

The Ethics of Forensic Engineers:

Abstract:

This paper explores the role of ethics in the work a forensic engineer performs in relation to a project that might progress to a court hearing in which the engineer will give evidence. It deals expressly with the production of reports which will stand as evidence in chief in the court. It does not expressly deal with the appearance in court and the cross examination, or other more exotic forms of taking evidence that might be involved, however the obligations discussed here continue through all stages of the proceeding.

Introduction:

The intersection of the practice of law and the science of engineering is a complex and wonderful part of the structure of our society. At its most basic, litigation law is about resolving human conflict, and by that definition there are always at least two opposing points of view. There is always doubt and uncertainty; a lack of foreseeability of the result that fundamentally arises from the fact the case will be decided by a person. The landscape in view is filled solely with ideas; no part of what is “the law” is scientifically provable or disprovable. All law, unless one believes in divine edict, is made up by humans.

Enter then the forensic engineer into the court room. At their core, engineers are applied scientists, persons skilled in materials, structure and forces. To the engineer the world of law, with its lack of certainty, looks muddled and game like. To the forensic engineer there is a *scientific* reason why the concrete silo fell, the concrete slab settled or the nickel processing plant failed to achieve its rated output.¹ Forensic engineers in court proceedings sometime find it difficult to accept that evidence against them could be given by an ethical and competent engineer. They believe lawyers can be paid to argue anything,² but how can another engineer be so *unethical* as to challenge clear science?

But engineering views of engineering failures do differ. Sometimes this is because the engineering analysis is different, more often it is because different fact assumptions are made. Different assumed facts will lead to a different engineering conclusion.

What is required of an ethical forensic engineer in a court proceeding, at its core, requires the engineer to put the duty to the court³ above any duty owed to client. The administration of justice requires experts to adhere to strict principles that the law applies either through court rules or through the common law. Practicing as a professional engineer requires ethical conduct that reflects those principles. This article focuses on the ethical obligations owed by forensic engineers leading up to a court hearing.

However, before narrowing our view to focus on conduct leading to a court hearing, it must be acknowledged that the ethical obligations owed by professional engineers

¹ All examples given in this paper have been drawn from actual cases and experiences of the authors.

² In fact a case must be arguable for a lawyer to argue a case ethically.

³ The duties owed are the same, be it to an arbitrator, expert or tribunal.

concern much more than the relationship of the engineer to the client or to the court. The 3 Cardinal Principles of the current Engineers Australia⁴ written Code of Ethics⁵ are:

- to respect the inherent dignity of the individual,
- to act on the basis of a well informed conscience and
- to act in the interest of the community.

It is submitted that the overarching ethical obligation an engineer owes is to society and to ensure human safety.⁶

Codes of Ethics:

The existence of a body of practitioners classed as a profession and the existence of an ethical code are fundamentally intertwined. Loosely defined, a profession can be considered to be a group of individuals that share the same occupation who organise to work in a particular way. But that definition also describes a trade, and it is the “profess”, the public declaration or vow that is taken that traditionally distinguished professions from trades. Lawyers still make their vow in the public place of a court, but all members of professions are (or should be) aware of their moral codes. The members of a profession carry additional moral responsibilities to the general public *because* professionals are capable by training and experience beyond the ordinary public in the field of their profession.

Most professions have written down their codes of ethics and make them generally available to the public. They are sometimes called a Code of Practice, but the distinction in title is of no account. The written code is not, however, the limit of the ethical obligation. In truth the written codes of professions are earnest efforts to codify what is largely the ethical obligation of the profession dating back to before it was recorded in writing. Typically there remains a vast bulk of ethical rules that are not written down, but which are of importance. Different professions have different focuses to their moral codes, reflecting both the different work that they do and the current history of interaction with the public at large. For example, the need for informed consent of a client is as important to an engineer as it is to a medical practitioner, but much more emphasised in medical codes.⁷ The written ethical codes of different professions differ greatly in length and prescriptive detail. Most professions, if not all, have disciplinary structures to prosecute transgressions of their professional codes.

The study of comparative ethical codes of is of particular interest to some. There are university courses devoted to the investigation and comparison of ethical platforms

⁴ Engineers Australia is the current trading name of the Institution of Engineers Australia, founded 1919.

⁵ The current code, published in 2000 can be found at:
http://www.engineersaustralia.org.au/shadomx/apps/fms/fmsdownload.cfm?file_uuid=F0647595-C7FE-7720-EA17-70AC27062E0B&siteName=ieaust.

A review is currently underway of Engineers Australia’s Code of Ethics. See :
http://www.engineersaustralia.org.au/about-us/codeofethics/codeofethics_home.cfm.

⁶ The Draft Code of Ethics by Engineers Australia as at February 2010 has as its first value statement “Public wellbeing, health and safety and sustainability”. The Draft code can be found at:

<http://www.engineersaustralia.org.au/ieaust/index.cfm?3003C3B0-9761-1156-F6B3-5EED5575B099>

⁷ See for example the Medico-legal Guidelines of the Medical Practitioners Board of Victoria, issued March 2006.

across different professions.⁸ Some university engineering courses include Engineering Ethics as a subject taught as a distinct field of study, typically focussing on the broader relationship of the engineer to society. The broadness of courses on engineering ethics reflects the fact that engineering ethics are not defined by any written code.

This article focuses on engineering investigation of engineering failure and the provision of the results of the investigation to a court. Explicitly or implicitly the original design engineer's work is in question. In this framework, only a subset of engineers' ethics have relevance. Indeed, the highest ethical obligation owed, to ensure public safety, rarely has application in court proceedings.⁹

In Court, the fundamental requirement of any expert giving evidence is to comply with the Rules of Court. Evidence that is produced to a court that does not comply with those rules may be ruled as inadmissible or given little weight.¹⁰ On top of that, the ethical rules, or rules of conduct, are a benchmark by which the evidence of an expert may be measured. Overlaying both the published Rules of Court and professional ethics is the common law; the numerous published decisions in which judges have explained how expert evidence is to be presented and treated. It is primarily in the judgments of courts that both the clarity and depth of discussion about the ethical obligations of an expert is to be found.

The Rules of Court:

All Australian Courts have Court Rules, made by councils of judges, that prescribe the requirements for expert evidence.

At this stage, the distinction drawn by the law between "lay" and "expert" evidence needs explanation. Lay evidence is evidence adduced from people involved in the dispute in some way, and those people are able to give evidence of facts - what they saw, said, did and so on. Lay witnesses are not permitted to give evidence of their opinions. However, expert witnesses are entitled to provide their *opinions* to the court on particular issues that are within their area of specialized knowledge. For this reason, their evidence is also known as "opinion evidence". Such opinions are formed by an expert in response to questions asked and usually require the expert to assume specified facts.

Although there are some differences between jurisdictions as to the requirements for expert evidence, the content of such rules is mostly similar. In Victoria, the relevant Court Rule is Order 44A of the Victorian Supreme Court Rules of Civil Procedure which sets out:

⁸ For example: Centre for the Study of Ethics in the Professions at the Illinois Institute of Technology

⁹ However, it sometimes occurs that facts become apparent during a trial that give rise to a concern for public safety. In those circumstances an engineer has an ethical obligation to inform the owner of the property and, if appropriate, the relevant building authority, of the issue they have become aware of.

¹⁰ The weight evidence is given denotes how persuasive it is to judge. Evidence that a judge will take into account is admissible evidence, but a judge might give evidence such little weight that it hardly matters it was admissible at all.

1. *A person engaged as an expert witness has an overriding duty to assist the Court impartially on matters relevant to the area of expertise of the witness.*
2. *An expert witness's paramount duty is to the Court and not to any party to the proceedings (including the person retaining the expert witness).*
3. *An expert witness is not an advocate for any party.*
4. *Every report prepared by an expert witness for the use of the Court shall state the opinion or opinions of the expert and shall state, specify or provide-*
 - ... the facts, matters and assumptions on which each opinion expressed in the report is based ...;*
 - ... a declaration that the expert has made all the enquiries that the expert believes are desirable and appropriate, and that no matters of significance which the expert regards as relevant have, to the knowledge of the expert, been withheld from the Court;*
 - ... any qualification of an opinion expressed in the report without which the report is or may be incomplete or inaccurate has been stated; or*
 - ... whether any opinion expressed in the report is not a concluded opinion because of insufficient research or insufficient data or for any other reason."*

This concise set of rules must be complied with. They deal partly with formal requirements of the report presented, but also the way in which the expert must conduct the investigation.

Engineers Australia's Code of Ethics:

Written codes of conduct are intended by their authors to establish what is and is not acceptable practice within a profession. They should provide a framework for assessing both what the design engineer should have done in designing the structure under investigation, and what the forensic engineer should do in assessing the failure or alleged failure. Unwritten codes of behaviour, in both contexts, are relevant, but more difficult to use to support expert evidence in a report or in cross examination. In the United States written ethical rules of a profession are given considerable weight by judges and arbitrators in deciding whether a proper standard of conduct has or has not been met.¹¹

¹¹ *Woods v Covington County Bank* 537 F 2d 804 (1976) at [23]. The case concerned the legal profession.

In 1994 Engineers Australia¹² substantially revised its Code of Ethics (“the Code”) to “reflect the changes in expectation of the community and the broader role of the Institution in community affairs”.¹³ The Code was last revised in 2000¹⁴ but is under review at the time of writing this article and exists as a draft code dated 2009 issued for discussion by Engineers Australia (“the Draft Code”).¹⁵ The Code contains 3 Cardinal Principles, and 9 Tenets. Associated with the Code, and published with it is the General Guidance for Members (“the Guidance”). However the Guidance expressly states it is not part of the Code itself, notwithstanding the fact it contains the most helpful assistance to engineers as to what is required of them.

The Guidance, but not the Code, has a section dealing specifically with “Acting as an Expert Witness”. Amongst the professions, only accountants appear to have a specific code directed to forensic activity.¹⁶

The Draft Code is more expansive than the current Code, but less expansive than the Guidance. It contains no specific assistance to the engineer engaged as an expert witness.

The Code provides no real assistance to a forensic engineer engaged in a legal dispute.

The Guidance intends to provide more assistance, but might actually lead an engineer into error. For example, contrast the clear statement in the Court Rules that an Expert shall not be an advocate and the strong similar theme stated by judges in decided cases, with the weak statement in the Guidance. The Guidance states:

“...advocacy rather than objective and honest presentation of evidence is likely to inconsistent [sic] with obligations under the Code of Ethics”.

One is left to wonder how it could *ever be* that advocacy, rather than objective and honest presentation, could be *consistent* with the Code?

Similarly the Guidance states that:

“any opinion expressed *should* be on the basis of adequate knowledge and *technical competence in the relevant area* **but** may be speculative based on experience and *wide relevant knowledge* provided such speculation and the basis are clearly disclosed...”(emphasis added).

This is not the legal test of when opinion evidence can be received by a court. An expert opinion must be given by an appropriately qualified expert in the field in which the opinion is proffered to be admissible. If there is a *lack of expertise*, that must be disclosed, and the evidence will not be admissible. Further, the *basis of an opinion* must *always* be disclosed; whether it is a speculative opinion or not. And, of course, a speculative opinion should never be portrayed as a firm opinion; to do so in court on oath would be to misrepresent the opinion to the judge.

¹² Then trading as the Institution of Engineers, Australia.

¹³ Preamble to the IEA Code of Ethics 1996.

¹⁴ http://www.engineersaustralia.org.au/shadomx/apps/fms/fmsdownload.cfm?file_uuid=F0647595-C7FE-7720-EA17-70AC27062E0B&siteName=ieaust

¹⁵ <http://www.engineersaustralia.org.au/ieaust/index.cfm?3003C3B0-9761-1156-F6B3-5EED5575B099>

¹⁶ Statement of Forensic Accounting Standards, The Institute of Chartered Accountants.

Similarly, the Draft Code contains no useful codification of the forensic engineer's obligations in the court environment. The weak statement requiring engineers that they must:

“not unfairly criticise others for their past works, where such work was conducted in accordance with the accepted standards and practices and community values at the time and in accordance with the needs of the time”

is not only meaningless as a guide to what is required to be sound engineering, it actually implies it is OK to *unfairly* criticise other engineers in all *other* circumstances.

Therefore, forensic engineers are best guided by the published Rules of Court and statements made by judges dealing with the obligations of experts who present evidence to them. One would like to think that the unwritten standards of the profession are at least as high as the courts impose as a matter of law, notwithstanding the current state of the written codes.

The Australian Standards:

The extensive range of Australian Standards (published by Standards Australia) provides a useful benchmark of the standard of engineering required in any project. They are, of course, more directed to strictly engineering matters than ethical considerations, but nevertheless are invariably used in court to investigate questionable conduct by design engineers. They are also commonly the battle ground of the cross examination of the forensic engineers called to support or attack a design.

Australian Standards are called up in contractual documents and compliance by a design engineer is therefore often mandatory as a matter of contract. In other circumstances they commonly act in negligence cases by setting what an ordinarily competent engineer should have done.

However, applying an Australian Standard in a legal context is not as easy as lawyers unfamiliar with engineering cases often first imagine. Most engineers, on the other hand, know that typically the deemed to comply engineering methods contained in an Australian Standard are only one way the Standard can be complied with. Broader engineering analysis can also comply with a Standard and be sound engineering.

Lawyers commonly involved in engineering disputes know the way the Australian Standards work, but also recognise the attraction judges typically have for measuring engineering against the deemed to comply methods they contain.

Further, the Australian Standards are not infallible. In at least one case a design in accordance with the deemed to comply method in an Australian Standard led to insufficient structural stiffness (leading to excessive deflection) in a reinforced concrete floor. There was extensive evidence that the failing of the Australian Standard in the particular circumstance encountered was common knowledge amongst competent structural engineers at the time of the design. Designing in accordance with the Standard did not excuse the failed design that was produced.

On the other hand, compliance with an Australian Standard might not actually be required in order for the engineer's conduct to be considered good practise by ordinarily competent engineers. For example, when considering a concrete slab suffering unacceptable differential settlement, one can examine what the Australian Standard requires where class P soils have been encountered. The Standard says the maximum differential settlement has to be calculated by engineering analysis. To do that, an engineer will have to have the relevant soil parameters (or assume them) and know the depths of the relevant soil layers under the slab. If evidence can be presented to the court that the accepted engineering industry practice for class P soils is for structural engineers to simply adopt footing depths for class H soils and *not* to do an engineering analysis, notwithstanding the provisions in the Standard, will a judge consider that to be good practice? Does it depend on whether the slab has failed or not?

Even when it can be shown that an Australian Standard was not complied with, engineers are usually alive to the possibility that a higher level engineering analysis might show that the departure from the deemed to comply part of the Australian Standard was not in any way related to the failure that occurred. The simple, deemed to comply, procedures in the Australian Standard might not have been complied with, but a computer based three dimensional plastic deformation analysis might show the failure of the structure was unrelated to the failure to follow the code methods correctly. A finite element analysis, for example, might show the failure of the structure and the code violation were, in fact, unrelated.

Consider this example: A light tower at an oval was designed for a maximum 47m/s, 3 second wind gust using the simple procedures of the wind code. When the design was checked using the same simple procedures for a 50 m/s, 3 second wind gust, it was shown to be inadequate. However, it cannot be said to be a defective design when a finite element analysis showed it was structurally sound for a 50m/s wind in any event, even if that analysis was done after the initial design had been questioned on an engineering review, and in circumstances where no failure had been observed.

Thus a design engineer might have missed a load case, or not performed a particular calculation, or slipped up in doing the calculation; but unless that event actually caused the damage, there may have been no consequence from *that* error. Measuring performance against the Australian Standards should only be the start of most investigations.

In passing, it should be noted that one strategy occasionally employed to justify an engineering design that contravenes the deemed to comply section of an Australian Standard is to assess it against an overseas standard of high international repute. With the growing internationalism of both engineering and law, and the increasing prevalence of international experts involved in Australian cases, such an approach, while still relatively rare, is becoming more common.

The Forensic Engineer in the Law:

Before turning to discuss how ethical obligations have been interpreted by the courts, it is useful to consider what *question or questions* the court is concerned to answer in cases that come before it. Too often experts giving evidence lose sight of the fact that

courts are task focussed. Courts are only concerned with deciding disputes between two conflicting points of view. Only evidence that helps decide the relevant issues is relevant and is technically admissible at all.

Most engineering disputes concern an engineering failure, or alleged failure, that has resulted in economic loss to one party. They are typically commercial disputes fought in one of the specialist lists of one of the levels of court.¹⁷ There is, occasionally, a tragic case where an engineering failure causes personal injury or death, but Australian engineers can be proud that such cases are relatively rare.

The area of law most engineering disputes concern is negligence; the failure to exercise the ordinary level of skill and care that would be expected of an ordinarily competent engineer. Even when a failure is alleged to have been caused by a breach of the engineer's contract of engagement, ordinarily the term alleged to have been breached is to the same effect as the engineer's obligation to avoid being negligent. There are occasional contracts that an engineer might sign that impose an obligation to achieve a particular *result*,¹⁸ an absolute outcome that must be achieved regardless of everything, and there are a number of legal obligations that apply in certain situations that impose strict liability, but these circumstances are relatively rare.

In most cases that a forensic engineer is likely to be involved, four issues are likely to arise.

Failure

Firstly, the question of failure is commonly in issue. Has the structure, device or plant¹⁹ failed or will it fail? If a cement silo is lying in pieces on the ground, clearly there has been a catastrophic failure.²⁰ However, more often than not in commercial disputes whether or not a failure of the engineering design has occurred is in dispute.

A plant may not produce 100 tonnes of nickel an hour, but the design engineer might argue that is due to poor operation, not design. The floor slab of a community centre may well have settled more than 100 mm at one end, but the design engineer might argue that the settlement and distress caused are within acceptable limits for a three year old structure. An engineering review of the partly constructed light tower at a sports oval considered above may have led to the principal embarking on engineering revisions despite the design engineer insisting the original design was competent.

Cause of failure

Secondly, the cause of the failure is commonly in issue. Why did it fail?

¹⁷ Of course expert determination, arbitrations and tribunal hearings are also common.

¹⁸ Such contractual terms are often expressed as an obligation on the engineer to produce a structure that is "fit for its purpose". In the absence of qualifying terms, such a term requires the *result* to be fit for purpose, regardless of the level of skill and care applied. Engineers considering entering into contracts containing such terms should consider whether their professional indemnity insurance covers liability arising from their breach.

¹⁹ We will ordinarily refer to "structure" as a generic term.

²⁰ Catastrophic failure meaning complete structural collapse, as an engineer would define the term.

Perhaps the cement silo had been constructed with bad welding, and the fabricator is a party to the proceeding. Alternatively, perhaps the torsion applied to the main supporting beams was not adequately resisted as a consequence of poor design. If both welding and poor design were factors in the collapse, in what proportions should the court find liability? Perhaps the design engineer of the nickel plant will argue that feeding it the wrong grade aggregate caused the failure of rubber linings that reduced its capacity.

The design engineer of the community centre might explain that the design was sound, but the building had been constructed over an old creek bed that the entirely competent geotechnical investigation simply had not revealed. The designer of the light towers might explain that the crisis of confidence in the light tower fundamentally came about because the reviewing engineer used a higher wind speed in the review than the design engineer used in the design. The design engineer might still maintain the lower wind speed is appropriate – there never was going to be a failure.

Performance of the design engineer

Thirdly, the performance of the design engineer²¹ will usually be in issue. Having established that the structure failed and the reason for the failure, the question of whether, with proper engineering, the failure should have been avoided arises.

It is in this area that the forensic engineer may criticise the work of the design engineer and be in conflict with any opposing forensic engineer called to support it. It is not surprising that this is often the area in litigation that is the most hard fought, and where the weight of the forensic engineer's evidence will be most challenged.

A crucial question that the judge will ordinarily have to answer in every engineering case is whether or not the design engineer performed in accordance with the standards of conduct expected. Put directly: was the design engineer negligent? Did the design engineer do all that was required of an ordinarily competent engineer²² or not?

In order to assist the court, the forensic engineer has to explain the factual position the design engineer was in, explain the way an ordinarily competent engineer would have performed the engineering involved, and then comment on any departures exhibited in the work of the design engineer. Finally, the forensic engineer has to explain the relationship between the departures observed and *cause* of failure of the structure previously described.

Providing these steps in a report provides the logic to a forensic engineer's opinion. A bald statement of opinion expressed on the ultimate issue, for example as is contained in the statement: "the design engineer was negligent", without the reasoning behind it is so unhelpful it is actually not admissible in a court of law.²³ As was held

²¹ We refer to the original engineer whose competency is in question as the design engineer. In reality, it can just as often be a construction engineer who is alleged to be responsible.

²² Higher standards might, of course, apply depending on the expertise the engineer held himself out as having

²³ "... the expert may not give an opinion on an ultimate issue where that involves the application of a legal standard – for example, that the defendant was negligent, that a risk was foreseeable...." *RW*

in *Makita (Australia) Pty Ltd v Sprowles*²⁴; the prime duty of experts giving opinion evidence is to furnish the judge with criteria enabling evaluation of the expert's conclusion.

The forensic engineer is guided by professional ethics when giving evidence in a report. What is written must be a genuinely held belief of the standard of ordinarily competent engineers. The court is not helped by evidence to the effect that the design engineer "could have done it better" or that the forensic engineer "would have designed it in a different way". For example, the forensic engineer may well say that taking into account the remote location that the cement silo was to be constructed in, had the forensic engineer designed it, the welding would have been specified so that achieving a good field weld was less critical to structural strength. But would an ordinarily competent engineer at the time of the alleged faulty design have performed have designed it that way? Did sound engineering require welds to have greater capacity in remote locations? Hindsight is a wonderful thing.

Take a second example. Was the selection of a design wind speed of 47m/s for the light towers where the wind code required a design wind speed of 50m/s (in the deemed to comply provisions) divergent from sound engineering when, at the time, it was expected in the profession that the maximum design wind speed in the relevant Australian Standard was about to be reduced to 47 m/s? Has the state of knowledge changed since the design was done? ²⁵

It is in dealing with these types of questions that there is commonly a legitimate difference of engineering opinion.

Rectification

Fourthly, how the failed structure should be rectified is often in issue. Although in law the measures of damage in a case in negligence and in contract are different, ordinarily such matters will not concern the forensic engineer. The issue will be how to restore the structure to the way it should have been, and no better. Perhaps surprisingly, there is often a high level of conflict in expert evidence presented on rectification.

Whereas the cost of reconstruction of an entirely collapsed cement silo will not usually be the subject of much debate, where a building settles considerably, an underground freeway tunnel fills with water or a nickel processing plant cannot make design capacity, there is always a range of rectification options. Engineering views often widely vary on how best to achieve rectification.

Here the forensic engineer is not concerned with what an ordinarily competent engineer would do. A different battle ground is common. One typical issue on which

Miller & Co Pty Ltd v Krupp (Australia) Pty Ltd (1991) 34 NSWLR 129 at 130. Although note the NSW *Evidence Act* 1995 s.80 has removed this as a ground for excluding expert evidence.

²⁴ 52 NSWLR 705

²⁵ The Guidance, discussed below, specifically requires professional engineers to "have regard to the normal practices at the time of the occurrence of the incident which gave rise to the call for advice" and reflects the common law of negligence.

engineers often disagree is the level of risk that a particular rectification plan will be unsuccessful.

Other roles for forensic engineers

The above outline of what forensic engineers commonly do in litigation assumes that their primary role will be to put evidence before the judge; in the first instance by way of an expert report. On occasions forensic engineers are engaged to provide advice on the merits of the overall technical positions of the parties (typically in relation to settlement negotiations) or to assist in the development of cross examination preparation. Forensic engineers engaged in such roles, which can best be referred to as litigation advice and support, are preferably separate from the engineers who give evidence to the court. This is so for a number of reasons. Fundamentally the forensic engineer must be seen as independent and not in any way an advocate for the employing party if the evidence given is to be given significant weight. Once a forensic engineer provides litigation support, it can be difficult to maintain real independence.

While the same expert is occasionally used for litigation support and presentation of an expert opinion to court, the better approach is to use an entirely separate expert. Where the same expert is used, at the least there must be a clear separation of the correspondence between the lawyers and the expert, and vice versa, between the roles being performed.²⁶ This paper does not deal with forensic engineers who are engaged in roles other than as a client appointed expert to present expert testimony.

The First Approach to act as a Forensic Engineer and the issue of specialist knowledge

It is convenient to now look at the stages of involvement of a forensic engineer in a court proceeding.

An independent expert intended to present evidence to a court ordinarily will be, and invariably should be, first approached by the lawyers acting for the client. There are a number of reasons for this. Firstly, the selection of experts is ordinarily the province of the lawyers as they should understand the issues in the case that must be addressed. They should understand the field of specialist knowledge involved. They should know the attributes that make a good expert witness. Selecting an expert is an important and time consuming part of the role lawyers in an engineering dispute will perform.

Secondly, by having the lawyer engage the expert rather than the client, the lawyers can carefully control the expert relationship. The lawyers can ensure the forensic engineer is only provided with material that the lawyers can prove in the court through lay witnesses that will be called, and they can ensure the forensic engineer is clear as to the questions they are asked to address. An expert opinion expressed on factual matters that are in dispute and which are not proven will not be accepted by the court.

²⁶ Communication properly in relation to case preparation is privileged and need not be discovered (that is - provided to the other side), while that in relation to the preparation of the expert report is not. See *Temwell Pty Ltd v DKGR Holdings Pty Ltd* [2003] FCA 930 at 985.

Thirdly, the lawyers can ensure that what is provided to the forensic engineer will not become an embarrassment during the trial. Right from the first contact, the engaged forensic engineer should understand that any documents that go onto the investigation file will most likely have to be produced to the court as part of the cross examination that will occur.²⁷

As outlined above, the expert is in the privileged position of being permitted to provide opinion evidence to the court. The leading case of *Makita (Australia) Pty Ltd v Spowles*²⁸ explains the relationship of having the necessary expertise to express the opinion, the process the expert must follow and its interrelationship with that expertise and the admissibility of the evidence produced in this dense, yet concise statement²⁹:

“In short, if evidence tendered as expert opinion evidence is to be admissible,

- it must be agreed or demonstrated that there is a field of “specialised knowledge”;
- there must be an identified aspect of the field in which the witness demonstrates that by reason of the field in which the witness demonstrates that by reason of specific training, study or experience, the witness has become an expert;
- the opinion proffered must be “wholly or substantially based on the witness/s expert knowledge”; so far as the opinion is based on facts “observed” by the expert,
- they must be identified and admissibly proved by the expert, and so far as the opinion is based on “assumed” or “accepted” facts, they must be identified and proved in some other way;
- it must be established that the facts on which the opinion is based form a proper foundation for it; and
- the opinion of an expert requires demonstration or examination of the scientific or other intellectual basis of the conclusions reached: that is, the expert’s evidence must explain how the field of “specialised knowledge” in which the witness is expert by reason of “training, study or experience”, and on which the opinion is “wholly or substantially based”, applies to the facts assumed or observed so as to produce the opinion propounded.

²⁷ In *Temwell Pty Ltd v DKGR Holdings Pty Ltd* [2003] FCA 930 it emerged that there were ten drafts of the expert’s report. Ryan J, in the Australian Federal Court held that all notes, memoranda and successive drafts had to be discovered “in order to explore what instructions [the expert] had been given and the extent to which his opinions have been formulated independently of [the client] and its advisers”.

The South Australian Court Rules (Rule 38 (4)) explicitly require each party, on request, to provide a list of all conversations that expert has had with any party, legal representative or any other expert in relation to the matter. All notes by any of those involved in such conversations are discoverable.

²⁸ [2001] NSWCA 305

²⁹ The paragraph has been broken up from its original form to improve its readability

“If all these matters are not made explicit, it is not possible to be sure whether the opinion is based wholly or substantially on the expert’s specialised knowledge. If the court cannot be sure of that, the evidence is strictly speaking not admissible, and so far as it is admissible, of diminished weight. And an attempt to make the basis of the opinion explicit may reveal that it is not based on specialised expert knowledge, but to use the Gleeson CJ’s characterisation of the evidence in *HG v The Queen*³⁰ on “a combination of speculation, interference, personal and second-hand views as to the credibility of the complainant, and a process of reasoning which went well beyond the field of expertise”.

Therefore the lawyer considering engaging a forensic engineer will be vitally concerned to assess, whether or not the requisite expertise is held by a forensic engineer under consideration. Similar considerations apply to cases heard under commonwealth legislation.³¹

Although there is no written ethical rule for engineers that deal with how an engineer might hold him or herself out to an approach by a lawyer in this regard, it is suggested that it is a clear ethical breach to hold oneself out as an expert in a particular field when one is not. As discussed above, the Guidance does not make this clear. The Australian Medical Association puts it much better where, in their policy statement of 1998, they said;

“The AMA believes that it is unethical for doctors to hold themselves out as experts in particular areas of practice when they are not recognised as such by their colleagues”.

Returning to our light tower and settlement examples: many structural engineers do work with wind loading, dynamic oscillation and soil mechanics but there is a clear difference between having experience in these disciplines and holding oneself out as an expert in any one of them. An expert who exaggerates the expertise he has not only does a disservice to the potential client, he also is behaving unethically and the cross examination experience will be most unpleasant.

An expert must accept that ordinarily his or her expertise will lie in just one narrow area of scientific knowledge. An engineering expert who had previously given evidence to a court of the trajectory of a bullet through timber and, in second case, on the slipping characteristics of a leather shoe on a rubber mat, should not be surprised to find evidence to a third court on the acceptable standard of painting on an offshore oil platform essentially ignored.

If the first contact with a forensic engineer is made by a client, it is recommended that the forensic engineer enquire immediately whether litigation is contemplated. If it is, the forensic engineer should suggest the client take legal advice on the engagement contemplated. For the reasons referred to above, it should be a rare event that a

³⁰ (1999) 197 CLR 414

³¹ See also Section 76 and 79 of the Evidence Act (Cth) 1995 and the exception to the prohibition on opinion evidence therein contained. Also see *HG v The Queen*, *ibid*, Gaudron J at 432

lawyer is content for a client to select and directly engage a forensic engineer intended to present evidence to a court.

If the forensic engineer considers that there might be a conflict of interest in taking the engagement, this must be revealed. The Guidance requires professional engineers to “reveal the existence of any interest, pecuniary or otherwise, that could be taken to affect their judgement in a technical matter about which they are making a statement or giving evidence”. A prior engagement in respect of the same matter will often be enough to disqualify an expert being engaged by a second party.³² Ordinarily, having raised the issue, the forensic engineer can be guided by the client’s lawyers.

The Terms of Engagement, Independence and Questions to be answered:

In a properly managed court case, the forensic engineer can expect the lawyers to ensure, from the earliest time, that the need for independence is stressed. This need for utmost independence is a requirement of Court rules of procedure across Australia. The first three rules of Order 44A of the Victorian Supreme Court Rules, as set out above, all address this fundamental requirement.

A lack of independence, such that an expert slips into advocacy, is the most common attack made by cross examining barristers to discredit expert witnesses. If the court has any reason to believe the expert is presenting as an *advocate* for a client, the expert evidence will be disregarded, or at least accorded little weight. As referred to above, the obligation a forensic engineer owes to the court in its administration of justice is considerably higher than that owed to the client. As a Victorian Supreme Court judge put it : “The product of the expert should itself be the independent product of the expert, uninfluenced as to form or content by the exigencies of the litigation”.³³ Numerous other cases contain adverse statements against experts perceived of being advocates for their clients.³⁴

This primary obligation of independence and the impact of any shortfall is succinctly summarised in the Guidance: “An expert is not an advocate. Advocacy by an expert diminishes the value of advice both to the client and to the proceeding.”

In the circumstance where a client directly approaches a Forensic Engineer to assist, it is the forensic engineer who has to educate the client as to this independent role that will be performed. One experienced engineer sensibly suggests responding, in writing, in the following way:³⁵

“Thank you for your request for me to provide assistance in this matter. I consider that I have the experience and skills that can provide a contribution. I must point out before we commence that, as a technical expert, my role is to find, investigate and interpret the facts and to provide an opinion as to the cause, responsibility or remediation needed based solely on those facts and

³² *Protec Pacific Ltd v Cherry* [2008] VSC 76

³³ *Fagenblat v Feingold Partners Pty Ltd* [2001] VSC 454 at [9], Pagone J

³⁴ *Cubillo v Commonwealth, FCA* 14 December 1995, *Arnotts v Trade Practices Commission* (1990) 97 ALR 555, 24 FCR 313

³⁵ *Duelling Technical Experts*, Paper presented to the NACE Corrosion Conference, Atlanta USA, March 2009

not be biased by or towards the party who is paying my fee. This means that I cannot be an advocate or a hired opinion for any position on the dispute and my findings may indeed be counter the position of the party that commissions and pays me. The reason for this stance is that if I am called to give evidence on this matter before any Court hearing, arbitration or the like and am accepted by the Court as an expert witness, my specific duty under the Court's Expert Witness Code of Conduct is to assist the Court impartially on matters relating to my area of expertise, and that I cannot be an advocate for any party including the person retaining me as an expert.

Ordinarily the letter of engagement of a forensic engineer will contain a set of questions that require a response. These must be studied and understood. The forensic engineer should assume a great amount of effort has gone into asking the specific questions asked. That is because the questions asked reflect the legal principles involved.

A forensic engineer is *not* undertaking an intellectual exercise on the design of aluminium processing equipment, nor is he or she conducting a Royal Commission into how nickel processing equipment *should* be designed. The engagement is to assist the court in deciding the questions it must answer in the litigation. It is a constant wonder to lawyers engaged in working with experts how often that role is not understood. The questions are the questions; they define what the forensic engineer must address.

Producing the Report:

The content and style of an expert report by a forensic engineer are the subject of prescriptive requirements of the relevant Court Rules. It can be expected that the letter by which the lawyer engages a forensic engineer will set out the requirements in considerable detail.

What a forensic engineer's report will address, as set out above, is usually some of the questions of whether or not the structure has failed, what the cause of the failure was, whether the design engineer departed from the standards expected of competent engineers and what is the appropriate rectification for the structure. As referred to above, the ethics of the profession, Australian Standards and what an ordinarily competent engineer should have done are what is likely to be raised by the questions the forensic engineer is asked to consider. All these matters are concerned with the view of the original design process. They are concerned with what the *design engineer* did and how the failure came about.

However, the same issues play a key part in how the *forensic engineer* performs his or her investigation, and what the report must contain.

There is no Australian Standard dealing with how an engineering forensic investigation is to be conducted, nor do the written ethical standards give any guidance. There are, however, a number of good texts on the subject. The question is, how should a competent engineering investigation be performed? The answer to that question sets the approach the forensic engineer must adopt *as a minimum*.

It is beyond the scope of this article to go through the steps that should be followed as part of a sound engineering investigation. What is required in each investigation will depend on the circumstances. However, what is required by courts is complete transparency in the investigation that is conducted, and a full and proper documentation of it.

One authoritative American guide to ethics in Forensic Engineering investigation³⁶ suggests the following are examples of unethical practices in forensic engineering investigation:

- Removal of evidence from the scene,
- Altering notes taken at the scene,
- Deleting non supportive notes,
- Deleting portions of data,
- Altering or discarding photographs or
- Withholding material during discovery.

With respect to our American cousins, one hopes each of these activities is far outside of the ordinary practice of forensic engineers in Australia. It is certainly much less than what any Australian court requires. It is hard to credit that American engineers would need to be told such basic transgressions are unethical. In Australia such conduct would be actionable.

More often, issues that arise in Australia concern the failure of the investigating forensic engineer to properly document the structure as it was found and investigated, to properly record what witness said or to properly investigate a line of enquiry that might have revealed a different cause or effect.

At the cutting edge of the ethical obligation in this regard is the obligation on the forensic engineer to consider material which could detract from the concluded opinion.³⁷ A complete picture must be presented, including facts helpful and not

³⁶ *Guidelines for Forensic Engineering Practice*, ch 4, Ethics in Forensic Engineering

³⁷ *National Justice Cia Naviera SA v Prudential Assurance Co Ltd, The Ikarian Reefer*, [1993]2 Lloyd's Rep 68. In this case Creswell J helpfully summarised the common law list of duties and responsibilities of experts in civil cases as follows:

- “1 Expert evidence presented to the Court should be, and should be seen to be, the independent product to the expert uninfluenced as to form or content by the exigencies of litigation...
- “2 An expert witness should provide independent assistance to the Court by way of objective unbiased opinion in relation to matters within his expertise...An expert witness in the High Court should never assume the role of an advocate”
- “3 An expert witness should state the facts or assumptions upon which his opinion is based. He should not omit to consider material facts which could detract from his concluded opinion.
- “4 An expert witness should make it clear when a particular question or issue falls outside his expertise.
- “5 If an expert's opinion is not properly researched because he considers that insufficient data is available, then this must be stated with an indication that the opinion is not more than a provisional one... In cases where an expert who has prepared a report could not assert that the report contained the truth, the whole truth and nothing but the truth without some qualification, that qualification should be stated in the report...
- “6 If, after exchange of reports, and expert witness changes his view on a material matter having read the other side's expert report or for any other reason, such change of view should be communicated (through legal representatives) to the other side without delay and when appropriate to the Court.

helpful to the case being advanced. If this ethical obligation is not complied with a court will consider the forensic engineer to either be incompetent to the point of not understanding the job required, or to have become an advocate for one party. In either case the weight of the evidence presented will be slight, if it is admissible at all.

The obligation is reflected in the Guidance, which requires professional engineers to “cover all matters relevant to the question of which they have knowledge”. It also states: “members should ensure that all reports and opinions given to a client prior to a hearing include all relevant matters of which they are aware, whether they are favourable or unfavourable”.

One of the authors of this article watched appalled as an expert witness called for his client on the welding in the cement silo case was cross examined on his opinion that the welds were not a cause of the collapse.

“Dr X” the cross examiner asked, “you say you don’t see the defects that Dr Y, called by my client, says exist in the weld being a lack of root fusion and impurity inclusions. Is that right”.

“That is correct”, replied Dr X.

“So you would have the tribunal believe this weld, which my client’s experts say is defective, is perfect?” continued the cross examiner.

“Oh no”, responded Dr X. “There are many defects in this weld, just not a lack of root fusion and inclusions”.

Somewhat flabbergasted, the cross examiner then asked : “But Dr X, you don’t refer to seeing *any* defects in your report. Why is that?”.

“Well sir, that is because your expert only suggested a lack of root fusion and the presence of inclusions. If he didn’t see other defects, why should I point them out?”

Not through any positive act, but rather through omission, Dr X was seen as either as an advocate for his client or, at the least, a forensic engineer who did not understand the independence required of his role. In any event, the tribunal accorded his evidence little weight and found the failure to be primarily the result of defective welding.

The duty owed to the court by the forensic engineer is to bring “matters adverse to the interests of their clients to the attention of the court.”³⁸

A proper expert report must reveal the factual assumptions upon which it is based.³⁹ This is required in the legal context so that a court can see how the facts support the

⁷ Where the expert evidence refers to photographs, plans, calculations, analyses, measurements, survey reports or other similar documents, these must be provided to the opposite party at the same time as the exchange of reports”.

³⁸ *Chapman v Luminis Pty Ltd* [2001] FCA 1106 at [297]

opinions expressed, and also so other forensic engineers can follow the application of logic and engineering analysis to the factual situation. Sound engineering reasoning should be apparent. While not *every* factual circumstance needs to be gone into, Justice Pagone in the Victorian Supreme Court explained the need for the factual background to be expressed in the report as:

“It is the *what* and the *why* which form the underpinning of the evidence which must be sufficiently revealed to enable the parties to test the evidence and to permit the court to understand those matters which form the foundation of the evidence relied upon for the disposition of the ultimate issue by the court”. (emphasis added)

Put another way, unless the forensic engineer details in his or her report the factual basis on which the report is founded, the court cannot consider if the factual basis is or is not correct, and hence the weight of the opinions it contains. A report that does not reveal the factual basis is not only a poor report, it will not be accepted by the court.

It is because an expert must, ordinarily, provide his or her opinion based on a number of factual assumption that ordinarily a forensic engineer will not be asked to finalise the report until lay witness statements have been exchanged. Then, when provided with the lay statements and if properly instructed, the forensic engineer will be told what facts to assume are correct where there is a conflict in the lay evidence. Further, the forensic engineer should be instructed as to the legal obligation or test that should be applied. Such matters; deciding conflicts on factual matters or determining the legal test that should be applied, are not within the expertise of the forensic engineer.

If, before a firm opinion can be provided, further investigations are required, facts need to be known or assumptions need to be made, the forensic engineer must ask for instructions from the engaging lawyers. If the enquiry is not answered, the need for those instructions should be referred to in the report.

In the USA there has been a debate between the American Bar Association and the Technical Council on Forensic Engineering on a number of issues that Australian Courts have firmly decided and which, in this country, are not open to debate.⁴⁰ One issue, however, that does arise in both jurisdictions is the question of the reasonable degree of scientific engineering certainty required for opinion evidence to be given. In Australia the issue is dealt with within the framework of the primary obligation of the expert being to the Court. A controversial hypothesis can be put forward by a properly qualified forensic engineer, as long as the fact it is controversial is advised and the facts and research upon which it is based are clearly revealed to the court.⁴¹

³⁹ *National Justice Cia Naviera SA v Prudential Assurance Co Ltd, The Ikarian Reefer*, [1993]2 Lloyd's Rep 68

⁴⁰ *Guidelines for Forensic Engineering Practice*, ch 4 Ethics in Forensic Engineering. In Australia:

- contingency fees for experts would simply not be accepted;
- full disclosure by experts is *always* required, ordinarily including the experts entire file; and
- an expert must always be a legitimate expert in the relevant field to give opinion evidence.

⁴¹ *Re AB (Child Abuse : Expert Witness)* (1995 1 FLR 181 at 192

What cannot be ethically done is to present as a mainstream theory what is in fact a controversial hypothesis.

Reply Reports:

Typically after the exchange of expert reports, a forensic engineer will have an opportunity to reply to the report of a forensic engineer expressing an opposing view. What is required in a reply report will depend on the content of the report. Ordinarily the lawyers instructing the forensic engineer will identify the questions that need to be addressed in the reply.

What can, however, be said is that there is an ethical obligation to consider what is said carefully and logically, and to respond in a way that is helpful to the court. If a forensic engineer changes his or her view because of the opposing report, or indeed, for any reasons at all, this should be set out in the reply report.⁴² It is unethical to leave the initial report uncorrected. If the opposing report is based on different factual assumptions, that difference should be identified.

What is useful to a court, although not an ethical requirement or a requirement of the Court Rules, is to identify in a reply report, without embellishment, where there is agreement and where there is disagreement between the experts. Courts and arbitrators often employ a variety of procedural methods to achieve this objective.

The Essential Point:

A forensic engineer should understand that in legal proceedings, the primary obligation owed both ethically and as a matter of law is to the court. Evidence that is presented that is not in accordance with the obligations set out in the Rules of Court and the binding judgments that comprise the common law is likely to be inadmissible, given no weight and be contrary to an engineer's ethical obligations. As such evidence is unlikely to be accepted by the court, the expert is also doing his or her client an enormous disservice if he or she departs from these obligations. Flowing from that primary obligation are clear requirements concerning the openness and helpfulness of the evidence the forensic engineer presents.

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⁴² *National Justice Cia Naviera SA v Prudential Assurance Co Ltd, The Ikarian Reefer*, [1993]2 Lloyd's Rep 68