CHAPTER 8

CONCLUSIONS

8.1 Product general conclusions

An opportunity niche was found when this project was started, so the construction of the final prototype is highly recommended. Further surveys should be done so expectatives around the product can be evaluated in terms of ergonomics, comfort and security perception while driving.

Cost of the product must be defined in terms also target market should be evaluated about how willing it is to afford it.

Due to the conduit-based geometry, manufacture of each component of the subassembly of rear axle becomes easy to achieve, being its most complex parts the steering matrix and the spring supports. Such parts are susceptible of being processed in a CAD/CAM software to develop a program to be run in a CNC milling and/or turning machine. Specially for the steering matrix, a set of steps to reallocate the part during its manufacture should be set.

8.2 Steering device conclusions

Design of the steering system deals only with the variation of angle due to weight shifting. Tests on the final prototype are highly recommended to evaluate driving easiness. Also improvement in such device should be developed after evaluation.

Number of coils for springs can be reevaluated in terms of material saving, so it can be diminished.

8.3 Rear axle conclusions

Further studies about weight reduction are recommended to optimize weight lessing in module 1. Considering some high resistance non –metallic materials, such as polymers composites and certain types of plastic to be used in module 1 subassembly might derive in a better material reduction.

8.4 Finite elements analysis: materials performance

Finite element model analysis is perhaps the most important part of this thesis, being its results a good parameter of whether or not to use certain materials for the parts that form the assembly. Aluminum performance in main parts of subassembly as the steering matrix is acceptable; also rear axle and matrix conduits show a good performance under both static and dynamic load.

Static stress distribution is evenly present in almost all assembly. The most problematic part in terms of stress distribution was steering matrix due to a dangerous stress concentration in a rib considered in a first design. Following redesigns presented better stress distributions.

Behavior of assembly under cyclic force was satisfactory and is a good parameter to establish life time of product. However, it is recommended to run a 50E6- cycle test to realize about full behavior of the assembly.

Some dynamic tests additional to the one presented in this project can be done. Use of a workstation suitable to perform large-process FEA dynamic analysis is a must to achieve data of special concern.

Other materials to be considered for main parts are nylon 6/6 impact proof , which will reduce mass of steering matrix to a half of the one for aluminum 6061. However, for this purposal an impact test should be done due to the non-metallic nature of material.

8.5 Elements design: design factor

Design factor for every bolt was 4. This warranties a good performance under dynamic conditions and in all cases design trial diameter is over the one required for each case. However, it is recommended to keep such diameters until further tests in physical model and FEM impact test show the advantages and disadvantages of reducing such diameters.

8.6 Redesigns to smooth stress distribution

Mainly stress distribution in almost all assembly was uniform or at least evenly present. Steering matrix presented a dangerous stress concentration in the rib feature considered for the first design. Following redesigns helped to even such distribution and reduced stress that part experienced.

Material removal was done as a trial to smooth distribution with a moderate success.

8.7 Final mass properties.

Chart 8.1 shows final volume and mass for subassembly. Bolts were not considered for this calculation.

Chart 8.1 Final volume and mass for subassembly.

	Volume [m^3]	Mass [kg]
Rear axle conduit	0.00022	0.59685
Matrix conduit	0.00013	0.35044
Matrix	0.00010	0.27457
Spring support(x4)	0.00003	0.07114
Adjuster(x2)	0.00001	0.02000
Total	0.00057	1.54642

Final subassembly mass is reported as 1.546 kg with a volume of 5.E-4 m^3 . General assembly has a reported value of 7.84E-03 m^3 and a mass of 12.010 kg. This means that rear axle subassembly represents the 12.88% of the mass of the full assembly.

8.8 Recommendations.

Team work for future projects must be followed closely and it is suggested that for the project presentations every member of the team is present to provide deep details.

Partial evaluations for the full team should be set to warranty a general advance in the project.

Once a physical prototype is built, further assembly tests are recommended to set an assembly plan document that supplies a time-saving procedure for its assembly.

Definitions for principal features in each part must be set up to specify assembly principal points in parts.

Further studies for driving performance are recommended in final prototype in terms of braking, steering, and carrying.

Optional materials should be tested to accomplish a lighter device.

Manufacturing is an issue of special concern. Studies about its production, whether unitary or series, are recommended.