on subsequent Revision drawings and As Constructed drawings. Refer Sections 1.7.1.2 and 1.7.1.3.

The standard title block for the department's produced project drawings is shown in Figure 1.6.3.1.

Figure 1.6.3.1 - Standard title block signature requirements



1.6.3.2 Drawn

The meaning of the word ‘Drawn’ in the title block is that reasonable skill, care and diligence has been exercised by the external consultant or internal business unit in preparing the engineering drawings in accordance with the ethics of the engineering profession, departmental drafting and design presentation standards manual and includes:

- the process of structuring the layout of the drawing (drafting and readability)
- the intent of the design is absolutely clear
- the accuracy of the design detail included in the drawing, and
- the appropriateness of the drawing to the users performing the next step in the process, e.g. approval, tendering, and construction.

The key person responsible for this function must insert their name with a date in text within the ‘Drawn’ box in the title block.

1.6.3.3 Designed

The meaning of the word ‘Designed’ in the title block is that reasonable skill, care and diligence has been exercised by the external consultant or internal business unit in carrying out the design in accordance with the ethics of the engineering profession, the departments suite of road design standards, manuals and guidelines and includes:

- the appropriateness of the designed components for their intended function
- the design complies with the relevant standards, guides, legislation, and codes
- the design has been carried out in accordance with an approved quality system for appropriateness of design inputs, including assumptions
- the appropriateness and accuracy of the design calculations.

The department requires the key person responsible for the design within the drawing to insert their name with a date in text within the ‘Designed’ box in the title block.

Depending on the definition and complexity of the design individuals performing these tasks would be expected to have attained a two or three year civil engineering qualification from a recognised tertiary institution as a minimum qualification.

It would be expected the designers producing the design have been appropriately supervised by a RPEQ in accordance with the *Professional Engineers Act 2002*.

1.6.3.4 Design certification

The department requires engineering drawings to be certified by a RPEQ.

Where a design drawing contains different areas of engineering, the design responsibility is identified by separate engineering certification. Only a RPEQ qualified in the area may certify that relevant part of the design drawing.

For all 'Issued For Construction' drawings (refer to Section 1.7.1.1), the RPEQ must place their name in AutoCAD text, signature, and registration number under ‘Engineering Certification’ in each drawing title block. The RPEQ number must be clearly shown in AutoCAD text.

Drawings with revised design content after being issued for construction must record any engineering changes to the design detail / intent / functionality (refer to Section 1.7.1.2). These changes must be certified by the relevant RPEQ(s) in the revision area of the drawing sheets title block by writing their RPEQ number in AutoCAD text and signing (in blue).

1.7 Management of project drawings

As part of all transport infrastructure projects undertaken on behalf of Transport and Main Roads, design documentation, including drawings, need to be prepared and submitted to the department to provide a record of works between being Issued For Construction to As Constructed (Finalisation).

The departments Plan Room has an Engineering Drawing Request Form which is a tool used to request numbers, when drawings / packages are ready to be issued drawing numbers, by completing all mandatory fields and submitting the completed Request Form to the District GIMS officer or central Plan Room. The GIMS officer or Plan Room will then allocate TMR drawing numbers to the listed drawings from the projects sub-allocated number block, and then return the supplied completed Register.

If there are any changes to any drawings that have already been issued TMR numbers, Plan Room will need to be notified and sent an updated version of the Register involved to update records.

If any drawings that have been issued TMR numbers are cancelled Plan Room will also need to be notified and sent an updated version of the Register involved. Drawing numbers already allocated cannot be reused for other drawings (e.g. Cancelled drawings) without contacting Plan Room for confirmation and advice.

The need for capture, storage and retention of information is driven by the statutory requirements and particularly by the following legislation:

- *Transport Infrastructure Act 1994*
- *Public Records Act 2002.*

Each of these statutes supports different objectives. To satisfy these requirements all project drawings are required to be archived as part of the construction drawing development process. Project drawings are the mechanism by which this need is addressed. All Issued For Construction, Design Revision and As Constructed engineering drawing meta data and images are loaded to the departments asset management application GIMS. Figures 1.7(a) and 1.7(b) show the Engineering Drawing Lifecycle for Principal Supplied Design indicating when drawings should be certified, amended, registered and by who.

Where drawings form part of a report they will be retained as part of the report as individual report references.

Figure 1.7(a) - Principal Supplied Engineering Drawings – Lifecycle Part 1

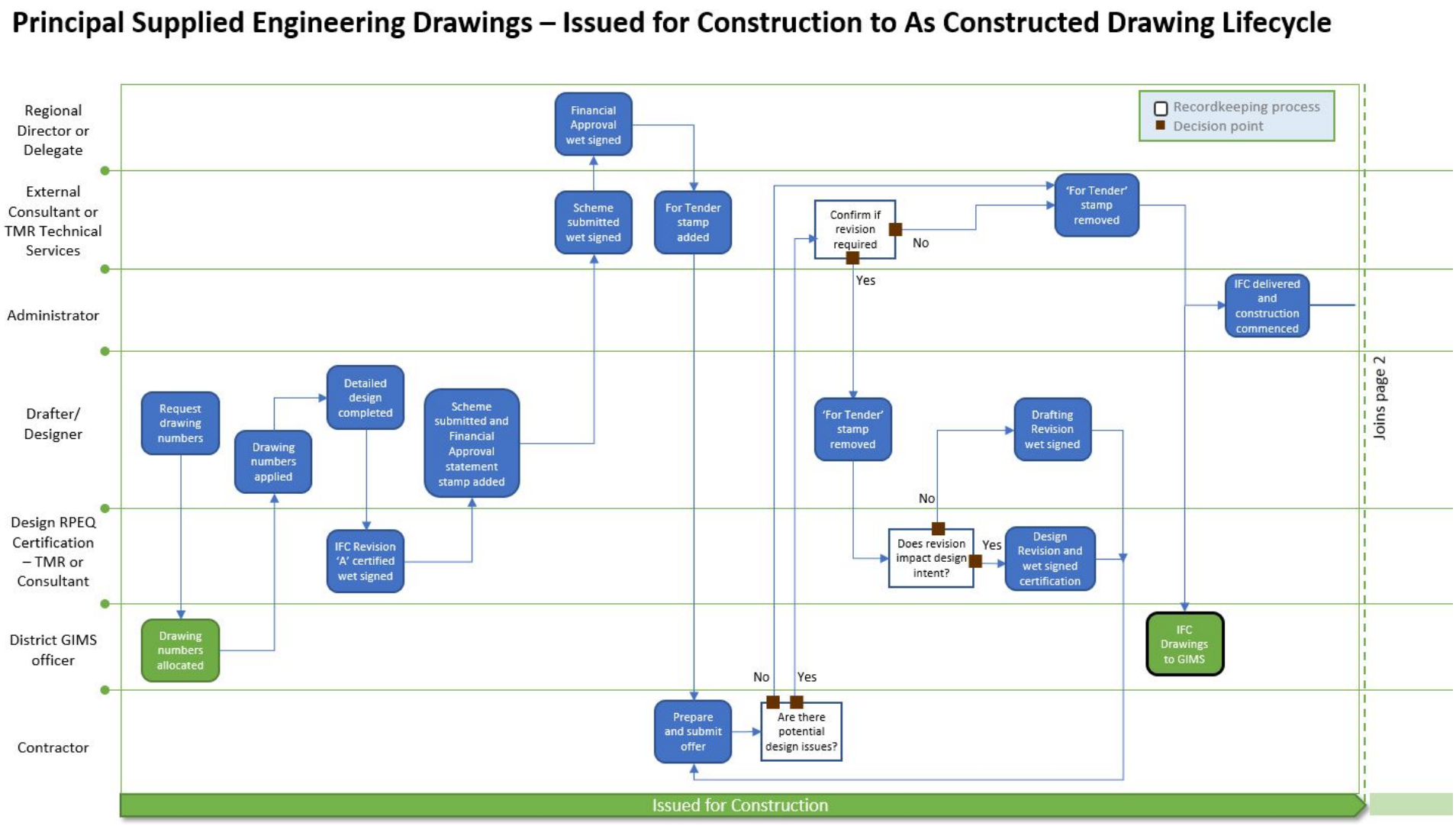
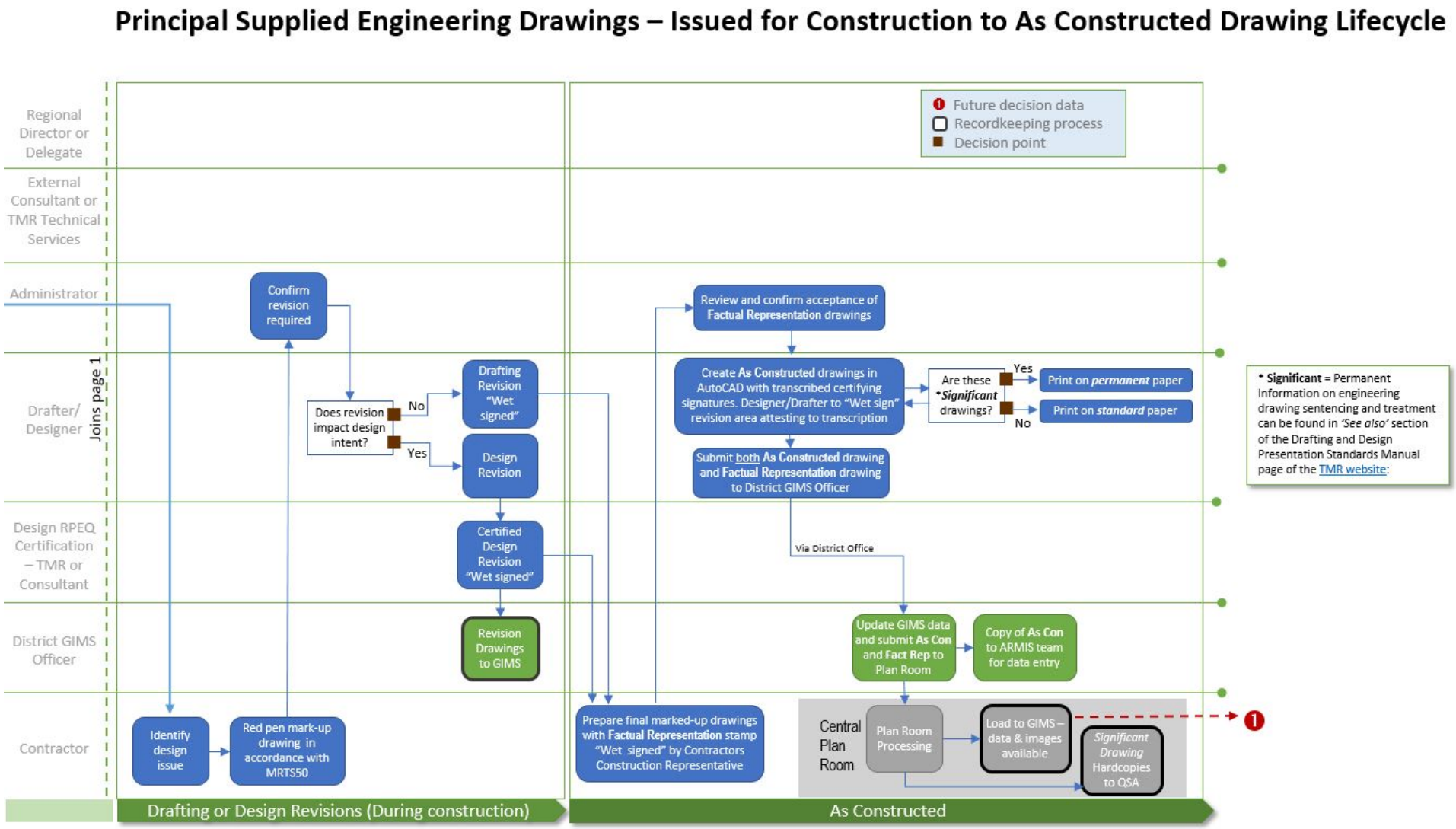


Figure 1.7(b) - Principal Supplied Engineering Drawings – Lifecycle Part 2



1.7.1 Construction Drawings development process

Project drawings will often require a number of versions to accurately document the construction of transport infrastructure projects.

For version of drawings at preconstruction stages (i.e. concept, planning, preliminary and detailed design) the department recommends the use of a numerical revision identifier to document the version of each drawing, the initial version is to be labelled ‘1’ and any subsequent revisions are to be continued progressively in numerical order (i.e. ‘2’, ‘3’, ‘4’, ‘5’ and so on).

Once issued for construction the department uses an alphabetical revision identifier to document the version of each drawing, the initial version is to be labelled ‘A’ and any subsequent revisions are to be continued progressively in alphabetical order (i.e. ‘B’, ‘C’, ‘D’, ‘E’ and so on). These versions include:

- Issued For Construction (mandatory) – Revision A
- Drafting or Design Revision (as required during construction)
- As Constructed (mandatory).

These versions of the project drawings and the procedure for their creation are explained in the following sections of this manual.

1.7.1.1 Issued For Construction drawings

‘Issued For Construction’ is the term given to the first project drawings officially approved and produced as a complete set of detailed design drawings ready to be constructed and which are released for inclusion in the scheme. These drawings are the ‘A’ revision drawings initially issued for construction. These drawings must have all of the appropriate signatures for engineering certification, scheme scope and financial approval. These signatures are required prior to the drawings being placed in the documentation for project construction (refer to Section 1.6.3.4).

1.7.1.2 Drafting or Design Revision drawings

‘Drafting or Design Revision’ is the term used when a project drawing has drafting or design content amended after it has been issued for construction and during construction. Each area in the drawing where the drafting or design content has been amended must be shown with a revision cloud around the amendments and be labelled with the current alphabetical revision identifier inside a triangle positioned next to the revision clouds. The revision area and revision identifier located in the title block are required to be updated to reflect the current revision of the drawing, see Figure 1.6.3.1. Where subsequent drafting or design revisions are required, the revision clouds from the previous revision are to be removed. For certification or verification requirements of ‘Drafting or Design Revision’ drawings refer to Section 1.7.1.4.

1.7.1.3 As Constructed drawings

The term ‘As Constructed’ is acknowledged within industry as a method to record the final construction of a transport infrastructure project. ‘As Constructed’ drawings are those drawings that record what was physically constructed and therefore are a factual representation of the asset. They represent and incorporate progressive design revisions certified by a RPEQ and drafting revisions in accordance with the design dimensions, specifications, and all other construction details and design variations.

For verification requirements of ‘As Constructed’ drawings refer to Section 1.7.1.4. A wet signed (in blue) statement is required on each drawing, prior to being submitted to the designers or drafters to update the drawing in AutoCAD, stating that “the Works shown on the drawing are a factual

representation of works constructed". The signatory of this statement shall be the Contractor's Construction Representative. For further details on conformance, responsibilities and specific requirements of 'As Constructed' drawings for various delivery methods and contract types refer to specification MRTS50 *Specific Quality System Requirements*.

Designers or drafters are required to create As Constructed revisions in AutoCAD. Revision clouds are not required on 'As Constructed' drawings and are to be removed. The Drawing Index must also be updated to reflect the 'As Constructed' drawing revision. The revision area and alphabetical revision identifier located in the title block are required to be updated to reflect and verify that the drawings are the 'As Constructed' version of the drawing. This update does not certify or confirm what has been constructed, see Figure 1.6.3.1 and Section 1.7.1.4.

When updating the drawings, the factual representation statement and signature by the Contractor's Construction Representative are to be electronically transcribed onto the 'As Constructed' versions. It is then expected that 'As Constructed' drawings produced as a factual representation require no further revision and are then plotted from AutoCAD on appropriate permanent or standard weight paper before verification. Refer to Section 1.7.1.5.

The final payment certificate certifies that the road infrastructure has been built in accordance with project drawings and specifications.

It is not intended for 'As Constructed' drawings to be represented by detailed site survey measurements except for changes to new or relocated underground services, drainage, foundations and other subsurface infrastructure which must be established before backfilling occurs (or for piles as driving or drilling is completed). 'As Constructed' drawings are a separate deliverable item from the 'As Constructed Survey'. 'As Constructed Survey' refers to on-site survey measurements that accurately depict constructed objects in three dimensions in geospatially referenced location with attribute information. If an 'As Constructed Survey' is done as part of the project's deliverables, then the former does not apply.

1.7.1.4 Drawing certification and verification

Certification or verification in the revision area located in the title block is required where amendments have been made to the 'Issued For Construction' version of the project drawings, see Figure 1.6.3.1.

i. Where the amendment would affect the engineering intent or functionality the revision shall be certified by the relevant RPEQ design engineer/s. Where the principal has supplied the 'Issued For Construction' drawings this will be the Principal's RPEQ design engineer. In all other cases it will be the Contractor's RPEQ design engineer. The 'Design Revision' drawing must be certified by an appropriate RPEQ (registration number in AutoCAD text and wet signed in blue) and reissued with the next sequential alphabetical revision identifier. It is expected the certification of an 'As Constructed' drawing, following an 'Issued For Construction' or 'Drafting or Design Revision' drawing, is not required as this only involves design or drafting verification acknowledging previous certified revisions have been incorporated into the 'As Constructed' version.

ii. Where the drawings require amendment and the changes do not affect the engineering intent or functionality to that shown on the 'Issued For Construction' drawings, the drawings are not required to be certified by an RPEQ design engineer but are to be verified by wet signing (in blue) next to the first initial and surname (in AutoCAD text) of the person responsible for amending the drawings.

Examples include:

- Issuing a ‘Drafting Revision’ drawing due to a service being located in a different position.
- Issuing an ‘As Constructed’ drawing which is the final revision following a ‘Drafting or Design Revision’ drawing. This only involves the removal of revision clouds and does not certify or confirm what has been constructed, see Figure 1.6.3.1.

1.7.1.5 Submission of drawings for registration and archive

For registration purposes drawing numbers obtained from Plan Room are to be placed on the appropriate title block of the ‘Issued For Construction’ project drawing/s produced and released for inclusion in the scheme under any contract type.

‘Issued For Construction’ and 'Drafting and Design Revision' drawings are to be managed by the relevant District or Major Project. If a project is considered 'significant' for archival purposes, drawings are to be printed to permanent paper-white film, thickness between 100mic and 135mic prior to RPEQ wet signature certification. Non-significant project drawings can be printed to normal weight paper (usually 80gsm) with hand written signatures. For more information on ‘Significant’ drawings please refer to the *Engineering Drawing Sentencing and Treatment* document located on the *Drafting and Design Presentation Standards Manual* page on the department’s website.

‘As Constructed’ drawings are to be plotted from CADD files on A3 paper with the required transcribed signatures i.e. no hand-written mark-ups nor be produced from photocopies.

As a public record the expectation is that presentation of detailed design drawings complies with this manual.

Bridge drawings are to be presented in accordance with Volume 3 of this manual.

It is mandatory that all versions of drawings produced for construction purposes, including As Constructed drawings must:

- be allocated a Transport and Main Roads drawing number
- comply with presentation standards described in this manual, and
- be submitted for scanning, digitising, registration and archive by the department.

Drawings other than civil design drawings that depict project information that informs the final design e.g. Geotechnical Investigations, Resumptions, Native Title and so on that require registered plan numbers need to be submitted to the department’s Plan Room.

Planning drawings, or those drawings prepared during project development, are not required to be submitted for public record to the Plan Room.

It is expected that Regional / District offices and contractors engaged in the production of such drawings will maintain their own system for identification and records management of these drawings. All original and amended drawings must be to the same standard.

Detailed ‘As Constructed’ design drawings including the drawing containing the updated 'Drawing Index' are required to be submitted by the Superintendent or the Principal’s Construction Administrator to Plan Room for registration and archive.

The Superintendent or the Principal's Construction Administrator is also responsible to forward a copy of the complete set of 'As Constructed' drawings to the corresponding Regional ARMIS Section of the department for updating of the ARMIS database.

Where bridges and/or other structures occur in the project a separate copy of the bridge drawings and bridge related reports, shall be forwarded to the bridge design branch for the updating of bridge design records.

1.7.1.6 Asset documents

There should be no construction notes on the asset documents. Where emergency work has been performed, asset drawings must be developed from actual construction work details and recorded on new drawings or by updating existing asset drawings.

1.7.2 Drawing management costs

1.7.2.1 Project cost amount for management and registration of drawings

The Principal shall pay the costs associated with management of all project drawings including digitisation, registration and storage at state archives where appropriate.

1.7.2.2 Cost of approved design change

The organisation responsible for the providing the 'Issued For Construction' drawings is responsible for amending the relevant drawings.

The practice of hand written notes on the last drawing issued are not acceptable. All issues of project drawings must be to the department's standards of drafting and design presentation and produced in CADD format.

1.8 Drawing documentation

Drawing documentation provides the basic elements for tenderers and construction personnel to carry out their respective activities.

1.8.1 Standard drawings

Standard drawings have been developed to reduce the number of details that have to be shown in the project drawings.

These standard drawings are provided in the department's *Standard Drawings Roads* and are updated on a regular basis and can be referenced in the design documentation.

These drawings provide standardised construction details for selected road related structures including drainage, retaining structures and protective treatments, general earthworks, road furniture, noise barriers, road lighting, traffic signals and bridges.

1.8.2 Design presentation drawings

1.8.2.1 Road infrastructure design

Road infrastructure design drawings diagrammatically show the actual extent and types of treatment necessary to provide for both horizontal and vertical alignments of specific road infrastructure profiles.

1.8.2.2 Bridges

Bridge design drawings show the general layout of the bridge, profiles and structural details. Bridges are typically built over streams, railways or other roads.

The structural details include reinforcement details as well as stressing and welding symbols. They also specify the exposure classifications for durability. In complex structures, there may also be construction sequence drawings to ensure that the imposed design loads are the same as the designer assumed.

1.8.2.3 Retaining walls

There is a large range of types of retaining wall. The choice of retaining wall may depend on appearance, environment, construction restraints and structural action. Care should be made in the correct choice of system for the project. In urban situation, the job restraints may impact severely on the choice of system.

The road designer should consider the maximum depth of excavation for road construction and the impact of this excavation on the retaining wall.

1.8.2.4 Noise barriers

Noise barrier walls and earth mounds are a very effective means of reducing road traffic noise if designed and constructed to the requirements of the *Transport Noise Management Code of Practice*.

Noise barrier drawings are to depict, construction detail and consider all design elements of the proposed noise barrier including, location, height and length as determined from an approved noise assessment report.

These drawings are to refer to other relevant Standard Drawings and *Transport and Main Roads Specifications* as they relate to the project specific requirements.

1.8.2.5 Drainage infrastructure

'Drainage devices' are components of a project that are designed and constructed for the purpose of controlling runoff and form part of a 'drainage system'. A 'drainage system' is a system of natural and constructed pathways that are used to convey runoff through a project site to its receiving waters.

Examples of drainage devices are: culverts, gully inlets, pipes, drainage system, overland flow paths, open channels, energy dissipaters, kerb & channel, sedimentation traps and retention & detention basins.

Water flows as a result of fall in the ground i.e. a negative level difference between two points. Therefore, with regard to drainage devices, the most important details that have to be shown in design drawings are the heights to which the devices are to be constructed.

Other details that are required are:

- Plan views to clearly show location and orientation of devices and the linkage between them, e.g. the outlet of a culvert linking to a diversion channel then to a retention basin.
- Drainage cross sections to clearly show the position and design details of cross drainage (culverts).
- Longitudinal sections to clearly show the position and design details of underground piped systems, in conjunction with gully inlets and pits.
- Construction details (dimensions etc.) for drainage devices which cannot be simply purchased and have to be built, e.g. open channels, scour protection and drop inlets.

- A complete project electronic model will provide all of the details necessary to tender and construct the drainage structure concerned.

1.8.3 Urban design

Urban design, promotes an integrated relationship between the road user, roads and the environment (location, function and character), through which they pass. The functional, architectural and aesthetic forms and treatments for selected road related structures and elements demonstrate this integration.

Urban design documentation is typically associated with structures, including bridges, retaining walls, and noise barriers, but may be delivered by various design disciplines including landscape architects, engineers and architects.

1.8.4 Environmental design

The environmental design drawings are divided into two phases:

- the planning phase
- the development phase.

The drawings in each phase contain the information relevant for that stage of the project.

1.8.4.1 Environmental features and management drawings

Environmental features and management drawings show the existing environmental features and the recommended management of these features to ensure compliance with legislation.

These drawings are on large-scale and/or complex projects.

These drawings are a diagrammatic representation of the environmental assessment taken from such documents as an Environmental Impact Statement (EIS), Environmental Approval Report (EAR) and/or an Environmental Management Plan (EMP).

1.8.4.2 Soil suitability drawings

Soil suitability drawings show the suitability of a site soil for use as planting media and for the construction of drainage devices.

The drawings diagrammatically show the extent and types of soil along a road alignment and relate to the Planting Media Management Plan.

1.8.4.3 Erosion and sediment control plan drawings

An erosion and sediment control plan drawing shows a possible approach for sediment and erosion management.

The drawing is included in contract documentation so that tenderers can use it as a basis for pricing. After the contract has been awarded the contractors can choose to adopt the drawing/s or develop their own:

- Environmental Management Plan (Construction) Drawings
- Environmental Management Plan (Construction) Drawing shows the environmental risks associated with the construction of a project.

The standard sets out what must be contained on the drawings but allows the option that information is shown on drawings and diagrams as opposed to just text. EMP(C) drawings are not intended to replace a text-based document but to provide an efficient means of conveying information.

1.8.4.4 Landscape and revegetation drawings

Landscape and revegetation drawings show the scope and extent of landscape and revegetation works.

The scope may be as simple as the grassing and turfing of batters and table drains or as complex as the revegetation of environmentally sensitive areas or the more horticultural based landscape projects that are typical of the major urban roadways.

It should be noted that the planting material used for these projects may impact on civil engineering components of the design e.g. clear zones, sight distance, or structural components e.g. retaining walls, tunnel portals etc.

These drawings will require RPEQ certification from the area of engineering that may be affected by landscape treatments.

1.8.4.5 Compensatory revegetation drawings

Compensatory revegetation drawings show the scope and extent of landscape and revegetation works specifically intended as compensatory plantings beyond the limit of clearing. They are separate, but complementary to the landscape and revegetation works that typically include the vegetation of areas within the limit of clearing.

The planting areas typically fall within the road reserve but may, in some instances where local landowners and/or the community are involved, extend into adjoining properties. The works may be contracted separately to the associated road contract and start during the pre-construction phase of a project and continue after final inspection into the maintenance activities.

1.9 Survey drafting presentation

Survey information forms the base data for the design process but can also be used for drafting and design presentation purposes. Survey products include aerial imagery, photogrammetric data, topographic and feature information, digital surface data as well as the digital cadastre. These products may be used to enhance the presentation of a design, for public information and consultation purposes. The department maintains a large library of aerial imagery and other digital survey information that is available for use. Contact local departmental survey offices to gain access to this existing information or procurement of new survey information.

All survey features and modelling must be presented in accordance with the department's current standards as set out in *TMR Surveying Standards*. No variations will be allowed to the codes, symbols, line styles or designated models.

1.10 References

- *Professional Engineers Act 2002* together with the Code of Practice.
- *Work Health and Safety Act 2011* together with amendments. (WH&S Act 2011).
- *Transport Infrastructure Act 1994* together with amendments.
- *Public Records Act 2002* together with amendments.
- *Evidence Act 1997* together with amendments.

Appendix 1A: Engineering certification and safety in design

Road design is becoming an increasingly complex process with significant Legislative and Departmental requirements to be satisfied.

The legal requirements emanate from:

- The *Professional Engineers Act 2002* together with the Code of Practice
- The *Work Health and Safety Act 2011* together with amendments.

Professional Engineers Act 2002

The Act regulates the carrying out of 'professional engineering services' in Queensland. 'Professional engineering services' are defined as meaning:

> "An engineering service that requires, or is based on, the application of engineering principles and data to a design, or to a construction or production activity, relating to engineering, and does not include an engineering service that is provided only in accordance with a prescriptive standard".

Specifically, the responsibilities of RPEQ are set out both within the Act, and its accompanying Code of Practice (The Code).

The Code has many similarities to other Codes of Ethics but it has the force of law in Queensland. It includes the following definition of engineering:

> "Engineering is a creative process of synthesising and implementing the knowledge and experience of humanity to enhance the welfare, health, and safety of all members of the community, with due regard to the environment in which they live and the sustainability of the resources employed. Engineering professionals must display detailed technical and professional understanding and the wise application of that understanding".

Key requirements of the Act and the Code, are as follows:

- An RPEQ can practice only within their engineering competency.
- The relevant Code must be complied with when carrying out professional engineering services.
- Compliance with all government legislation is mandatory (e.g. WH&S Act 2011).
- All engineering design work must be performed by or under the direct supervision of a RPEQ with such design work being in accordance with Australian standards and the departments' codes, manuals and guidelines.

The Board of Professional Engineers accepts an RPEQ may delegate the carrying out of "professional engineering services" to a non-RPEQ but that work must be performed under the direct supervision of the RPEQ.

Ultimately, RPEQs must exercise their judgment to determine if the delegate is competent to undertake the work (includes design and inspection), as the RPEQ will retain responsibility for work performed.

Work Health and Safety Act 2011

Legal obligations for designers of road infrastructure were introduced in Queensland on 1 January 2012 under amendments to the *Work Health and Safety Act 2011*.

Under the legislation a person conducting a business or undertaking that designs a structure that will be used, or could reasonably be expected to be used, as a workplace must ensure, so far as is reasonably practicable, that the structure is without risks to health and safety.

The *Work Health and Safety Act 2011* includes designers as one of the several duty holders for health and safety in the workplace.

A designer is a person conducting a business or undertaking whose profession, trade or business involves them in:

- preparing sketches, plans or drawings for a structure, including variations to a plan or changes to a structure
- making decisions for incorporation into a design that may affect the health or safety of persons who construct, use or carry out other activities in relation to the structure.

They include:

- architects, building designers, engineers, building surveyors, interior designers, landscape architects, town planners and all other design practitioners contributing to, or having overall responsibility for, any part of the design (for example, drainage engineers designing the drain for a new development)
- building service designers, engineering firms or others designing services that are part of the structure such as ventilation, electrical systems and permanent fire extinguisher installations
- contractors carrying out design work as part of their contribution to a project (for example, an engineering contractor providing design, procurement and construction management services)
- temporary works engineers, including those designing formwork, falsework, scaffolding and sheet piling
- persons who specify how structural alteration, demolition or dismantling work is to be carried out.

A person conducting a business or undertaking who alters or modifies a design without consulting the original or subsequent designer will assume the duties of a designer. Any changes to the design of a structure may affect the health and safety of those who work on or use the structure and must be considered by the person altering or modifying a design.

Complying with these responsibilities is part of the designer obligations under law.

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