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HOW TO SAVE MONEY BY TELLING A GOOD STORY - THE IMPORTANCE OF CLEAR DOCUMENTATION

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Introduction

As engineers, we normally pride ourselves on our ability to understand complex problems and come up with ingenious designs. However, if those designs aren't able to be understood by a multitude of different people, they have effectively failed.

According to Request For Information (RFI) data from Building Consenting Authorities (BCAs) throughout the country, nearly fifty percent of queries are about paperwork. RFIs can be expensive for the engineer and the client, and many of them are avoidable.

There is an enormous amount of information on how to design, but there is limited information available on presenting that information. In the field of seismic assessments, this has lead to the publication of templates by the NZSEE for presenting work. Likewise, the Greater Christchurch Claims Resolution Service has found value in providing templates for engineers to clearly explain their ideas.This paper aims to show the engineer a standard way of presenting work for checkers to understand it and builders to build it.

Why engineers produce documentation

Engineers typically produce documentation for contractors to build the design. For this to happen, it needs to be able to be:

1. Understood by the architect
2. Checked by another engineer or council representative
3. Interpreted by the builder/contractor
4. Paid for by the client

If the documentation isn't easily understandable, the process may not happen efficiently. It can cost the engineer and client time and money, the contractor may not complete the build per the design intent and the client may not pay the bill.

Where are the problems

In 2018/19, various BCAs provided Engineering New Zealand with their RFI records. We mined the data for the causes of the RFIs, which revealed that nearly fifty percent of them were around the documentation set before the calculations. A large portion of the remainder was around the engineer's assumptions, the drawings being unclear, and finally, the calculation set.

What good looks like

Talking to engineers across the country, one of the problems was that different BCAs want different levels of documentation. What is acceptable in smaller BCAs can be very different to what is acceptable in Auckland, Wellington, or Christchurch. As a result, there is no consistent bar for good.

Producer Statements

Most BCAs expect a Producer Statement 1 (PS1) with the project. Fourteen percent of RFIs relate to the PS1 not being filled in correctly. For example, the Building Code Clause would normally be B1 for structural engineers. The details should be concise, do not list out the standards used to achieve compliance. Typically relevant are VM1/VM4 or the acceptable solutions in the appropriate spaces.

Design Features Reports

Many engineers don't submit a Design Features Report (DFR) with their work. The engineer should fill out a DFR as the project begins and clearly state any assumptions. It helps the checking engineer spot any errors before it goes out the door. It also helps the council checkers understand what's going on when they pick up the job. SESOC has an excellent template for commercial work, and Engineering New Zealand has developed a two-page example aimed at the simpler designs and the residential market that members can download.

Construction Monitoring Schedule

The construction monitoring schedule is another piece that's often missing, with BCAs asking who will be inspecting various items. Notably, the contractor uses these documents to know when to call for an inspection before continuing with work. Therefore, it is good practice to reference the construction monitoring schedule on the drawings.

Engineering New Zealand has developed a template for members to download and use with pre-filled examples. If an engineer designs it, they should state who will be monitoring the construction. For example, a Building Consent Officer (BCO) can inspect timber lintels, gib bracing etc., but an engineer's representative should inspect everything else.

Picture

A picture tells a thousand words. For example, having a picture of the project makes it easy for a checker to confirm quickly whether basic assumptions are correct. Likewise, pictures of what the engineer is designing included with the calculation set makes following the calculations much easier.

Drawings

The drawings describe the project and tell the story of how to build it. Engineers start from the top of the building and calculate the loads working down. However, the contractor starts from the foundations and works up. The draftsman should order the drawings to the construction sequence. The engineer should ensure that the contractor will easily interpret the drawings and the design is buildable.

Calculation set

Calculations must be legible, there are cases where projects have been rejected because the checking engineer could not read the writing. Sections may consist of: loads, vertical system, lateral systems, foundations, envelope, parts. Frequently in that order.

Each section should have a cover page with a picture showing the relevant overview. For example, a beam layout plan with the gravity system.

Gravity

Gravity is a constant. Therefore, it is common to put the gravity system at the front. There have been recent examples where buildings have failed under gravity load. The beam layout plan shows where all the beams are going and lets the engineer check the load path and beam sizing at a glance. The beams should be clearly labelled and cross-referenced with the calculation so they can looked up quickly.

Lateral loads

The concept is the same for lateral loads. Have a picture of the load resisting system and how it ties into the building. For example, with residential work, if there is a portal frame, the engineer should show the tributary area assigned to it. A quick snip from the drawings can show the knee, top plate attachment and hold-down details, followed up by the calculations.

Foundations

Images can be vital for foundations. The engineer should provide slope cross-sections and any other relevant information such as soil testing.

If there are multiple retaining walls, provide a retaining wall plan with cross-sections to show the checker the assumptions.

Conclusion

In conclusion, companies can save time and money by producing good quality documentation that is easy to follow. Many of the documents needed for the set are available to download from Engineering New Zealand.

The engineer should clearly state any assumptions in the DFR.

Clear drawings are crucial for letting the contractor understand how to put the project together and the proposed construction sequence.

The engineer should break the calculation set into sections. Each section should have pictures to describe both the system and the individual parts to show the concept behind the calculations.