General Practitioners March 2021 Newsletter

Welcome to our first newsletter for 2021. In this issue we are fortunate to have been provided with some insightful figures on the financial performance of an anonymous engineer who started their own consulting practice, with their turnover and profits over the past 20 years.

We welcome Tamlyn Adams who has come on board as assistant editor. Tamlyn has written an interesting article on the corrosion resistance of stainless steel and its pitfalls in the incorrect environment.

We raise some questions on dealing with the spectre of being sued and how to carry on if it does happen, and we cover the changes noted in engineering since the 1960s. Finally, we have included some helpful engineering tips on stainless steel and green or dry timber.

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Message from the Chair

Hi all.

The new year is well underway – in fact, it is 1/6th of the way through. As a nation we are still struggling with Covid and in spite of some complacency in the community, still seem to be ahead of it. The hopping in and out of lockdown is somewhat stressful but the building business carries on and I for one am as busy as ever.

Our membership continues to grow with (at last count) 196 now belonging to our group.

This year will see the webinar series continue with Gordon Hughes already having delivered the first in a series on 'Lessons to be learnt'. We have more coming with Martin Pratchett working at assisting some of our members to develop these further. Look out for some new material on keeping basic detailing compliant while not making it too complicated. Especially useful will be some work we are doing on simplified approaches to the design of details and structures.

We are also looking at providing guidance on Design Features Reports (DFR) and how these can be developed to communicate design philosophy. The DFR's are powerful tools to not only assist in establishing an approach to the design of a project (eg load paths and generating a list of elements that require design) but to also communicate this to those who will review the calculation documentation. Using a DFR well will make it easier for your design, for the council to check your calculations and it will enhance your credibility.

Another series we are working on is a simplified approach to QA for small projects.

Our submission on the CPEng Review was well received and we have been invited to engage directly with the ENZ group who are developing the Review leading to new policies, rules and eventually modified legislation. It is good to note our voice being heard and having an input to how engineers will move into the future. It is vital that we EGP's have a part in this process to ensure that we are not lost in the drive for specialisation and the important work being done to develop ever more sophisticated design processes. These developments are important, but the old knowledge is no less valid just because we find more detailed ways of describing and analysing the performance of systems.

This year the SESOC conference will be held in Hamilton (Covid permitting). We have been discussing with the SESOC committee and the conference organising committee what part the EGP SIG can play in this event. I am pleased to let you know that SESOC strongly support us having a part in the conference and we have been developing a program to this end. We are looking for small practitioners who would be prepared to share some of their experiences at the conference. Ian Watson, Julie Elliott and I are heading this, and we hope to have approval from SESOC shortly so that we can develop our program in more detail. We will be in touch with the format and a request for input soon.

I know many of you will think that you are not equipped to speak to a large group. We are developing some different formats for our presentations to make this easier for those of us not used to speaking to large audiences. Please consider becoming involved and sharing your experience with others. Let us know if you have an idea.

All the best for 2021 and here is hoping that we will beat Covid in the near future.

Pete van Grinsven

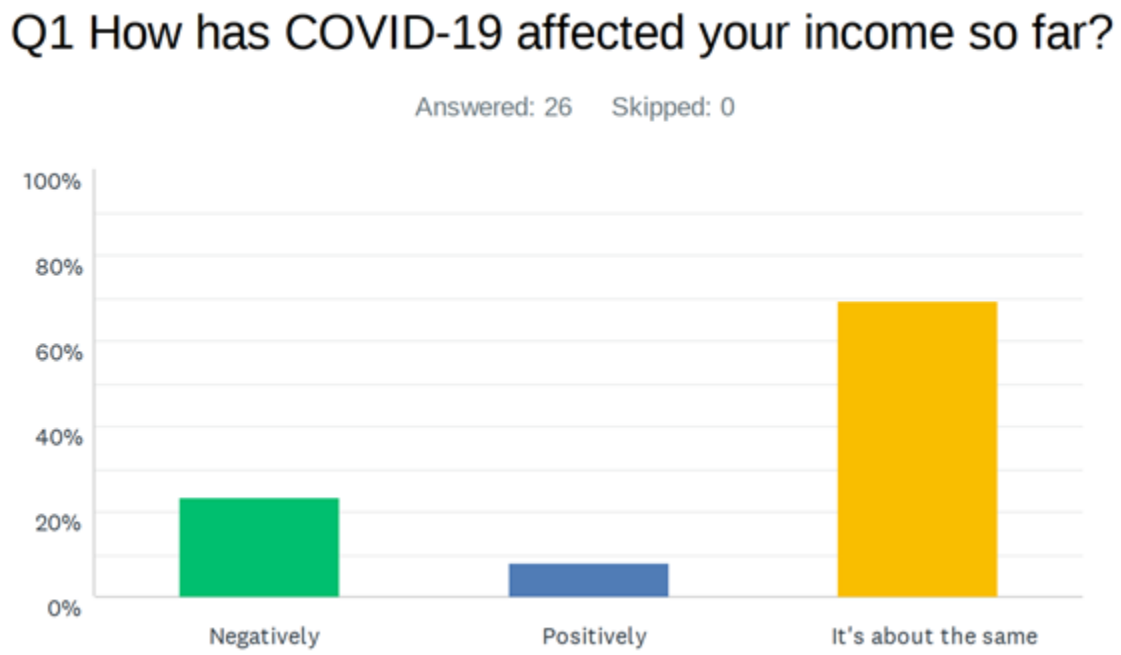
The EGP One Question Survey

This issue we are asking Engineering General Practitioners:

What do you consider to be an appropriate charge-out rate for a Chartered Professional Engineer doing your work (in dollars per hour excluding GST)?
Note: if you have different rates depending on the type of work you do, choose the most appropriate. All submissions will be anonymous and presented as a chart in the next issue.

Take Survey

In the last issue we asked how COVID 19 affected your income last year?
Here are the results:

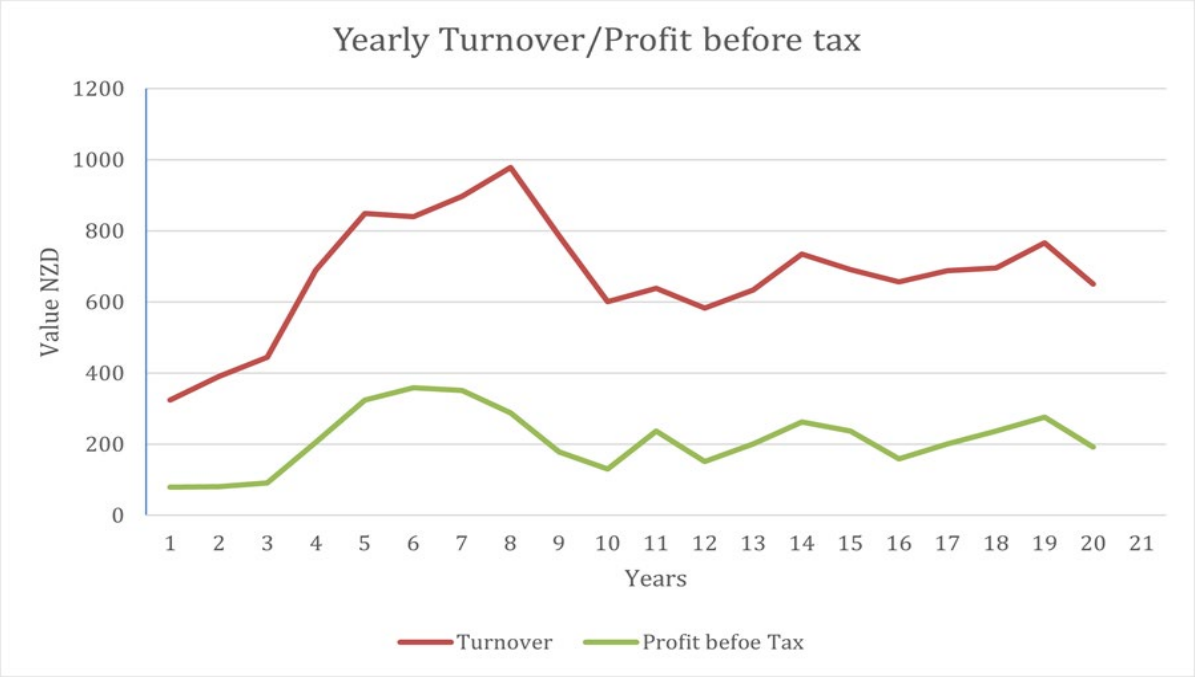


Financial Performance of a Small Consulting Practice Over the Last 20 Years

Anonymous

There seems to be very little published information on the financial performance of small consulting engineers' practices other than a study done by the Waikato University in the 90's.

A senior engineer who wishes to remain anonymous has shared the following information which may be of interest to other practitioners and with the hope that others can obtain adequate financial rewards in line with skills, value created and risks.



Notes

1. Year 1-6 was based in a large provincial centre with a total of 6-8 staff
2. Part of the practice was sold in year 5, shifting to a larger city, having retained half of existing clients. No employees just senior engineer and wife (who carried out all administration and financial duties)
3. Total salary for the Engineer and his wife per year were:

- Years 6-9 $190,000
- Years 9-15 $232,000
- Years 15-20 $265,000

Editor's note: Although turnover tends to fluctuate for various reasons in any business, the above graph appears to show a good correlation between profit and turnover, with profit being approximately 35% of turnover.

Is Stainless Steel the Best Option for Corrosion Resistance?

Tamlyn Adams, Chartered Member of Engineering New Zealand

It is becoming increasingly common to use stainless steel elements and connections in corrosive environments, such as coastal areas where the structure could be exposed to salts from the sea. Some Councils are pushing for stainless steel connections in these areas to satisfy B2 durability, but is this the best idea? Could this lead to catastrophic failures?

Stainless steel is known for its resistance to corrosion in most environments in which other steel alloys tend to corrode. It is however not impervious to corrosion and the way in which it corrodes should make engineers think twice before selecting it to satisfy durability requirements of the Building Code.

Stainless steel's corrosion resistance is a result of a thin oxide layer that forms on the surface of the steel due to the atoms (particularly chromium) within the stainless steel alloy reacting with atmospheric oxygen. This oxide layer, referred to as a passive layer, resists corrosive environments and is constantly self-renewing. If a section of the stainless steel is depleted of oxygen or exposed to certain chemicals, this passive layer starts to break down and the oxide layer cannot develop or renew. This is when the stainless steel starts to pit and corrode. Apart from chemical exposure (such as pool chlorines) biofouling, painting, salt build up and even the use of large isolation plates can all prevent the chromium oxide layer forming, resulting in the stainless steel rusting.

Galvanic corrosion is another form of corrosion, although it is more likely to affect other metals that are in contact with stainless steel rather than stainless steel itself. Galvanic corrosion occurs when two dissimilar metals come in contact with one another in the presence of a conductive liquid (eg: rainwater, sea spray or even condensation). Salt and pollution significantly increase the conductivity of the water hence the corrosion rate is higher in coastal and industrial areas. Stainless steel, for example, will absorb the electrons of carbon steel when an electrolyte (moisture) is added, thereby corroding the carbon steel. Luckily galvanic corrosion between dissimilar metals can be avoided by separating the two metals with isolation pads, galvanizing the carbon steel, where the zinc from the galvanizing is sacrificed rather than the carbon steel and lastly to reduce the exposure of the metals to electrolytes.

Although Stainless steel has better corrosion resistance to other alloys, it does still corrode. The biggest issue is that this corrosion is often not visible or significantly noticeable. Pitting corrosion happens when there is a localized breakdown of the oxide layer and the material starts to form pits (small holes) along its surface. This pitting may seem small on the outside but can spread like veins beneath the external surface, corroding a far larger area than can be seen from the surface and can also form stress corrosion cracks in tensile loaded areas. Pitting corrosion, once initiated can have a relatively rapid growth rate, which can result in catastrophic failure. Unlike other steel alloys where the corrosion can be monitored and maintained, stainless steel corrosion is not as easy to identify.

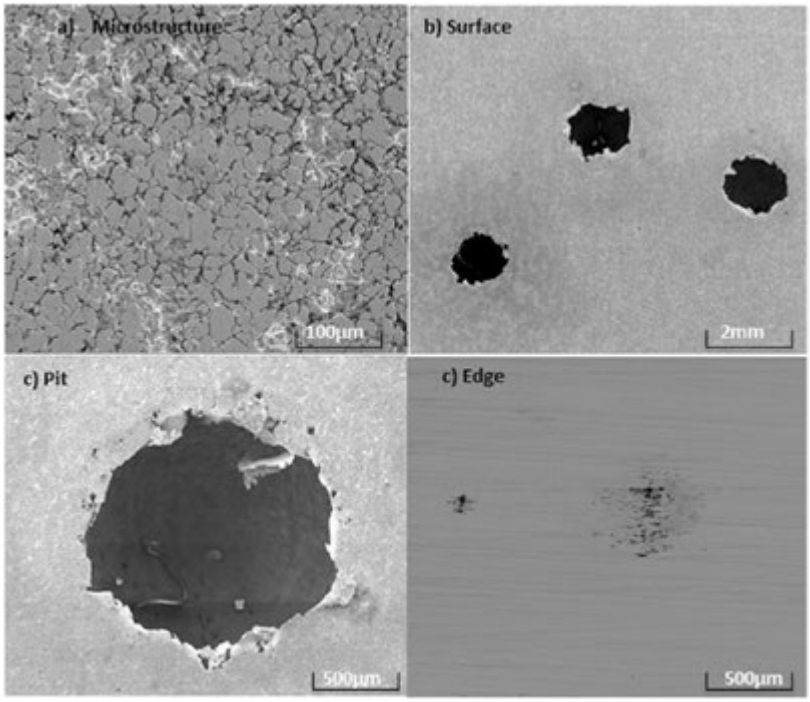


Figure 1: Pit morphology at the surface and edge of a tested specimen (Journal article: Accelerated pitting corrosion test of 304 SS using ASTM G48 by J Bhandar, S Lau, R Abbassi, V Garaniya, R Ojeda, D Lisson, F Khan)

There have been many incidents around the world within swimming pool areas where roofs and elements attached to roofs have failed and collapsed due to stainless steel corrosion. The most significant was probably in 1985 in Uster, Switzerland where 12 people were killed when a concrete roof supported by stainless steel tensioned rods collapsed.

In conclusion, stainless steel (particularly 316 not 304) has far better corrosion resistance than other steels in certain environments. Using the material in areas with high Chlorides such as swimming pools and seawater/sea spray is not recommended and personally I prefer to use methods such as galvanising, painting or the use of a sealing tape, where the elements can be monitored and remediated/replaced when required. Lastly, always be mindful of the use of structural elements, the ability to maintain them and the consequence of failure when selecting the material and protection systems for your designs.

Keeping Sane

Ian Watson, EGP SIG Committee member

I was having a quiet moment at home with my family on a Saturday morning and a strange car pulled into the driveway. I approached the car and a well-dressed man stepped out and addressed me.

“Mr Watson?” he asked
“Yes” I replied

He handed me a ream sized bundle of papers and said:
“You are being served with these documents; you may want to call your legal adviser.”

With that he backed down the driveway and drove off. Can you imagine how I felt? Fear, panic, cold sweats, and that is before I read the documents!

What followed were sleepless nights, hours and hours of time preparing defence documents, time attending hearings. Throughout this time feeling low and with the knowledge that this could go against me and I would have to pay a hefty settlement.

That was 20 years ago so I survived, but the experience was a hard lesson.

How do we manage ourselves as Professional Engineers during these times? How do we cope?

I would like to pursue this in more depth with our members either in a Webinar or by an address at a conference but for now I want you to consider these points:

1. It is a fact that as engineers we are highly exposed to being sued, often through no fault of our own, rather by virtue of the work we do.
2. How well does our training equip us to deal with problems on an emotional level?
3. How can we organise our work practices so that problems are dealt with before they escalate to a dispute or a claim?

If you identify with these sentiments, send me your experiences or comments:

Find me on the SIG Slack channel or email me at: i.l.watson@outlook.com

Reflections from an EGP Engineer

Gordon Hughes, Fellow of Engineering New Zealand
What was it like as a designer and how have things changed? I have noted a few recollections through the decades below:
1960’s

- Design Codes NZS 1900
- Calculation by hand moment distribution, Steel Designers Manual, Reynolds, Hemi slide rules, logarithm tables, Dorman Long steel section tables
- Working strength design apart from plastic hinge design in steel
- Drawings with Tee and Set squares on ‘butter paper’ then traced in ink onto film or tracing paper
- Plan printing on machines using sensitised paper with lots of Ammonia fumes
- Specifications copied onto Gestener copying machines
- Surveyors in the office using mechanical calculators by winding handles back and forth
- Bridge waterway calculations based on topographic map
- Geotechnical drilling was limited to large scale projects and bridges

- Introduction of Scala penetrometer tables prepared by fellow work mate engineer Mike Stockwell

1970's

- Development of Ultimate Limit State design methods
- Influential seminars at Canterbury University by Park and Pauley
- Drawings in pencil and ink directly onto tracing paper
- Development of Limit State standards and gradual change from WSD
- Introduction of electronic calculators
- Loading Codes from 1976 NZS 4203

1980's-1990's

- Rogernomics era fee competition and abandonment of scale fees
- PC's and software CAD drawings becoming more widespread
- Photocopiers
- Fax machines
- Gradual move away from paper records with drawings stored on discs
- More emphasis on ductility and introduction of capacity design
- HERA publications and guidance
- Concrete and Concrete Masonry Design Handbooks

2000's and beyond

- Introduction of new Loading Standards NZS 1170
- John Scarry's Open Letter
- Increasing and wider use of Spreadsheets
- All drawings in CAD
- Emails
- Cloud storage
- Quality of structural engineering
- Canterbury and Kaikoura earthquakes

While the changes have made things simpler for engineers, has the quality of design in General Practice improved because of improved technology? Are we relying too heavily of technology, particularly in the latest generation of engineers? Do we still have a good enough understanding of the basics of engineering to be able to interpret this data to ensure errors are not made?

Engineering Tips

Bruce Tricker, EGP SIG Secretary

TIP – Stainless Steel Design

When working out the bending strength of a stainless steel component a simple method is to use about 2/3 the strength of Grade 300 mild steel, i.e. 200MPa. Stainless steel does not yield in the same way as mild steel. The general approach is to take the limiting stress at 0.2% strain. Tables and other design properties and methods can be found in SCI Publication P291 but for common grades like 304 and 316 the values of $Y_{0.2}$ are 200-220MPa.

TIP – When to Use Dry or Green Timber Properties

Until the Timber Structures Standard NZS 3603:1993 is replaced it is a 'simple' matter of referring to Section 2 and Table 2.1. For example, if you are designing a 2/290x45 deck beam that is supplied 'Dry' (<18% moisture content) and will be 'Wet' in service (>25% moisture content) then you use 'Dry' for deflection and 'Green' for bending strength etc. NZS 3604:2011 also notes elements that can be considered to be 'Green' or 'Wet' in service.