Internet Appendix A8: Mechanical Engineering

Figure A8.1 Generic Template Commentary: A Current Student's Perspective (Suyash Mahto)

Pitcher's Name	OK	**Date**	OK
(A) Working Title	OK: It is important to decide this early on if the student is proposing their own thesis topic. In certain cases, however, supervisors may give the working title to students.		
(B) Basic Research Question	OK: A good way for students to test themselves and see if they know what the 'core question' of their topic is.		
(C) Key paper(s)	OK: Can be a good way of motivating students to start researching literature early on.		
(D) Motivation/Puzzle	OK: Very useful for the introductory section of the thesis as it tells the reader why the thesis was undertaken in the first place.		
THREE	***Three core aspects of any empirical research project i.e. the "IDioTs" guide***		
(E) Idea	OK: Helpful for students to understand what the crux of their thesis topic is. As was mentioned in the comments for '(A) Working Title', this information may be provided by supervisors. In such circumstances, this section would largely be redundant. Of course, a supervisor could also use this as a check to see if their students are able to understand and explain the idea(s) behind the thesis, in their own words.		
(F) Data	HANDY TIP: A lot of the data used in Engineering theses is produced through physical testing or simulations (e.g. computer-based simulations). As a result, questions like "Country/setting" and "Data sources" may not be relevant. This section can still be of use as it can help students plan out what sort of data they are aiming to collect – e.g. variables they want to consider, size of the dataset, limitations with the data etc.		
(G) Tools	HANDY TIP: In a Mechanical Engineering setting, think of this as 'Resources' – including any physical tools/testing equipment required for use in experimentation. Will you need to book certain labs to perform testing? Have you considered the procedures required to do this and issues relating to the availability of these facilities?		
TWO	***Two key questions***		
(H) What's New?	OK: Good to include this in the introductory section of the thesis, as it would help clarify what the thesis is doing differently.		
(I) So What?	OK: Complements the 'What's New?' component.		
ONE	***One bottom line***		
(J) Contribution	OK: Useful as the contribution of the project is important to consider.		
(K) Other Consideration	HANDY TIP: Risk assessment, with regard to obsolescence, is usually not a concern. For Engineering Honours students, 'Target journal' is likely to be a non-issue, as the end goal of the thesis is usually not to publish the paper in a journal (this can vary between universities, however, so it is worth clarifying this for your case).		

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Figure A8.2 Illustrative Pitch Template Example

Pitcher's Name	Suyash Mahto (13/9/14)
(A) Working Title	"Investigation of a theoretical function to describe damping in conveyor belts under non-steady state conditions"
(B) Basic Research Question	What methods exist to model damping in conveyor belts?
(C) Key paper(s)	(1) Lodewijks, G 1996, 'Dynamics of Belt Systems', Thesis, Delft University of Technology, Delft. (2) Nordell, LK & Ciozda, ZP 1984, 'Transient Belt Stresses During Starting and Stopping: Elastic Response Simulated by Finite Element Methods', Bulk Solids Handling, vol. 4, no. 1, p. 93. (3) Lodewijks, G 1997, 'Non-Linear Dynamics of Belt Conveyor Systems', Bulk Solids Handling, vol. 17, no. 1, p. 11. (4) Zienkiewicz, OC & Taylor, RL 2000, 'Finite Element Method Volume 1 – The Basis', Elsevier.
(D) Motivation/Puzzle	In industry, the majority of conveyors are currently designed using static analysis tools and the validity of using such methodologies, to analyse dynamic systems, must be questioned. During standard operating conditions, the dynamic properties of conveyor systems are relatively well understood. The necessity to study the dynamics associated with these systems, however, becomes increasingly important when long conveyors (lengths in excess of 1000m) are subjected to non-steady state conditions; such as emergency stops. The company currently uses an in-house dynamics software package to perform this dynamic analysis. While the software is operational, its damping module is incorrect and requires manual correction by the user to produce accurate results. This is not a major issue for those with extensive industry and modelling experience, however, becomes a significant problem for those without this knowledge. Failure to appropriately analyse these systems can result in poor engineering design; which as a consequence, may lead to premature failures of the systems and higher costs (both construction and maintenance costs).
THREE	***Three core aspects of any empirical research project i.e. the "IDioTs" guide***
(E) Idea	In dynamic analysis, the damping function is fundamental to obtaining accurate results. Particularly for long and/or complex conveyors, the lack of a suitable damping function will produce highly misleading results. Suppose these misleading results are used by company to design a conveyor system for a client – this will cause numerous problems. For example, the conveyor system may be overdesigned/over-engineered as a means of adding a 'safety margin' since its dynamic behaviour is not properly understood. This will not only cause the system to be more expensive; due to the overdesign, but there may also be high levels of component failures as these components cannot be optimally selected. Identifying factors which may assist in developing a function for damping can therefore allow the dynamic behaviour of the conveyor system to be understood more clearly.
(F) Data	The data required for this thesis will be site data obtained from current, operational conveyor systems and shall be sourced by the company. Ideally, the data should come from numerous different conveyor systems and should include the starting, stopping, and running cases. For each operating case, the following characteristics are needed: time,

	tension, velocity, and torque.
(G) Tools	Main resources expected to be used in the project include: Microsoft Office Suite and the company's Conveyor Dynamics Analysis Suite. No physical testing is expected to be required as site testing has been conducted previously.
TWO	***Two key questions***
(H) What's New?	The solution being developed will be novel. Literature and other publically available sources of information will be useful for guidance and ideas, however, there is no documented solution to this problem.
(I) So What?	Developing an improved damping module will allow for the software to be more refined and produce more accurate results. In turn, this will improve the overall design quality of these systems.
ONE	***One bottom line***
(J) Contribution	(1) Evaluating the existing damping module used in the software and assessing the limitations and flaws. (2) Proposing a refined method of modelling the damping in conveyor belts. This may build upon the existing method or may be an entirely new solution.
(K) Other Consideration	**Collaboration** and cooperation with UQ supervisor and work supervisors is highly desirable. Ideally, there should be a meeting once a week, with each party. **Scope** is well defined. The problem is specific to the extent that it provides a clear picture of the goal, however, is not too specific that it restricts any flexibility. **Risk** assessment. ▪ Competition is a non-issue. ▪ No-result is a strong possibility. There is a great degree of disagreement in industry regarding this topic and minimal collaborative efforts between organisations. As a result, the problem is highly complex and an ideal solution may not be achievable. It is, however, believed that an improved solution (even if not ideal) can be proposed.