

PROCUREMENT AND RISK SHARING

Case Study

DECLINING STANDARDS OF PROJECT DOCUMENTATION QUALITY IN THE BUILDING & CONSTRUCTION INDUSTRY

A MAJOR CHALLENGE FOR ALL STAKEHOLDERS

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ABSTRACT

Evidence of a continuing decline in the quality of project documentation in the building and construction industry has been documented by a number of authors over the past 10 years.

The scale of the problem is so significant that poor quality design and documentation is contributing at least 12% to project costs. This equates to some \$7b that is lost on unproductive activities in Australia's building and construction industry each year.

The authors have concluded that the causes of the problem lie in all phases of project delivery from concept and project initiation, through development, design and documentation stages, to tendering and construction activities. All stakeholders in the industry contribute in one way or another to the problem (by their attitudes and/or direct actions) and all of them have much to gain if the problem is overcome.

A number of attempts have been made to address the problem and some proposals have been developed.

This paper outlines the initiative being undertaken by Engineers Australia (Queensland Division) to address the problem collaboratively with a number of industry stakeholders. The methodology being employed and expected outcomes are outlined.

The paper demonstrates that resolution of the problem can only be achieved through development of an industry-wide strategy and generation of commitment by all industry stakeholders to implement the strategy in a spirit of cooperation.

INTRODUCTION

Designers provide the graphic and written representations that allow construction and trade contractors to transform concepts and ideas into physical reality. How effectively and efficiently this transformation occurs depends largely on the quality of the design and documentation provided. Whilst good design needs to be “effective” and ensure fitness for purpose, it also needs to be communicated effectively through the contract documentation including drawings, specifications and project controls.

Engineers Australia members have been concerned about the problem of poor project documentation quality for more than ten years. Some of them have been directly associated with initiatives aimed at overcoming the problem (eg CIDA, 1993).

Subsequently, some members developed an association with the research being undertaken by CSIRO (Tiley et al., 2002 & 2000). Engineers Australia was one of a number of organisations that actively assisted CSIRO by promoting to its members the desirability of their responding to questionnaires and other approaches for collection of research data relevant to the problem.

During 2001, progress findings of this CSIRO research was discussed at two seminars sponsored by Engineers Australia (Queensland Division). In this context the authors concluded it was essential that the problem be addressed in a manner which ensures that the various issues, adverse impacts and consequences would be turned around, and that there was an urgent need to do this in the interests of efficiency and productivity of the building and construction industry.

Subsequently, the authors and a number of their industry colleagues prepared a proposal whereby the Queensland Division of Engineers Australia would assume a leadership role in the resolution of the matter by involving their members and all other industry stakeholders (Gallo et al., 2002).

Engineers Australia (Queensland Division) adopted this proposal and has established a Task Group to address the problem. Some 12 stakeholder bodies are represented as well as a number of members of Engineers Australia (Queensland Division).

The aim of this paper is to demonstrate that resolution of the problem can only be achieved through :

- development of an industry-wide strategy on the part of industry stakeholders,
- generation of commitment by all of them to implement the strategy in a spirit of cooperation, and
- their active participation in a managed plan for implementation of that strategy.

It is also hoped to foster support for and participation in the work of the Task Group.

THE PROBLEM

OVERVIEW

The Australian construction industry has been portrayed by industry analysts as being uncompetitive and inefficient (BCA, 1993; CIDA, 1993; Crow, 1997; Ireland, 1988 & 1994; Koskela & Sharpe, 1994; Love et al., 1996; Mohamed & Yates, 1995;

Walker, 1994. Crow (1997) in particular is highly critical of the Australian construction industry, claiming that:

“...up to 40% of effort in developing and operating capital works facilities is wasted and adds no value to the end user/customer whilst depleting profitability of the client, designers and contractors.”

Concerns have been expressed in the building and construction industry that a declining standard of documentation quality has contributed significantly to a similar decline in construction efficiency.

These concerns have been confirmed by research undertaken by CSIRO (Tilley et al, 2000, 2002), the Construction Industry Development Agency (CIDA, 1993), and Construction Queensland (eg Construction Queensland 2001).

RESEARCH FINDINGS

Since 1995, Paul Tilley and others in the CSIRO Manufacturing and Infrastructure Technology Division have been investigating issues affecting design and documentation quality and their impact on the efficiency of the construction process. During his research Tilley has undertaken a number of surveys among client organizations, designers, main contractors and trade contractors. His research findings include specific data on the nature of the impacts of poor documentation quality (for all stakeholders), their causes, and perceptions of the various stakeholders. These are published in a number of papers, some of which are included in the list of references in this paper.

Key research conclusions based on data collected and analysed are:

- design and documentation quality have worsened over time apparently in direct relationship with reductions in design fees; and
- at the same time there have been increases in project time, costs and non-desirable elements of construction including (inter alia) disputation, project delays, and cost overruns.

SCALE OF THE PROBLEM

Size of the Industry

In the 2000-2001 financial year, the building and construction industry accounted for approximately 12% of Australia's Gross National Product, ie an annual expenditure of \$58b. (Smithies, 2001) There are also approximately 210,000 firms operating within the industry employing around 670,000 people, which represents about 7.4% of the workforce. (McCarthy, 2001, Smithies, 2001)

However, as large as the industry is, the effect that the industry has on the rest of the national economy is sometimes overlooked. For every extra \$1m of construction undertaken, an additional \$1.87m is generated elsewhere in the economy and provides an additional 1.73 full-time, non-construction jobs. (McCarthy, 2001)

Scale of Inefficiency

It has been determined that up to 40% of the cost of non-manufactured components of built-assets (eg certain management processes, rework by designers, documentation clarification, resolving RFIs) adds no value to the end-user and thus

reduces the investment value of the assets to clients. (Construction Queensland, 2001)

In an environment where inadequate time is allocated for design and analysis of alternatives, it is inevitable that conservative designs which are not necessarily the best-for-purpose are produced; for example manufactured components are often over-sized for functionality by up to 15%, or do not achieve fitness-for-purpose criteria.

Clearly there is significant scope for improvement with consequent benefit to all stakeholders and to Australia as a whole.

Research has indicated that poor quality design and documentation can conservatively contribute up to 12% of project costs at tender time (due to allowances for project uncertainty) (Tilley, 2000) and is a major contributor to project variations and rework (Love et al, 2000). When the costs of project delays, disputation and additional project administration by all project participants are included, the overall costs of poor design and documentation are very significant indeed.

Assuming that improvements in design and documentation can reduce overall project costs by just 1%, based on the figures above this alone has the potential to save the Australian construction industry around \$600M each year. Clearly there is significant scope for improvement with benefits for all stakeholders and for Australia as a whole.

CAUSES

Overview across project phases

The authors have recognised in the available research as well in their professional experience that there are many causes that contribute to the problem – some are consequential on others, some involve more than one stakeholder.

Gallo et al., (2002) listed under stakeholder groupings a number of causes that have been identified by a range of stakeholder representatives and professionals working in the building and construction industry. These same causes are represented below in lists of causes attributable to project phases.

Project initiation phase

- Inadequate recognition of whole-of-life implications at briefing and design phases.
- Lowest price mentality in engagement of planners and designers.
- Unrealistic expectations about time and cost constraints.
- Client reluctance to bear design and construction phase risks.
- Failure to appoint an overall project manager.
- Inadequate client knowledge of the implications of their expectations, demands and directions.

Design phase

- Optimum design solution not adequately researched.
- Inadequate consideration of whole-of-life cycle and constructability issues including poor coordination between services and suboptimal sequencing of project activities.
- Focus on risk shedding rather than on targeting quality of documentation.

- Reluctance to allocate experienced staff to projects because of their high cost in an environment of inadequate fees.
- Short-cut design times result in inadequate checking of details and insufficient reviews with relevant parties.
- Inadequate design coordination between engineering, architectural and mechanical design disciplines.
- Inadequate coordination across design components developed by various parties.
- “Cut and paste” syndrome due to quest for economy of design time - lack of integration results in ambiguities in documentation.
- Erosion of expertise – eg design draftsmen being replaced with CAD operators.
- Fewer “green field” and more retrofit projects lead to tighter tolerances and more interfaces – increased costs without corresponding recompense in fees.
- An apparent “design by crisis” operating mentality - leaving design issues to be sorted out in the construction process.
- Emphasis on minimum effort rather than on doing the right job the first time – driven by commercial pressures and failure to maintain professional standards.
- Incomplete documentation including inadequate detail - issued with known deficiencies.

Tendering phase

- Multiple “notices to tenderers” and question/answer steps erode document accuracy due to short time for amendments.
- Reluctance by tenderers to ask questions that might reveal competitive edge.
- Extended and unduly complicated award processes.
- Reduced tender times.

Construction phase

- Adversarial attitudes (all parties) and seeking to re-apportion risks to other stakeholders.
- Defensive approach to variations and claims for additional costs or time.
- Cumbersome and defensive approach to RFIs.
- Introduction of legal and insurance advice in order to cover perceived risks.
- Lowest price mentality in engagement of subcontractors.
- Difficulties in maintaining skill levels.

Consequences for Stakeholders

Overall Environment

Overall, these causes work together to create an unsatisfactory environment for the building and construction industry characterised by :

- disruption to programmed activities and delays including fabrication of components and completion of stages of projects;
- acceptance of rework and additional expense;
- additional time in analysis of problems and determination of remedial actions;
- an unnecessarily conservative approach including over design and other attempts to ensure inter alia adequate factors of safety and margins;
- overly complex and voluminous contract documentation through over prescription of control mechanisms in traditional forms of contract (which in turn lead to adversarial approach to problem solving);
- a culture of blame rather than one focused on effective team work;

- adversarial consideration of the costs and impacts of time delays and additional work;
- inequitable sharing of risks and costs;
- diminution of respect between parties – deterioration of relationships and breakdown in cooperation;
- focus on immediate or short term activities at the expense of whole-of-life asset considerations.

Consequences

The following lists are not exhaustive; they are presented here to illustrate the range, scale and severity of the problem – as recognised by a range of stakeholder representatives. A picture of inequitable project delivery is also evident.

1. Contractors

Contractors are expected to price their tenders in a competitive environment often with inadequate time to research all details of site conditions. Poor project documentation results in adverse consequences during a number of project stages -

- a) during the tender stage as a result of inadequate tender documentation
 - multiple notices to tenderers, amended documents issued during the tender period resulting in wasted effort by all tenderers;
 - uncertainty following “rounds of questioning” causing increased costs of tendering and higher tender prices;
 - increased costs (to all tenderers) in attempting to respond to notices and answers to questions;
- b) during the contract award stage
 - extended and/or complicated award processes causing increased costs;
- c) during the construction stage
 - ambiguities, errors and oversights leading to RFIs with consequent direct costs due to rescheduling and delays; indirect costs due to reallocation of resources and secondary effects;
 - resolution of documentation deficiencies often occur at inopportune times, leading to deterioration in contract relationships;
- d) during the post-construction stage
 - delays in reaching agreement on final quantities, variations, extensions, delay and disruption effects leading to further costs and deterioration in relationships.
- e) throughout
 - additional managerial and administration costs;
 - perception of inequitable sharing of project risks generates adversarial behaviour.

2. Subcontractors

Subcontractors are often remote from the direct superintendent/contractor dealings; hence subcontractor generated RFIs generally involve significant time delays, complex dealings and increased costs -

- additional drafting time spent on shop drawings;
- delays and rescheduling of activities;
- relocation costs for men, equipment and materials;
- secondary effects on other trades – rescheduling;
- interfaces between trades work areas not aligned;
- frequent changes and reissue of drawings generate quality concerns;

- solutions offered for correction of design errors and ambiguities without the benefit of insight to the overall design;
- tight time frame when RFIs are resolved often requires “high pressure” work, overtime and even sharing of work with various subcontractors leading to consequent loss of work volume to individual subcontractors who then are not able to recoup overheads and set up costs.

3. *Clients*

Clients take the lead in project initiation and indeed in setting the framework within which the project is to be delivered. The following are some consequences of the problem that indicate that client objectives are often frustrated -

- higher tender prices;
- extended and/or more complex award processes;
- time and cost over runs;
- disputation and relationship issues;
- sub-optimal outputs for the overall project.

4. *Designers*

Designers are relied upon to apply their professional expertise and to ensure that appropriate standards are followed. However, undue emphasis on cost and time factors often leads to the following consequences -

- loss of professional reputation;
- loss of expertise of design draftsman resulting from cutting fees and not being able to afford to use the best people for the job and having good people filter out to other parties;
- loss of profitability and perhaps business viability;
- increased stress levels for design staff by having to revisit old jobs to fix problems;
- current job programs being put constantly under pressure by having to revisit completed jobs;
- inadequate opportunity for analysis of alternative options - the chance of defining the optimum design solution is consequently limited;
- restricted review processes with all interested parties – implications include constructability deficiencies, poor coordination between services, project activities suboptimal, whole-of-life cycle issues not adequately considered, inadequate detail in documentation;
- designers are required to place undue emphasis on commercial aspects to maintain viability – often at the expense of truly professional performance.

Summary of Consequences – Broader Issues

The overall problem and the environment it has created generate impacts on all stakeholders, particularly in the aspects summarised below; this leads to inequitable outcomes from the project delivery:

- delayed completion of projects;
- increased costs;
- reduced margins; and
- reduced quality of built infrastructure and/or level of service.

Consideration of the problem and its consequences is complex due to the wide ranging issues, their causes and implications. Some of these are of a broad strategic nature whilst others are quite detailed and operational in nature.

To overcome this problem it is essential that a thoroughly planned and prioritised approach be taken and which will be defined, implemented and managed with a strategic focus.

PREFERRED PROJECT ENVIRONMENT

The authors consider that a transformation is needed to create a preferred project environment that would include the dimensions summarised below. This list is indicative only, and needs to be examined further in order to develop a comprehensive vision for the future.

Dimensions

Dimensions of the preferred project environment :

- sustainable and efficient construction industry which contributes to wealth creation;
- end users satisfied;
- viability of projects established in the business case before initiation of project design;
- reasonable profits for all stakeholders – through equitable project delivery;
- built infrastructure of a good standard in both the physical and whole-of-life senses;
- thorough assessment of the risks and their equitable allocation to the various stakeholders;
- industry supported by research and development leading to future improvements in productivity;
- proper balance between commercial and professional imperatives.

Preferred behaviours and operational strategies

These dimensions would be characterised by behaviours and operational strategies that encompass the following:

- cooperative relationships between all parties – client/designer, client/contractor, etc;
- allocation of appropriate people, time and budgets to each phase of all projects;
- sufficient project planning undertaken prior to commencement of design;
- competent processes for design coordination and design review on all projects integration of project documentation essential;
- adequate assessment of constructability of designs;
- documented processes for progressive client acceptance and sign-off of the design during previously identified phases of the design process;
- effective communication and collaboration processes involving clients, designers, contractors and other stakeholders;
- adoption of appropriate and more effective project delivery processes – more equitable forms of contract;
- less allocation of blame and taking of positions – more professional integrity and accountability.

Vision

The authors have concluded that the above characteristics can be summarised in the following vision for the industry :

- Emphasis on best-for-project and end-user outcomes – so as to ensure best value for investment and costs of operation.
- Elimination of unnecessary costs of argument, arbitration and litigation.
- Encouragement of innovation and “clever” designs – fit for purpose, yet encompassing new ideas and “new ways”.
- All stakeholders have ownership of and pride in the outcomes.
- Improved satisfaction levels and co-operative working environment will encourage capable people to join and remain in the industry.

WHY PREVIOUS ATTEMPTS HAVE NOT CHANGED THINGS

A number of well founded and well intentioned initiatives have been undertaken by various parties over the past 10 – 15 years with a view to overcoming the problem (of declining quality of project documentation), eg

- Strategies for the Reduction of Claims in the Construction Industry – a research report (Nov 1988)
- “No dispute” – Strategies for Improvement in the Australian Building & Construction Industry (May 1990)
- Construction Industry Development Agency (CIDA) – established to *(to be expanded when details obtained from DPW library)*.
- Construction Queensland – established to *(similar wording as for CIDA above yet to be “researched”)*.
- “Design Documentation Guidelines for Architectural and Structural Designers” - Construction Liaison Group, NZ (draft 2002)
- Improving Project Documentation – a Guide to Improve Current Practice – Australian Procurement and Construction Council with the Australian Construction Industry Forum, Canberra, Australia (2003)

It is recognised that in certain situations considerable improvement and benefit have been achieved :

- Project Initiation Guide for project sponsors, clients and owners – published by the Construction Industry Development Agency, 1993
- Model projects (success stories) highlighted in “Wealth Creation through Equitable Asset Delivery” – report & implementation guide published by Construction Queensland, 2001
- Advances in equitable project delivery, including relationship contracting alliance agreements.

Nevertheless, the overall picture continues to be one of declining quality in project documentation as evidenced by most recent research findings and reports on industry experiences.

The authors have concluded that there are a number of factors preventing the desired improvement; these include :

- The building and construction industry is very complex with many specialist components and many stakeholders with competing and sometimes conflicting objectives.
- The identified problems involve more than one stakeholder – resolution requires communication skill and co-operation without allocating blame.
- Lack of appreciation that feasibility analysis (including consideration of options), planning and design all form part of overall project delivery – small increases in effort during these phases give potential for significant savings in construction

- costs (ie better designs with fewer errors and less ambiguity result in less re-work, less unproductive time in resolution of disputes, etc).
- Political and commercial pressures for “instant” results – pressure on project initiation and project planning phases and which also flow on to the construction phase.
 - Lack of appreciation of the distinction between project initiation and project planning phases on the one hand and design processes on the other.
 - Preparation and publication of technical guides does not of itself lead to their implementation and improved performance and productivity – other initiatives are essential (eg build awareness of relevance and need for the improvements, training, feedback on use, etc) in order to embed the improved practices in the culture of the industry.
 - Industry culture and attitudes – including erroneous views that engagement of professional and specialist services can be made in the same way as purchase of commodities.
 - Government policies which may not be best suited for the realities of the building and construction industry (eg purchasing policies that pursue unbridled competition).

“DIMENSIONS” OF REAL SOLUTIONS

Whole-of-industry (involvement & commitment)

Widespread acknowledgement of the problem, and of its causes in all stakeholder areas is needed so as to ensure commitment by all stakeholders to collaboratively develop solutions and to implement them.

Without such understanding and commitment by all stakeholders to work together, part-solutions only can be defined and implemented. Such initiatives have only limited impact on the problem and may not be sustainable (as has been found with a number of previous attempts to overcome the problem).

Strategic approach in definition of package of solutions

The authors contend that the only way to define a comprehensive package of solutions is through application of strategic thinking about the overall problem (and its dimensions).

In this way all components of the necessary solutions can be identified, including measures that :

- Can be implemented in the short term.
- Need longer periods to fully research and define.
- Address industry attitudes and the need for culture change.

Relevance & need for managed change program (including cultural change)

Changes are inevitable and are continuously affecting the industry (eg in materials, equipment and technology) –of themselves these are the cause of some dimensions of the problem.

It is essential that an organised approach be defined and implemented for management of change in the industry (by all stakeholders and the industry at large) so that :

- The benefits of the improvements available can be achieved.
- The necessary attitudinal and cultural changes can be put in place.

Management plan & arrangements for implementation

The magnitude and complexity of the challenge in implementing the necessary solutions to the problem are significant. The industry needs to apply the same techniques for ensuring successful delivery of the package of solutions that all of its stakeholders apply to their business endeavours, viz define and implement a management plan for the program of activities, including definition of :

- Management arrangements and responsibilities.
- Priorities and time targets.
- Processes for review of progress and reporting of results.
- Means for highlighting and rewarding success.
- Procedures for identification of impediments and shortcomings, and for their resolution.

ENGINEERS AUSTRALIA, QUEENSLAND DIVISION INITIATIVES

Following consideration of the paper “Project Documentation Quality and its Impact on Efficiency in the Building & Construction Industry” Gallo et al., 2002 the Queensland Division of Engineers Australia decided to establish an industry wide Task Group to address the problem of declining project documentation quality that is evident throughout the building and construction industry. The charter of this Task Group is defined in the following terms.

Mission

To avoid waste and to raise effectiveness and profitability in the building and construction industry by achieving a high standard of project documentation.

Objectives

- a. To understand the wide impacts of poor quality of documentation on the national economy, and on the well being and profitability of all industry players along the supply chain.
- b. To articulate the problem in a way that allows identification of the full range of critical issues and their primary causes.
- c. To develop sustainable and implementable solutions that address the critical issues.
- d. To influence industry at all points along the supply chain to avoid the pitfalls and to consistently adopt best practice in project documentation quality.

Scope

Definition of practical solutions to the problem and a plan for their implementation.

Stakeholder bodies

The following stakeholder bodies have confirmed their commitment to the charter of the Task Group and are represented by experienced and senior professionals :

- Air Conditioning & Mechanical Contractors Association of Queensland Limited

- Association of Consulting Engineers, Australia (Queensland Division)
- Australian Institute of Building (Queensland Chapter)
- Australian Institute of Quantity Surveyors (Queensland Chapter)
- Australian Steel Institute (Queensland/Northern Territory Division)
- City Design – Brisbane City Council
- Civil Contractors Federation (Queensland Division)
- Department of Main Roads, Queensland
- Department of Public Works, Queensland
- Queensland Major Contractors Association
- Queensland Master Builders Association
- Royal Australian Institute of Architects (Queensland Chapter)

Construction Industry Forum

The Task Group convened a Forum in May 2004 at which 120 representatives of all stakeholders in the industry discussed the problem. Small group workshops were conducted to identify causes of the problem and possible solutions to them; each workshop was followed by group feedback and plenary discussion.

The findings of the Forum are documented in a report that has been widely published “The declining standard of documentation in the building and construction industry – report on possible causes and solutions – outputs from Construction Industry Forum” May 2004. These are summarised as follows :

- The dimensions of the problem, the issues behind them and the list of causes being developed by the Task Group were confirmed.
- The Task Group can proceed with confidence with more detailed analysis of causes and development of solutions – for consideration by the industry.

Management framework

The Task Group has adopted a project management framework with specific goals, target dates and desired outcomes. Specific sub-groups of volunteer professionals from the various stakeholder bodies represented on the Task Group have been established, each with nominated roles and objectives – progress reports from each sub-group are considered at each Task Group meeting :

- Project Plan – definition and monitoring of progress, methodology, communications strategy, and stakeholder involvement.
- Review research – identification of relevant research papers, development of data base with convenient electronic access.
- Root Causes – define the root causes of the problem, including identification of priorities for resolution and practical constraints.
- Develop Solutions – identify those root causes amenable to short term solution and those with longer term constraints, develop practical solutions with any implications and/or constraints to be addressed.
- Define Implementation Strategy – a package of achievable implementable activities, including proposals for management and monitoring of an implementation plan, and for identification of costs and benefits.

The Task Group was established in January 2004 and proposes to document its findings in a report by the end of 2004.

The report is to be published throughout the industry and the wider community with a view to ensuring support for the implementation strategy that it will propose, for

adoption of it and agreement to proceed with its implementation in a collaborative manner.

SUMMARY

There is widespread acknowledgement in the building and construction industry that the problem of declining standards in the quality of project documentation must be overcome. This paper outlines a wide range of causes and consequences of declining standards and provides an indication of the direction that must be pursued in order to overcome the problem.

Significant commitment, support and effort is being devoted to that endeavour by the primary industry stakeholders, including acceptance of the importance of the lead role being taken by Engineers Australia (Queensland Division).

The authors (and the Task Group) are confident that these joint endeavours will enable the problem to be turned around and that significant benefits will result for the industry and the community at large.

Support and assistance from organisations and individuals associated with the industry, or affected by it, are welcome at any time.

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About the authors

The authors are members of the industry task group established by Engineers Australia (Queensland Division) to develop a strategy for overcoming the problem in Queensland. They were instrumental in preparing the proposal for establishment of this task group.

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Prior to 2001 he spent 36 years in the Department of Main Roads (Queensland) with extensive experience in transport infrastructure planning, design, construction and operation.

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