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The engineering student and the laws

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ABSTRACT: Two questions come to mind when considering the engineering student and the laws. The first is: what law studies (and how much) should the engineering student get during tertiary education? The second is: what laws apply to the engineering student while attending university? As the answer to the first question, this author suggests the common law system, government Acts and Regulations, the employment and industrial relations systems, the background and administration of contracts and other matters. The second question introduces some curious secondary features. Because the student is not an employee of the university, industrial relations legislation, which affects staff, does not apply to students, but does the Occupational Health and Safety (OHS) Act and Regulation apply? Alternatively, the Regulation also refers to safety for visitors at a place of work, so is the student a visitor and covered by that clause? This article will cover the first question stated above, suggest an answer, and explore some aspects of the second question.

INTRODUCTION

As educators, should we consider making a law subject available to engineering students? The main argument against this is the plethora of subjects currently available to be included in any engineering curriculum, increased by the burgeoning number of sub- and sub-sub-disciplines in the profession and electives available from other faculties, which makes the idea of including one on law quite a daunting proposition.

As an example of the extraordinary range of subjects available to university students, a certain Vice-Chancellor has been heard to refer to *Underwater Basket Weaving* (and in another country he might have added *101* to those words) when he was talking about electives. He was, of course, demonstrating that even a Vice-Chancellor can have a sense of humour.

It is important to look first at arguments in favour of such an introduction of a law subject. However, before launching into the pros and cons, are there basic, fundamental, criteria for the concept, criteria that may influence a decision from the pros and cons?

CRITERIA FOR A DECISION

Looking at the proposition from a negative position, if there are no aspects of law relevant to engineers, then there is no point in having such a subject. Indeed, *Underwater Basket Weaving 101* may be more relevant as it involves some form of technology.

As such, it is salient to determine if aspects of law can be identified that are relevant to the individual engineer, the engineering profession and the work situation of the engineer, then it can be said that those aspects are relevant and should be known by engineering graduates.

ONE ARGUMENT IN FAVOUR

The first thought in favour of giving engineers some, even slight, instruction in law is so that they know it exists. This may seem to be a rather convoluted concept, but consider: if an engineer encounters a law-related problem, he/she will not know that it is law-related unless the engineer knows such problems might exist in the work being undertaken. If he/she at least has a broad idea of what might turn up, then the engineer will recognise one of the Hydra's heads has appeared. The engineer may not know exactly what to do, as such, but he/she will know that it is time to contact a lawyer, explain the situation and set the lawyer to work. A few anecdotes will demonstrate the importance of knowing when to worry and when to summon that defence lawyer.

So, in what aspects of law should an engineering student be informed?

EMPLOYMENT, INDUSTRIAL RELATIONS, ETC

All engineering students (a gross generalisation, but probably close to correct) begin work as employees. Many stay that way all their lives. Some become employers.

Either as employees or employers, engineers should know that there are State and Federal laws (termed *awards*) covering employment. These laws deal with the individual relationship between an employer and an employee and follow from the common law contract of employment - mention of that immediately brings up the sources of these laws, which is background we need to know (that may also stimulate a despairing groan: so much of the law system is interwoven inextricably with other parts, one wonders just where the starting point should be).

WHERE DOES IT ALL START?

The Australian legal system has two starting points [1][2]. The oldest one is *common law*, which goes back centuries to the time of the Norman Conquest of England, when the king took on standardising the then very loose system by appointing judges who travelled from city to city and made English law uniform. In time, their decisions and those of their successors have become accepted as *common law*, based on precedent.

The other starting point is laws made by government, termed *Acts of Parliament*, or statutes, or legislation. As examples, there are laws on criminal acts and omissions; some laws cover the behaviour of citizens to each other. Crimes are *prosecuted* by authorities, while civil actions are *sued* by individuals. The Australian system is somewhat complicated because both Federal and State Parliaments can enact laws, but Federal law overrides any State law that conflicts with the Federal law.

Having got that cleared up, there are further complications: any Act (which is often unintelligible) can have subsidiary legislation enacted from it in the form of Regulations. It is these, rather than the Act itself, that usually relate to engineers' work. Examples will be presented later in the article.

Acts and Regulations that relate to engineers' work include those covering factories, shops and industries, Occupational Health and Safety (OHS) and the environment (clean air, clean water and noise). In addition, the WorkCover Department in each State issues a wide range of descriptive publications that explain how to apply these Regulations.

The seemingly-connected Federal Worksafe Department has a much less important role, apparently existing only as a background coordinating body.

Standards Australia issues standards on an enormous number of things and activities, all of great interest and value to engineers because these tell engineers how to design and build things. But Standards are not *law*; they are only advisory and a person is not bound to use them by force of Acts and Regulations. The trap is: if an engineer designs something that fails and causes damage, and a plaintiff can prove that it did not meet the relevant Standard, then the engineer may be both prosecuted and sued. More examples will come later.

BACK TO EMPLOYMENT, ETC

Engineer's employment is covered by a mixture of Federal and State awards, and by agreements reached between the Association of Professional Engineers, Scientists and Managers Australia (APESMA) and employers. APESMA is a member organisation of the Australian Council of Trade Unions (ACTU) and is by now quite influential. However, unfortunately for some working engineers, APESMA does not have an agreement with all employers and only looks after engineers who are members.

The other professional engineers' organisation, the Institution of Engineers, Australia (IEAust), has a different, purely professional function that is concerned with the profession's standing in the community, illustrated by its checking the content and quality of engineering courses at the universities. Members may refer to themselves as *Chartered Engineers*, which carries weight under certain circumstances.

Engineers also need to know something about the trade union system generally, because so many workers under engineers are members. The number of trade unions in Australia is quite remarkable, a recent publication gave a figure of 275, but only a few of those actually relate to engineering [3].

Summing up, a professional engineer is required to know under what award he/she is employed under and of which unions employees under him/her are members. The engineer also needs to decide whether to be a member of IEAust (worthwhile for professional reasons) and a member of APESMA (worthwhile for employment protection).

CONTRACTS

Many engineers are, or become, at some stage of their lives, engaged in buying goods and services. These engineers probably exceed those involved in *selling* goods and services, and those such as consulting engineers, who may be involved in both selling to clients and buying on behalf of clients. Both of those activities involve contracts, which come under the old common law system [1][2]. The way this works, generally, is that one party offers to do something, another accepts the offer, an agreement is reached, and then action follows.

The essential features of a contract are: the parties must both have the intention to create a legal relationship; there must be offer and acceptance, and consideration in the form of mutual promises; the parties must be such as can make a contract; there must be no misrepresentation, duress or undue influence, and the purpose of the contract must be legal. An example of those last two points, a contract between a shopkeeper and a local criminal to prevent the shop's windows being broken would be both illegal and made under duress.

Many engineering contracts begin with what lawyers term *an invitation to treat*: by the engineer sending out a specification to contractors and inviting them to offer to supply the goods or do the work described in the specification. The next step (after a contractor has been selected, which has nothing directly to do with the contract process) is issuing an order, which, of course, the contractor may refuse to accept. Alternatively, the engineer may finally accept and supply the goods or work. Incidentally, there is no need for a contract to be in writing. A word-of-mouth contract is equally enforceable, provided there's evidence (such as a witness) that offer and acceptance occurred.

The alternatives in that last step are important and can be illustrated by an experience from several decades ago when this author was a project engineer and sent a specification to some six contractors. One offer was half the others and should have been rejected, but the author's manager insisted on accepting it. So an order was placed, based precisely on the specification issued. There was a breathless pause, waiting to see whether the contractor realised he was in error and rejected the order. But no, a truck drove in, unloaded workers, materials and equipment, and started work, which implied acceptance of the order. It is interesting that occurred long before ethics became a topic in engineering work. Was accepting the obviously wrong offer unethical? Probably. Why was the contractor not warned? The young engineer was concerned about staying employed.

More recently, the author has been involved as an expert witness in a case in which a supplier of a mix of engineering

goods and services carefully spelled out exactly what he would provide. The review of the documents showed the order he received simply said to do what he offered to do and that he performed the task as was required by his offer. He is now being sued for non-performance but there is no substance in the claim for what are obvious reasons.

OCCUPATIONAL HEALTH AND SAFETY

The author has remarked elsewhere that what engineers do can injure and even kill people, often after the best of intentions that have been applied to a design. It is fortunate that this aspect of engineering (and other) work is an example of what is covered by an Act and Regulations, so it is known quite specifically what the authorities require.

Until recently, there were differences between the States, now being overcome by a move towards uniformity. The main emphasis in the Regulations is that employers must provide *a safe system of work*, which, curiously, is not defined in either Act or Regulation of the State of NSW, an omission that almost always allows an injured person (via his lawyer) to claim the *system of work was not* safe, and presents the defence with great difficulty when trying to explain that it *was* safe.

But there are still some other difficult areas, one of them being labour hire, in which a worker is employed by one firm and hired out to another, a situation often encountered by engineers. If strictly interpreted, the labour hire firm is responsible for safety because the labour hire firm is *the employer per se*, yet there seems to be a recent shift to making the workplace responsible to some extent, and, in some cases, entirely responsible.

NEGLIGENCE

Negligence is one of those legal actions that come under the general heading of *torts*, which are *civil wrongs*, and are distinct from *criminal wrongs*. Criminal wrongs (crimes) are actions that are considered detrimental to society and are prosecuted by government authorities, such as the police. Civil wrongs (torts) are actions between members of society and usually arise because of what one person has done (the defendant), who has infringed on the rights of another (the plaintiff), who then sues the defendant for recompense, termed damages [4].

There are three quaint legal differences between the two wrongs. A criminal action has intention behind it. On the other hand, a tort may be committed unintentionally. Success in a criminal prosecution must be beyond a reasonable doubt, while in a tort, proof is based on a balance of probability. Criminal prosecution aims at punishing the offender, while a tort action seeks to compensate the aggrieved person.

All three differences apply to negligence, which occurs when four factors can be proved: the defendant must have owed the plaintiff a duty of care; there must have been a breach of that duty so that damage must have been suffered, the damage was predictable or foreseeable, and there must have been a close connection between the damage and the defendant. If all four can be proved to a high level of probability then the Court will award some compensation.

Engineering Examples

Engineers become involved, principally, in two types of negligence actions. One is when a person, such as an employee, has been injured and seeks compensation. In these cases, it is difficult to argue against the employer's very real duty of care and that injury has occurred, and defence usually comes from the third and fourth factors above.

As a further tricky point, a person can commit both a crime and a tort by the same action, illustrated by an example given to classes some years ago. If a truck has an accident on a hill, drops a drum of toxic material onto the road and the drum rolls down, damages a car and spills into the stormwater system, *someone* will be prosecuted under the Motor Traffic and the Clean Waters Acts and can be sued by the owner of the damaged car for negligence because the drum was not secured on the truck. If someone had been injured by the rolling drum, then this would introduce further charges.

Many negligence actions on which this author has been an expert witness use the reasoning in the Latin phrase *post hoc ergo propter hoc*, which gives (for example) because X worked at Y Pty Ltd, therefore the injury must have been caused by the work he/she did there [5]. In many cases, this reasoning defies logic but is still offered by the plaintiff.

The other type is when a person or a firm suffers economic loss (as in the case mentioned in the last paragraph of the section on Contracts) and seeks compensation for that. This is, generally, harder for the plaintiff to prove that all four factors apply.

Success in both depends on showing that level of probability, with (in this author's observation), overall, the most important factors being the third, which relates to whether *a reasonable man* would have foreseen or predicted what happened, and the fourth, the *close connection*, whether the alleged cause really probably was the actual cause.

The standard applied to *foreseeability and predictability* is that of *a reasonable man*, a delightful fiction of English law explored by A.P. Herbert, and used in cases even today [6].

Unfortunately, professional engineers can get dragged into this negligence arena via their work and suffer from the slings and arrows thrown by outraged clients et al. A tale has been told of a civil engineering lecturer of a certain Sydney university who was commissioned to design a concrete structure, which he did, and one day while it was going up casually dropped by to have a look at it. Subsequently, the structure was condemned and the developer sued the builder and the lecturer, based on his casual visit, which was held to have been *an inspection*, during which he should have seen that the work was faulty.

The moral of all that is engineers need to be not only careful in their work, but ultra-careful in details, dotting i's and crossing t's, when getting involved in contractual matters.

PROTECTION!

Employees of a firm are protected by the shadow of the employing firm's insurance umbrella. However, professional indemnity insurance should be taken out once an engineer goes into any form of private practice. Certainly all consulting firms have such a policy that provides coverage for most

misdemeanours of a civil nature, principally negligence causing injury to a person or economic loss to a company. Of course, there is no protection from prosecution after a criminal activity - apart from observing the 11th commandment: *do not get caught*.

INTELLECTUAL PROPERTY

Engineers are unlikely to get professionally involved in real property, which is more likely to affect them in their private lives. Yet intellectual property has become an important matter in recent years and literally anything turned out because someone has put thought into it is this sort of property. The most common areas of intellectual property are patents on inventions and copyright of anything on paper or other media, whether written or drawn or otherwise produced, with all of such items being protected by Acts of Parliament.

There is a theory that engineers make poor inventors because they are taught so well *what is*, and that knowledge limits them from inventing anything *which is not*, so engineers are good at developing what has already been invented. Whether that is actually true or not, engineers seem to get involved less in patent actions than in matters of copyright. This may be because all the documentation that an engineer produces, be it specifications, drawings, etc, are copyright by the employer and therefore should be protected in the same way as *War and Peace* or *Lord of the Rings*.

Yet that is not necessarily so: copyright protection does not always work. When the author was working for a certain consulting engineer, the head of the practice discovered that a previous client had used the specification and drawings from a previous job for another job, by altering details on both to make them fit the new project (rather poorly, as it happens). The head of the practice was furious about this, of course, because the original work was based on a contract related to one specific matter and his *property*. The client should have come back and asked for new drawings, etc, but tried to save a few dollars. The consulting engineer chose to say nothing to the client, rather than create a worse relationship - after all, that client might come back in the future. This is, of course, a reversal of the ethics noted in the previous case cited above; here the client was being unethical, as well as breaching the copyright law.

SOME POINTS OF LAW INVOLVING THE STUDENT

Is there a contract (formal or implied) between the university and the student, which the student can claim has been breached if subjects are not passed? Can a university be sued by a student, claiming lecturer incompetence has damaged his future earning power? Not yet in Australia; perhaps in the USA?

Another query: a student is not an employee of the university, so he is not covered by OHS insurance as staff are. One Sydney university has a long concrete stairway, which was probably fairly frictionless when built and probably polished by the passage of student feet. One day, an important visitor slipped on the stairs and injured her dignity, and one might safely wager that many students had slipped, and possibly were injured, before that day. Could a student have sued the university as a *visitor*, which is also protected by the OHS regulation? Possibly. It would be necessary to prove the University had been negligent, because it *knew, or should have known* that the stairs were slippery. There is, actually, insurance cover for students on a university's property, but few seem to know what rights they have under that insurance.

But another question is: what covers the student when the university arranges a tutorial visit and no longer on *the property* but outside. What about vacation employment arranged by the university: is the university in the position of a labour-hire firm, and therefore liable for any injury the student suffers while employed? Or jointly liable with the place of work?

On another level, there are matters of criminal law that may apply to students. There is theft, not only of physical property, which has been known to occur, but also of intellectual property, termed plagiarism in academia. There is also assault, physical harm to persons (eg the recent shootings at Monash University on 21 October 2002), and damage to the university, staff or student property.

There are many legal issues involving students. All, it seems, are rarely examined and poorly understood, particularly by students, but also, one may accept, by staff.

A SUMMARY WITH A QUESTION

This necessarily brief skim through employment, industrial relations, contracts, OHS, negligence and intellectual property has provided enough to show that engineers need to know something about law, the legal system and how it all works. This applies whether the engineer is employed in industry or in private practice, at any level; but there is enough to suggest, very strongly, that the further one is up the organisational hierarchy, the more important law knowledge becomes.

The question from all the above is: is law covered in any engineering-related text? The most likely ones would be those on management and a quick hunt through several in this author's library found nothing in the *real management* texts, a possible exception being Mintzberg's, which has a chapter on means of controlling corporations [7].

Satisfying numbers of pages appear in two texts on engineering management. Samson has a quite long chapter on the legal environment [3]. Kinsky also has a full chapter [8]. Both are Australian books. A lack of the topic in books from the USA is surprising; perhaps it is in more recent publications. A surprising discovery: a very old engineering management book has two pages in which the writer stresses the need for the engineer administrator to work with the company's lawyers [9]. This author admits, with regrets and apologies, that law gets no mention in his own book on engineering management, but that work was intended to be a very general coverage of management topics for undergraduate students.

CONCLUSION

So the inevitable conclusion is that engineers need to know something about some of the issues that connect between their work and the law, or with the legal system. There may be no need to set up a special subject to cover that; perhaps the basics can be woven as a few topics into another subject. Postgraduate students who are more deeply interested can already take an elective as a complete subject. The need for topics at both basic and elective levels seems evident.

A cautionary note: there is no need for such a subject or topics to be dull and uninteresting. There is a lot in law that is extremely interesting, even amusing, as shown by Herbert, whose work may be dated but still full of life [6].

And a further, final, cautionary note, as remarked by one of Dicken's characters in *Oliver Twist*, *the law is an ass.* Sometimes, but it is still very real and surrounds the engineering profession in many interesting ways – which is why law knowledge is needed.

REFERENCES

1. Barron, M., *Fundamentals of Business Law* (2nd edn). Sydney: McGraw Hill Book Co. Australia (1998).
2. Vermeesch, R.B. and Lindgren, K.E., *Business Law of Australia* (8th edn). Sydney: Butterworths (1995).
3. Samson, D. (Ed.), *Management for Engineers* (2nd edn). Melbourne: Longman Australia (1995).
4. Smith, D.J., *Engineers and Professional Negligence*. Melbourne: Thomas Nelson Australia (1986).
5. Gifis, S.H., *Law Dictionary*. Hauppauge: Barron's Educational Series (1996).
6. Herbert, A.P. *Uncommon Law*. London: Methuen (1935).
7. Mintzberg, H., *Mintzberg on Management*. New York: The Free Press (1989).
8. Kinsky, R., *Engineering Management*. Melbourne: Thomas Nelson Australia (1994).
9. Cronstedt, V., *Engineering Management and Administration*. New York: McGraw-Hill (1961).

Conference Proceedings of the *5th UICEE Annual Conference on Engineering Education* under the theme: *Student-centred Engineering Education*

edited by Zenon J. Pudlowski

The *5th UICEE Annual Conference on Engineering Education*, under the theme of *Student-centred Engineering Education*, was organised by the UNESCO International Centre for Engineering Education (UICEE) and was held over the Internet and in person at Anna University, Chennai, India, between 6 and 9 February 2002. This volume of Proceedings includes papers submitted to the Conference and offers a manifold collection of almost 50 papers detailing various international approaches to engineering education and specific activities.

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- Learning strategies and methods in engineering education
- Course development in engineering education
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- Multimedia and the Internet in engineering education
- Case studies

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