



CIVL2201 Structural Mechanics

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**Lab Report #1 – Material Properties - Comments**

Mean 3.13/5, median 3/5.

The 3 main aims of this lab session/report were to expose students to material behaviour, give them the opportunity to practice report writing skills, and particularly become familiar with Excel and drawing graphs. The ability to present and critically analyse data, experiments and observations is an extremely important professional skill to develop. In general, the quality of the reports was better than those from last year, so this is a good base upon which to build.

The instructions about assessing the report of a colleague were intentionally vague – but did anyone take the opportunity to tell their mate “Hey, this bit is wrong – I think you should change this”?

A key point about a report is that it is a proper document – not a set of unrelated paragraphs, figures and tables - that is why a sample report and template was provided. All graphs, figures and tables should be numbered and referred to in the text. Eg “The stress strain curve for steel is shown in Figure 2 and the results for all specimens are summarised in Table 4.”

This lab session was concerned with finding out the material properties of the 2 samples. There was no “theory” that predicted that the yield stress was going to be exactly 250 MPa. All that was known was that **typical** yield values for mild steel could be anywhere in the range of about 200 – 300 MPa – so there was not much scope for discussion of differences from “theory”. It could be stated that the yield stress was above the typical value for mild steel, hence it was likely that the specimen was a high strength steel. In the next lab report, experimental results will be compared with predictions from theory covered in the notes, and there will be scope for this type of discussion.

It was great to see that some students had gone to the effort of doing some extra research to find pictures of test machines or broken specimens from other sources. However, be very careful with taking information from another source and then denoting the figure as “Test machine for coupon test” – as the picture is *not* of the actual test machine! It may be better to write “machine similar to that used” or a similar phrase.

Also take care that the conclusions are justified by the results or evidence presented in the report. For example, it is reasonable to say “The initial elastic stiffness of the concrete in compression was approximately 20% of the elastic modulus of the steel in tension” – as this is what the results showed. Would it be reasonable to conclude – “Steel is much better in tension than concrete”? No – since concrete was not tested in tension, one cannot conclude anything about its tensile properties (unless reference is made to other studies/experiments etc).

Does concrete yield?

Similarly, some students took the initiative to mention some materials information from the lectures of Gwenaelle Proust, that might have referred to atomic structure or dislocations. While the information was fine, it did not relate to anything observed in the experiment – no observations at the atomic level were made. Unless there is a very good reason, discussion and conclusions should be limited to the data obtained in the experiment.

Some students also went to the trouble of doing computer produced drawings. This can be time consuming – and not always beneficial. A neatly hand-drawn image is quite acceptable for this course, and quite often will produce a better outcome in a shorter period of time.

Some common points that detracted from the quality of the report

- Units, incorrect units, MPA, mpa, Mpa
- it's or its. **It's** is short for **it is** and should not generally be used in a report anyway, while **its** is the possessive form of it – eg 'The steel was tested and its yield stress was 400 MPa.'
- **Use of first or second person (I, we, you, our). Rather than “we placed the steel in the machine”, it is better to write “The steel was placed in the machine”.**
- Inconsistencies – the stress strain curve might show the maximum stress as 0.4 MPa, but then the report later states that the yield stress was 400 MPa.
- In the stress strain curve diagram, 400 MPa is the appropriate vertical axis unit rather than 400.00 MPa or 400.0000 MPa (ie **significant figures**). In the horizontal axis, there is no unit for strain instead of (mm/mm).
- Use of smoothed curve without any dots or crosses instead of straight line in “xy scatter” graph with dots.
- Avoid putting big tables and calculations were put in the main body of the report. These tables should be put in appendices.
- Brief results of the tests should be mentioned in the abstract.
- All figures or photos taken from any sources should be referenced properly.
- Significant figures –  $E = 212002.234$  MPa. 212000 MPa is appropriate.
- Sentences begin with a capital letter And There Is No Need For Capital Letters to be used in the middle of sentences.
- Please use a space between a number and its unit – “5 MPa” rather than “5MPa”.
- Generally paragraphs should be separated by a blank line.
- Most reports did not show how to work out E of both steel and concrete
- Some graphs did not show the axes titles. It is meaningless with graph without titles.
- The curves from any graphs have to start from Zero not from the first point.
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Items to work on for the next lab report:

- Proof read
- Units
- Write as a “report” – all figures, tables, graphs referred to in the text.
- The method should be written in *past* tense – as the experiment has already been done.

Please ensure that the diagrams adequately show the test machine, the specimen and the direction of loading. A rectangle with an arrow pointing down does not give the reader a sufficient idea of how the experiment was carried out.

### **Marks**

The general marking scheme was that a “satisfactory” report would get 3/5. If the student does what is required, included most of the relevant information, given some reasonable diagrams, and only has a few small mistakes in calculations or grammar, then the mark is 3. Showing some initiative with respect to insight, taking some extra effort with respect to presentation or diagrams, making very few errors, gets extra marks (perhaps 3.5, 4 or 4.5). Making some fundamental errors (such as units, powers of 10), very poor diagrams, poor English, and the marks start to go down.

## Graphs

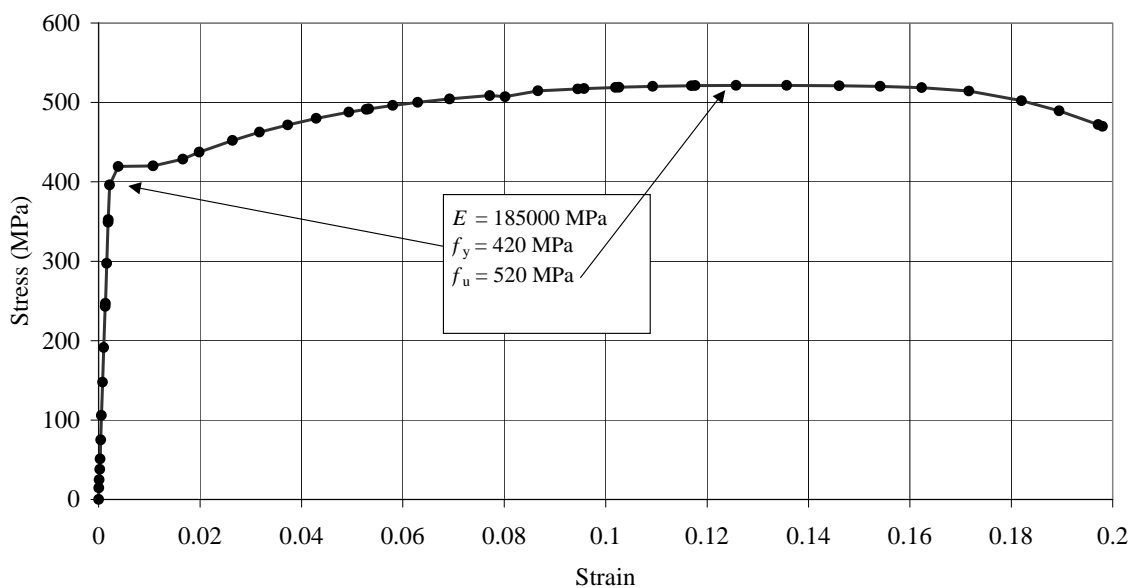
How should the slope of the graph be calculated? “Least square” - this was covered in one of the lectures.

The next three graphs are “good examples” of presentation. Students should note some of the important features:

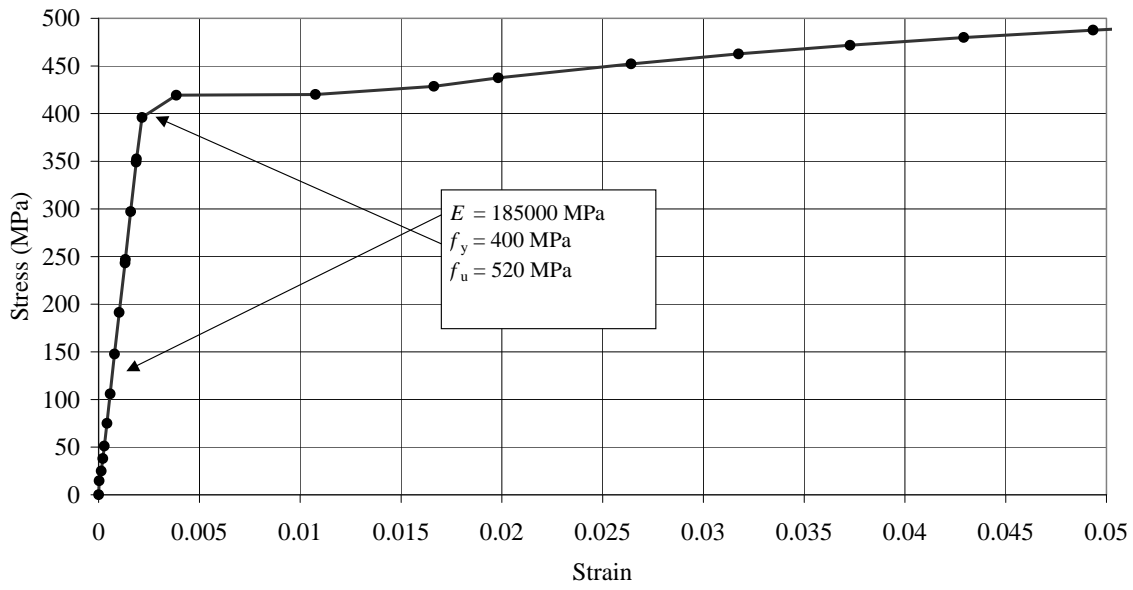
- Heading clearly identifying what data given in the graph.
- Axes labelled with units
- Dots (or crosses) for the actual data points
- “Decent” size graph, taking up the full width of the page.

(Note the values in these graphs are not applicable to the 2009 results)

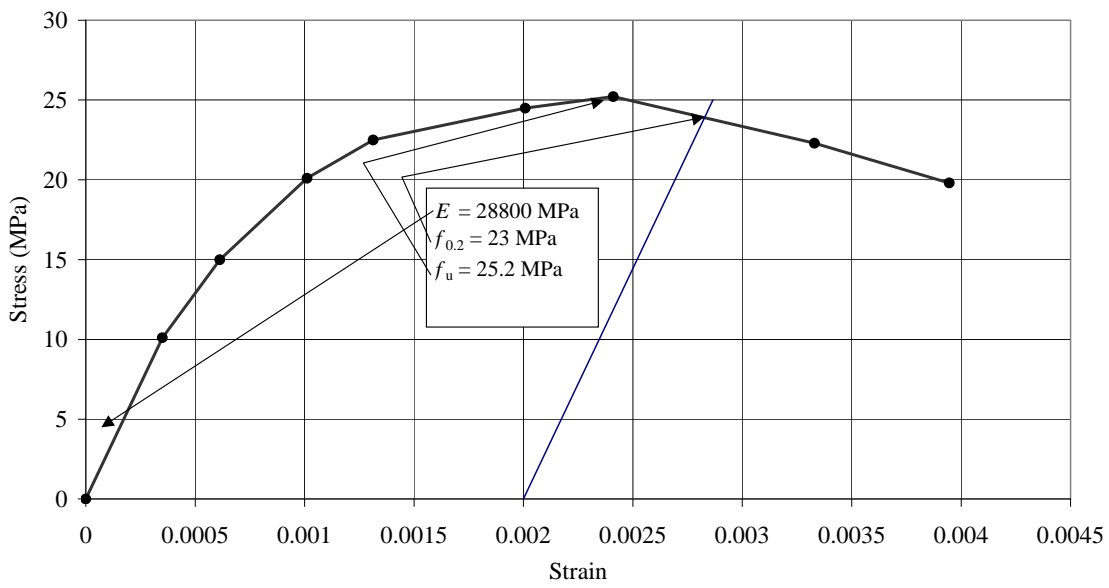
Stress Strain Curve - Steel



### Stress Strain Curve - Steel

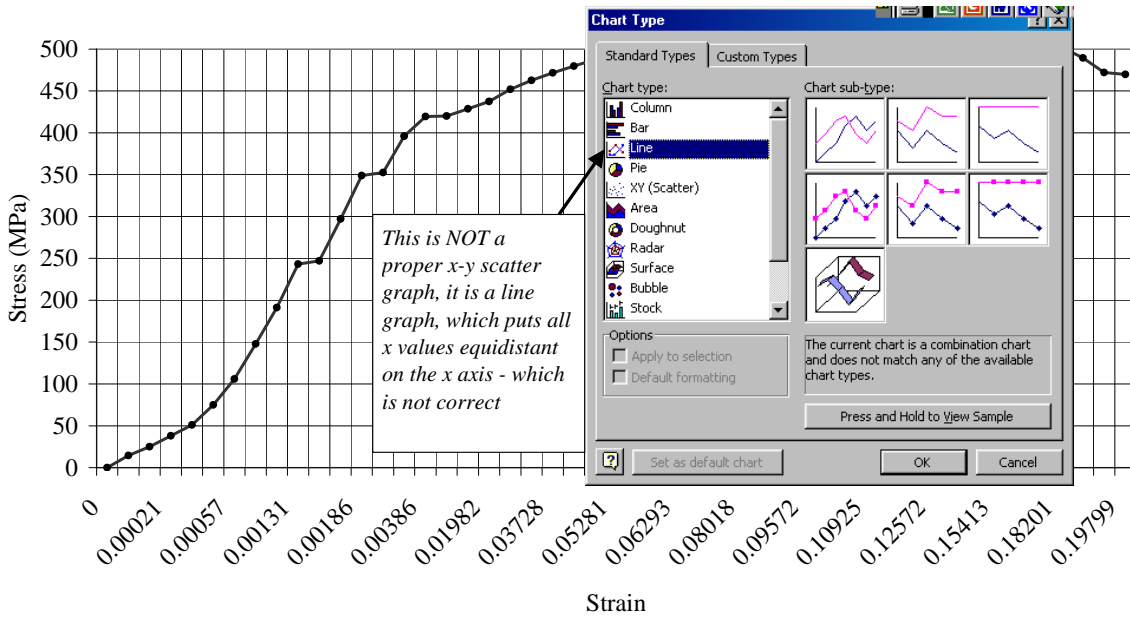


### Stress Strain Curve - Concrete

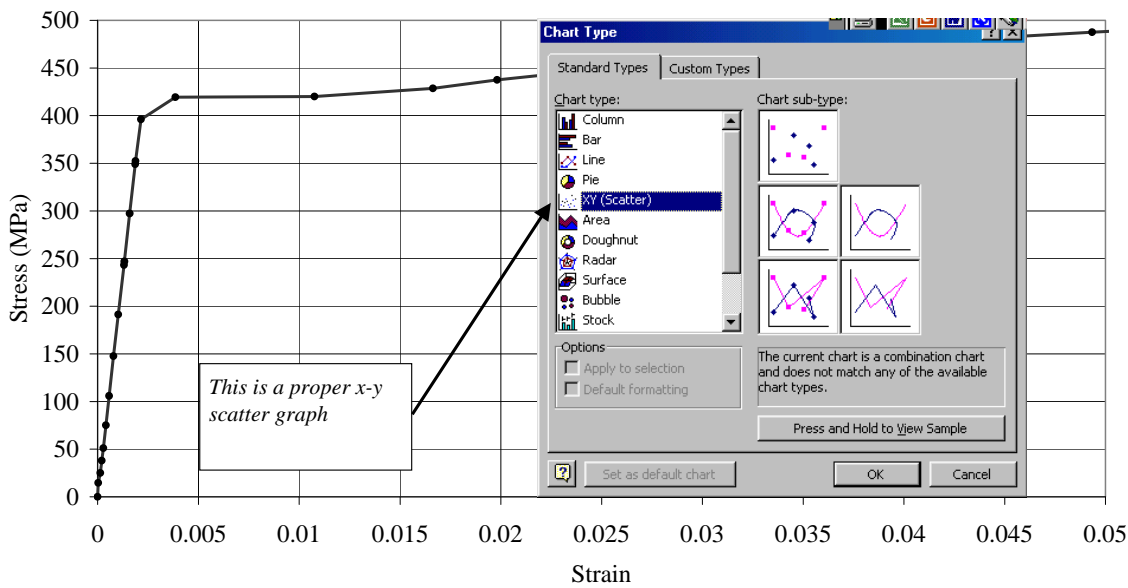


A common error was to use a “line” graph rather than a proper “xy scatter” graph as can be seen in the two examples below. It should be clear that the “line” graph is giving most unexpected results. **Most of you had fixed this problem up after the quiz.**

Stress Strain Curve - Steel

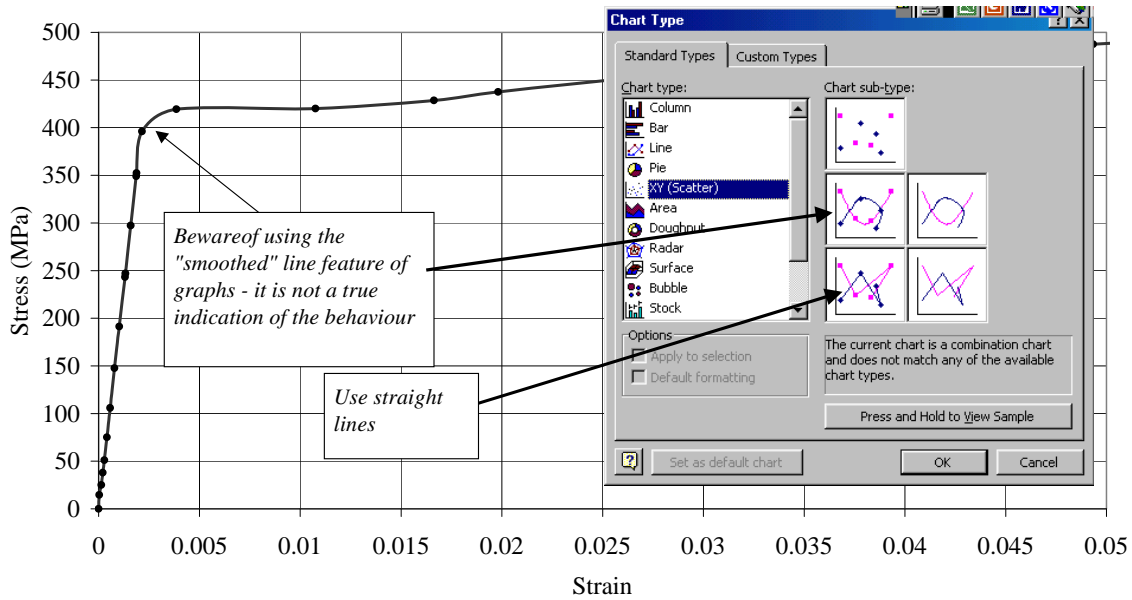


Stress Strain Curve - Steel



Finally – be very careful with using the “smoothed line” feature of excel graphs – as it may produce graphs that look strange and do not correctly represent the behaviour. Strictly speaking, the only points one can be sure about are the actual data points themselves, and the exact behaviour between the points is unknown. However, it is common practice to join data points with straight lines – using smoothed lines implies behaviour that one might not be sure about.

Stress Strain Curve - Steel



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