UNIVERSITY OF STAVANGER

Preliminary study report of master thesis “Dynamics analysis of damping system in FS car using ADAMS Multidynamics Simulation”

Report for Master thesis planning and structuring by using work breakdown structure and Gantt chart

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Foreword

This preliminary study report is made for the master thesis in cooperation with Institute of Mechanical and Structural Engineering at University of Stavanger. The duration of the thesis is from 1st February to 15th June 2014.

The goal of this report is to show how a work breakdown structure and Gantt chart can take an important role in planning and structuring in the upcoming master thesis "Dynamic Analysis of Damping System in FS Car using ADAMS Multidynamics Simulations".

The goal of the master thesis is to analyze, design and build the suspension system for the Formula Student 2014 car. The suspension system that will be design must meet the requirement set by Formula Student 2014 rules.

The suspension system will be analyzed more accurately by using computer-aided engineering software, ADAMS. Components such as upper and lower A-arm, pushrod and damper and spring will be the main focus of the project. Simulations will be focused on determining suspension properties such as:

- Roll center locations
- Camber, caster, toe angle and scrub radius
- Angle change during wheel travel

The work breakdown structure (WBS) in this report shows different level of planning and executing different tasks. There will be 3 major tasks for WBS; Design, Analyze and Manufacture.

The Gantt chart in this report shows the project schedule, from start to finish. The major and minor tasks from WBS will be integrated into Gantt chart with critical path, slack and non-critical path.

Contents

1. Introduction

This report is based on the master thesis of the Formula Student project. University of Stavanger is one of 3 teams representing Norway to compete in Formula Student UK at Silverstone. A team of Bachelor and Master-students will design, analyze and manufacture the open-wheel electric car.

This year car shall be lighter than previous years. Hence, each component has to be design slightly lighter by either reducing safety factor or redesign some of the components. The suspension system also needed to be manufacturing in the cheapest possible way due to limited amount of founding. At the same time, the components have to be able to manufacture as fast as possible due to deadlines.

Previous years, the team had a problem of not be able to finish the manufacturing process of critical parts of the car in time. Hence, there was no testing prior to the competition. The WBS and Gantt chart will serve as a helpful tool to eliminate this problem.

The scope of this report is to introduce WBS and Gantt chart and its role in planning and structuring in in the upcoming master thesis “Dynamic Analysis of Damping System in FS Car using ADAMS Multidynamics Simulations”. There are 2 major goals in this report:

- To determined level of details of each activity as well as each component.
- To find the critical path of the activity plan.

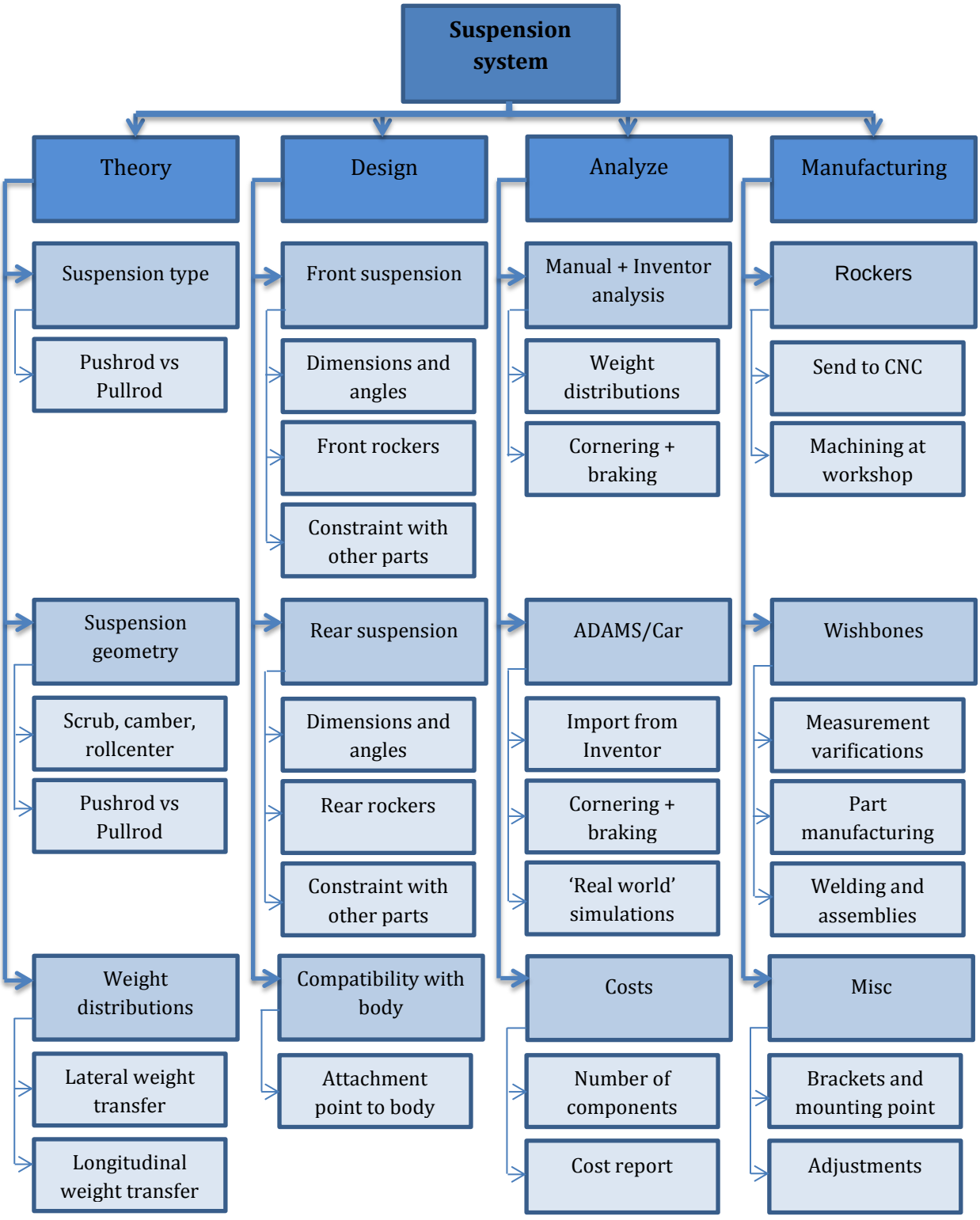
Milestone for each goal:

- Determined the amount of level of details.
- Determined each activity and divided into sub-activities.
- Add sub-activities into Gantt chart.
- Estimate time and deadline for each sub-activities.

The deliverable of this thesis project is to locate the optimal suspension geometries as well as design and manufacture lighter components for the suspension systems. Use of computer-aided engineering software, ADAMS, will give more precise feedback and better analyzing of the suspension systems. These will result in a better handling and control for 2014 car.

2. Work breakdown structure

WBS for this report is breakdown into 4 different levels:



3. Gantt chart

The Gantt chart illustrates the start and the finish date of the project. The deadline for the Master thesis is 15th June 2014. However, the car has to be finished minimum 2 weeks prior to the event at Silverstone. In this Gantt chart, the finish date for master thesis is set to 15th June 2014 and the deadline for the car is set to 25th July 2014.

The relationship between Gantt chart and the WBS from previous chapter is that the former is bar charts that keep tracks of different tasks across time. The Gantt chart will be used for schedule control of what is going to be done [1].It can be summarized to show a higher level schedule for executive review or breakdown to lower level schedule for task analysis [2].

Below show activity plan and activity schedule:

Table 3.1: Gantt chart

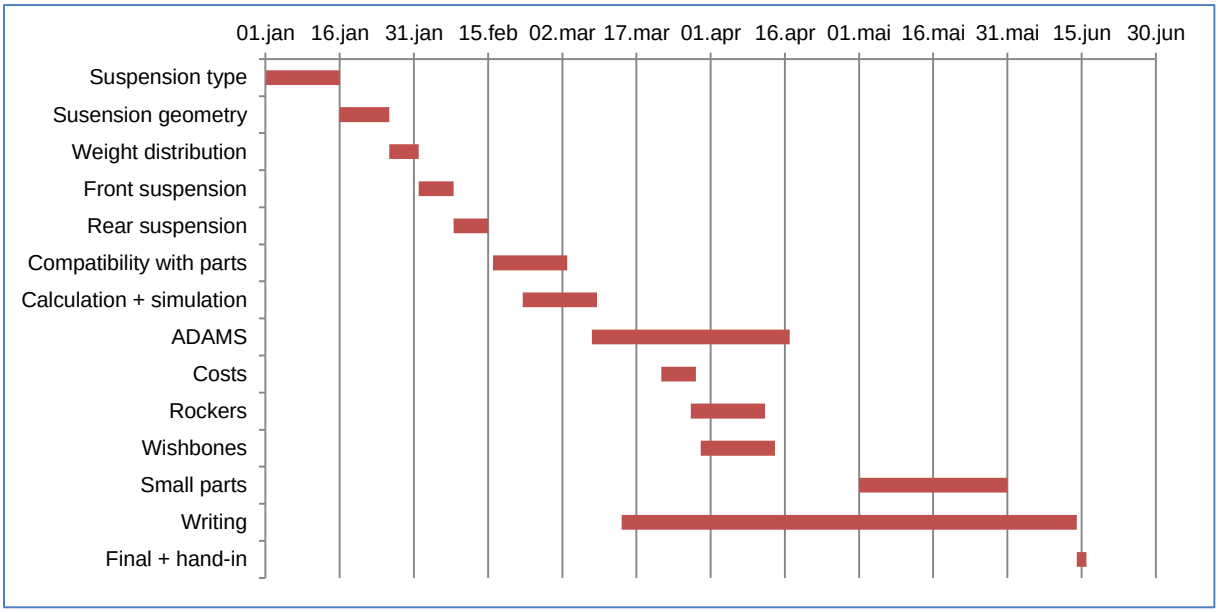


Table 3.1 shows Gantt chart during master thesis period. Red bars show the estimate duration of each activity which explains type of work.

After each of these activities is done, report will be sent to the suspension leader whom report directly to team leader.

Table 3.2: Activities schedule

Activity description		Duration			
		Activity code	Predecessor	Start	Duration
Theory	Suspension type	A	-	01.jan	15
	Susension geometry	B	A	16.jan	10
	Weight distribution	C	A	26.jan	6
Design	Front suspension	D	BC	01.feb	7
	Rear suspension	E	BC	08.feb	7
	Compatibility with parts	F	DE	16.feb	15
Analyze	Calculation + simulation	G	DE	22.feb	15
	ADAMS	H	F	08.mar	40
	Costs	I	G	22.mar	7
Manufacturing	Rockers	J	G	28.mar	15
	Wishbones	K	G	30.mar	15
	Small parts	L	JK	01.mai	30
Thesis	Writing	M	F	14.mar	92
	Final + hand-in	N	M	14.jun	2

Critical path: A, B, C, D, E, F, G, H, L, M and N

From table 3.1 and table 3.2 it can be seen that “Calculation + simulation” can be started almost 7 days earlier. Meanwhile “Rockers” and “Wishbones” have more than 2 weeks slack-time. During manufacturing process, unexpected events and delays will most likely occur. To prevent delays close to the deadline, the “Small part” activity is likely to be shift forward 2 weeks to give a better breathe room during the end of the project.

If any manufacturing activities take longer than estimated, the problem can be solve by outsourcing the process to 2nd year students or be more effective in manufacturing process.

The Gantt chart serves as a reminder that the later activities are highly dependent on the earlier activities. If one is delayed the master thesis may not meet the deadline date.

4. Conclusions

In this report, the WBS has been broken into 4 different levels. Each level contains more specific details of work that have to be done. The levels are shown in color coded, where darkest color is the top level and the brightest color is the lowest level. The WBS also shown that the work of the suspension systems is divided into 4 categories; Theory, design, analyze and manufacturing.

Gantt chart showed the activities and time schedule of each activity. Activities A, B, C, D, E, F, G, H, L, M and N represented the critical path. The Gantt chart also showed that there are some slacks in some of the activities. For this Formula Student project, slacks may be undesirable due to unexpected events and delays. It is also better to have more time leftover to properly test the car after the manufacturing process is finished.

The deliverable of this thesis project is to give better understanding of the suspension geometries. This will results in better handing and control of the car.

References:

[1] Duncan, “Relationship between WBS and Gantt chart,” 2013. [Online]. Available: http://www.projectsmart.co.uk/forums/viewtopic.php?f=2&t=1746. [Accessed: 20-Feb-2014].

[2] D. Espina, “What is the relationship between WBS and Gantt chart?,” 2012. [Online]. Available: http://pm.stackexchange.com/questions/4945/what-is-the-relationship-between-wbs-and-gantt-chart. [Accessed: 20-Feb-2014].