PROJECT REPORT FORMAT

Your report must comply with the following format. An example of such a report can be found on the BEB100 OLT website.

- Title Page (includes the following: Unit code and title, Name of project, Your name and Student number, Date, Your tutor's name, Workshop number, and a signed statement saying that the report is your original work).
- Executive Summary (one half to one page in length; this is essentially a summary of the objectives of the project, of the key outcomes of the research, of your conclusions and/or of your recommendations)
- Table of contents
- List of figures and tables
- Introduction to report (the objectives of the project, some background to the project, description of the layout of the report)
- The main body of your report which should be between 5 and 10 pages long. It should contain any tables, figures and diagrams you may wish to include. In this section your team must also report on the following:
    - Matters pertaining to the design, construction and testing of the artefact:
    - There is a proposal to construct two new developments in remote locations, one in the Northern Territory, the other in another country.
        - Your company is being asked by NT politicians to consider locating that new one in Arnhem Land to provide local employment opportunities.
        - The new development considered for construction in another country is also being sought for local employment opportunities. Unemployment in that country is around 60%, so labour is very cheap and your company is keen to take up the opportunity. Community groups in that country are desperate for the proposed new facility's injection of capital and wages into its poor economy, to help diminish local crime and suicide rates and to help ward off constantly impending starvation. It's widely known and openly required that any company wanting to do business in that country must pay what are called "procurement fees" to local and national politicians to get the project accepted.
        - Your company has been commissioned to provide a preliminary discussion of the implications of these two proposals. You will be required to provide approximately 1 page of discussion on the social and ethical factors that might impinge on the construction of each of these two new facilities – that is a total of approximately 2 pages.
    - You must also include approximately one page of discussion about the ways in which your team operated throughout this phase of the project – draw on your team's agreement, minutes and peer assessments in TeamWorker as well as each member's feelings about whether you all worked together successfully as a team, about what could have been done differently, and so on.
- Conclusions from your work.
- Recommendations from your work.
- Any references you may have used.
- Appendicies as follows:
    - the first appendix should contain the scaled drawings of your artefact, presented on one folded A3 page; you should present a plan view and elevation, and/or a 3D view whose preparation will be described in the graphics lecture on 30 April;
    - the second appendix will be a full printed copy of your team's agreement, its minutes and its peer assessments, all printed from TeamWorker's records;
    - the rest of the appendicies could be data, pictures, diagrams, facts, etc that are not important enough to include in the main body of the report but are important enough to include in the report.

So, what about the report?

- Remember that's it's now the end of Phase 3
- The report is to be aimed at the ***client***
- Don't do a "sales job" – stick to the facts and to the good points of your design solution
- The ***client*** will want to know whether your solution is what the ***client*** wants, so have convincing arguments, facts and figures…

How do you tackle the report?

- Use the same template as for Assignment 1
- Comply with the brief
- Satisfy the statements in the CRA sheet

What should go in the body of the report?

- Between 2 and 7 pages on the development of your design, how it satisfies the client's needs, how the artefact demonstrated the key points of the design
- One page on the ethical issues you need to consider about building the development while dealing with the problem of "procurement fees"
- One page on the cultural issues you might face in considering building the development in Arnhem Land and how you might go about finding out about these issues

NB: do NOT write about how the development would change as a result of these ethical and cultural issues, but rather on what those issues would be in the first place

- One page on the operation of your team this semester…

About ethics and cultural matters:

Cultural matters:

- "Do not write about how the development would change as a result of ethical and cultural issues". You may have talked about how your house would change (& some may well have illustrated it) in part. That's OK, but the primary discussion should be about the INPUTS not the OUTPUTS.

Minimum expected on ethics?

- Some acknowledgement that business is done differently overseas (When in Rome do as Romans do)
- Should you do your homework to see what a fair price is (for corruption money) so you are not paying too much (as that is what you would do if you were trying to do business in your own country)?
- How much should you consider that the transaction is done at arm's length (A transaction between two related or affiliated parties that is conducted as if they were unrelated, so that there is no question of a conflict of interest.)
- The experience must not compromise your personal high standard.
- An additional point might be to argue for and against eg AWB oil for food program…

What should be in the conclusions and recommendations?

- *Conclusions*: list the key positive aspects of your design solution
- *Recommendations*: list the concerns you may have and what action could be taken to mitigate those concerns…

XYZ000: INTRODUCTION TO AARDVARKS

EFFECT OF MAINTENANCE ON MISALIGNED RAIL WELDS

By: Melissa H. Murray S/N 09876543

2 April 2007

Tutor: John Hugenot
Workshop: DER 7, Wednesday 4-6pm

The work contained in this report has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the report contains no material previously published or written by another person except where due reference is made.

Signed:

EXECUTIVE SUMMARY

The high energy wheel/rail impact forces arising from defects such as poorly aligned welds in rails can in time cause serious defects in track components and deterioration of geometry. Suitable weld straightening operations improve the matter but there is uncertainty about the longevity of the effect and about what degree of misalignment (dip or peak) warrants straightening.

Three 2km long test sections were established on the Mt Isa Line in Queensland to evaluate the effectiveness of weld straightening operations. Each section received different levels of intervention to correct the welds and over 15,000 measurements of weld alignment were recorded and analysed over the life of the project. For welds with a dip less than 0.3mm, straightening produced no improvement.

Cycle tamping produced an improvement in the alignment of dipped welds but cycle grinding produced a slight worsening of dipped welds. After approximately 4 million gross tonnes of traffic the straightened welds appeared to remain unaltered by and large; those welds which received no straightening showed a minor worsening of both dipped and peaked welds due to the traffic.

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FIGURES AND TABLES

ABBREVIATIONS

CWR Continuously welded rail
QR Queensland Rail

1 INTRODUCTION

High energy impact forces are generated when wheels pass over rail surface defects. Continuous welded rail (CWR) has reduced the high maintenance requirements associated with jointed track, but welds are often not aligned perfectly.

The forces arising from poorly aligned welds can in time create continuous rail defects, loosening of fastenings, abrasion and skewing of sleepers, crushing of ballast and loss of formation geometry.

Badly misaligned (ie dipped or peaked) welds should be recognised as severe track irregularities that need to be identified and removed – see Figure 1.

Welds can become defective in numerous ways such as: manufacturing processes where the weld alignment is not correct to begin with; manufacturing processes where following the welding the areas is ground while the steel has not satisfactorily cooled.

Figure 1 Dipped Welds

However, suitable weld straightening operations may solve the problem but there is uncertainty about how long-term the effect is and about how severe misalignments should become before welds need to be straightened.

2 PREVIOUS WORK

Train speeds and axle loads have been increasing inexorably, especially over the past 20 years, so the presence of dipped or peaked welds has become an important maintenance issue. Misaligned welds can cause the unsprung mass of bogies to bounce significantly, leading to large wheel/rail impact forces and consequent damage to rollingstock and track (Zhai 2001, 23). In addition, Esveld (2001, 97) showed that the noise arising from these actions is an environmental problem of growing concern that has called for legislation regarding acceptable noise levels. In order to mitigate impact forces on track, the National Code of Practice (2001, 36) specifies a maximum allowable degree of misalignment in existing dipped welds of 2mm over a 1m reference length.

The severity of impact loading depends on the severity of the rail surface irregularity. In most cases, welds that are slightly peaked at installation develop localised batter and spalling in the heat affected zone. However, the dynamic forces from these welds can cause deterioration of the track down stream from the weld.

Dipped welds perform differently; the constant pounding of the wheel-sets create localised track degradation, leading to ballast breakdown near a dipped weld. This will then result into the loss of track geometry in the form of bad top-and-line and consequent increase in impact force (Mutton and Alvarez 2003, 156). Tamping of the track can reduce the effect of defects by restoring good vertical alignment of the rail running surface (top). However, Figure 2 illustrates how the effect of tamping on misaligned welds seems at best to be temporary (Frederick 1978, 193).

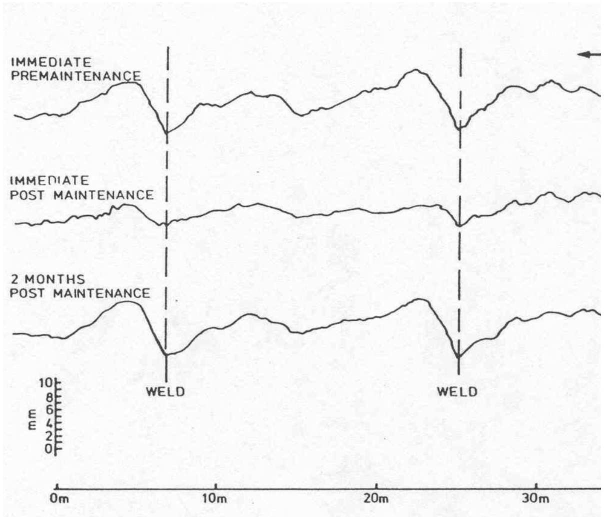


Figure 2. Weld shapes (Frederick 1978, 193)

3 TEST SECTIONS

A section of track on the Mt Isa line in Queensland, Australia was selected for this study. The Mt Isa line is fully operational system carrying mixed freight and passenger services and is owned by Queensland Rail (QR). The system starts at Stuart on the North Coast Line, 10 km south of Townsville, and services the industrial and rural communities of North West Queensland with all train being hauled by diesel electric locomotives. This single line track carries all types of traffic (passenger, freight and mineral) having different traffic tasks. Its track structure varies considerably from one end of the line to the other. Table 1 below shows the breakdown of straightening and maintenance measures on each 1km long division of the 6km test section.

Table 1. Details of test section divisions

Division of Test Section (each 1km long)	Weld straightening performed	Regular Maintenance activities
1	All dipped and peaked welds straightened	Tamping (twice).
2	Dipped & peaked welds ≥0.3mm straightened	Tamping (twice), rail grinding
3	No welds straightened	Tamping (once)

The degree of dip or peak to a misaligned weld was measured using both 1m and 1.5 m steel calibrated straightedges. The centre of the straightedge was positioned above the centre of the weld, and any gap between the rail and the straightedge measured with a taper gauge.

Over the space of the study 15000 readings of weld misalignment were taken in this way. Table 2 lists the dates at which measurements and maintenance activities took place.

Table 2. Dates of measurements

Date	Activity
Early July 03	Tamping, divisions 1, 2
Mid July 2003	Measurements of weld misalignment, all divisions.
Late March 04	Measurements of weld misalignment, all divisions.

4 RESULTS

4.1 Tamping

Figure 3 shows how the simple mean of the measurements of misalignment varied in divisions 1, 2 and 3. Now, only welds that were dipped at the time of measurement are included in Fig.3 so the results are only indicative and suggest larger mean dips than if all welds were included.

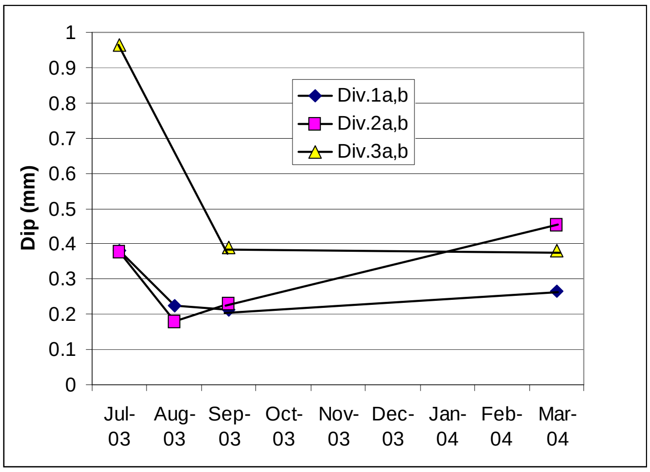


Figure 3. Mean of welds

4.2 Grinding.

Table 2 suggests that cycle grinding generally reduces the magnitude of peaked welds, which is not unexpected. The principal aim of cycle grinding is to remove continuous rail defects, minor rail surface defects and establish an effective contact band between wheels and rail by profiling the rail head. For cycle grinding to become effective at removing poor welds in conjunction with straightening, further investigation is needed.

4.3 Effects of Weld Straightening.

A comparison can be made between the history of the means of dipped weld measurements for divisions 1 and 2. In division 1 all dipped welds were straightened, whereas in division 2 only welds initially dipped more than 0.3mm were straightened. For only the months of July and August when straightening occurred, divisions 1 and 2 show the same mean dips before and after straightening. It may be, therefore, that there is no advantage in straightening welds < 0.3mm dip.

5 CONCLUSIONS

The paper has described a study of the efficacy of track tamping, rail head grinding, and weld straightening on the rectification of misaligned welds in continuously welded rails. Straightening of the welds produced a track with welds less than about ±0.4mm misalignment from flat rail. Measurements over a period of 8 months of traffic showed no obvious deterioration of the welds with time.

Cycle tamping without any other intervention seemed to reduce the degree of dip in welds, but other work shows the limited longevity of this effect. Tamping after straightening had little effect on the misalignment of welds. Programmed cycle grinding of the rail head produced a small reduction in the magnitude of peaked welds but some deterioration of dipped welds.

6 RECOMMENDATIONS

The project has identified the major factors affecting the straightening of rails, but the following factors need further investigation:

- The economics of cycle tamping of straightened rail needs clarification.
- There is growing pressure for a change in the misalignment threshold, so further investigation is needed for Australian considerations.

7 REFERENCES

The references below were sourced from the following databases accessed through the QUT Library: ABS Statistics, Blackwell Synergy, and SpringerLink.

Commonwealth of Australia. 2001. *Code of practice for the defined interstate rail network*. Canberra.

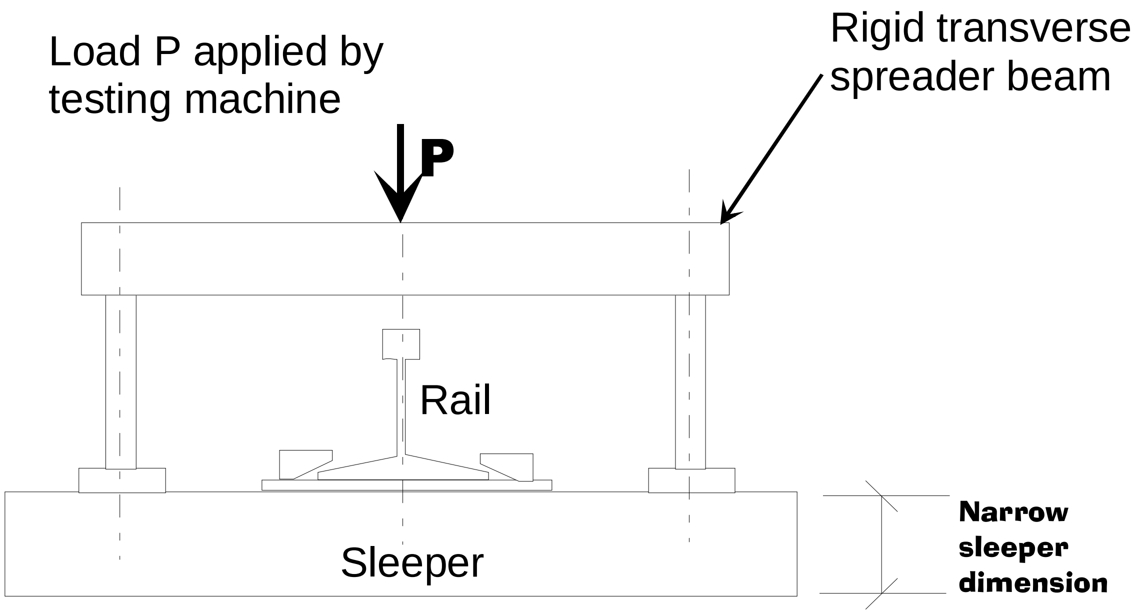
Esveld, C. 2001. *Modern railway track*. The Netherlands: Delft University of Technology.

Frederick, C. O. 1978. The effect of wheel and rail irregularities on the track, In *Heavy Haul Railways Conference Proceedings*. 193. Barton: Institution of Engineers, Australia, and Australian Institute of Mining & Metallurgy.

Mutton, P. J., and E.F. Alvarez. 2003. Failure modes in alumino-thermic rail welds under high axle load conditions. *Engineering Failure Analysis*. 11 (2): 151-161.

Zhai, W. M. 2001. Dynamic effects of vehicles on tracks in the case of raising train speeds. *Proceedings of the Institution of Mechanical Engineers. Part F*. Journal of Rail and Rapid Transit. 215: 23.

APPENDIX 1 – SKETCH OF SOLUTION



Front View of Uplift Test