The repairability of car body panels in a circular economy
Case study: Microcab Industries Ltd

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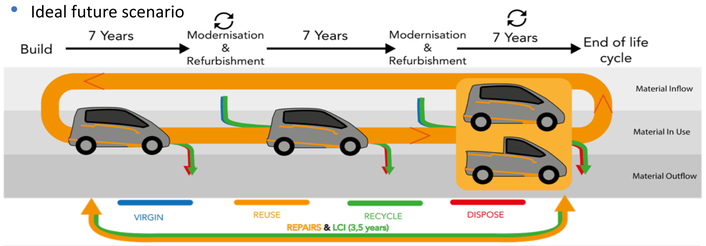
Summary

- Vision of Microcab is to increase the repair capabilities of the VIANOVA in a circular economy
- This research illustrates the elements that increase repairability and safety with regards to the VIANOVA
- The final concept offers a solution for Microcab to increase the repair capabilities a shift towards a circular design by creating a supportive front section and implement a different material
- The recommendation is to implement the elements in a specific order

Introduction

- The VIANOVA is a small city vehicle, that fits 2 people
- The research of Microcab focusses on the New mobility: thinking, feasibility and design with hydrogen economy as an important factor.
- Research focussed on Front section of the VIANOVA
- Increase annual production to 250-500 units
- 3 problem areas regarding repairability in a circular economy, focussed on the front section
  - Assembly/disassembly
  - Materialisation
  - Pedestrian and overall safety
- Ideal future scenario



Methods

- Analysis of company and relevant stakeholders
- Establishing a list of requirements
- Through literature review, field research and qualitative research, retrieving viable data related to the subject
- Determining most Frequent car damages
  - 26% is directly to the front (12 o'clock direction)
  - Overall rate of 51% on the front section of a car (Kurebwa, 2018).
- Development of front car bumper
- Influence of Passive safety measures
- Determining influence of aesthetics
- Material analysis, with regards to circular capabilities.
- Research existing surface finishes

Acknowledgements

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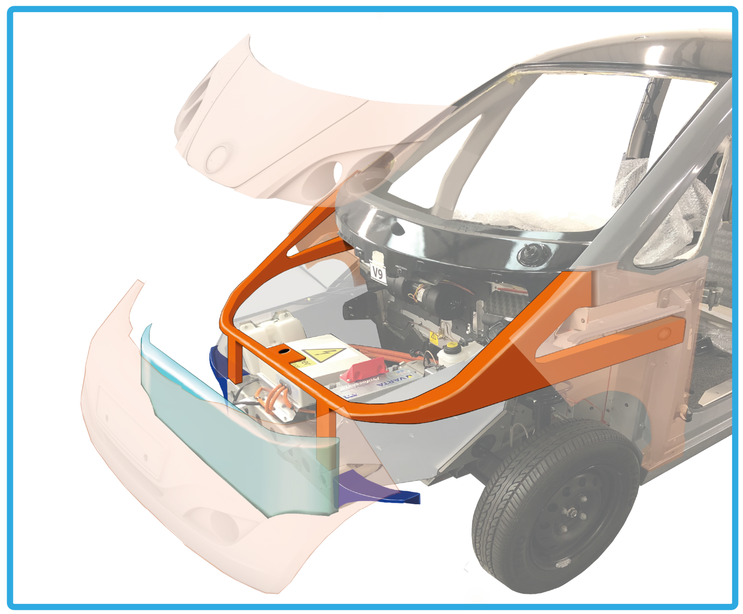
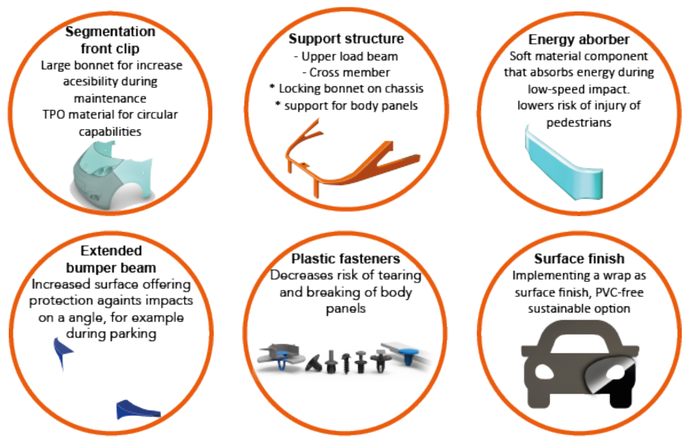
Result





Conclusion

- The combination of elements in final concept improve circular capabilities
- Repairability and safety is positively influenced
- Splitting the Front clip into multiple section would not have been a desirable solution as a stand-alone concept
- Thermoplastic olefin (TPO) is proven in the industry
- The results justify the combination of elements in the final concept
- All elements are relevant and contribute to make the final concept desirable, justifying the increase in costs (£745 vs £630, per unit)
- The final concept improves the VIANOVA and provides a basis to make the VIANOVA a Road safe vehicle

References

Kurebwa et al. (2019) https://doi.org/10.1155/2019/3927935

Recommendations

Implementation in specific order	How	Why
1. Energy absorber	• Implementing standard foam material (PE) • Cut into shape of available space • Determine how it influences to impact performance	• Desirable due added safety and repairability • Highly feasible due to the simplicity.
2. Support structure - **Upper load beam** - **Cross member**	• R&D optimal support structure • Use mechanical fastening on the chassis	• Required for separated body panels • Desirable due to added & repairability
3. Segmentation front clip - **Materialise TPO** - **Fasteners**	• Determine locations for fasteners • Mould design • Implementation	• High desirability • High feasibility • Requires funding to increase viability.
4. Extend bumper beam	The current final concept involves an intricately shaped bumper beam. • Start with implementing parts that can be bolted on the bumper beam as extension • Recommended to Simplify the design of the front bumper with regards to the fog light unit; • Determine available space and redesign energy absorber and bumper beam.	• Highly desirable considering the added protection • Feasible to implement • In beginning less viable • Redesign increases viability
5. Wrapping surface finish	• Test 3M PVC-free material • Test suitability • Acquire knowledge to do in-house	• Significantly improves circular capabilities → desirable • Will require training to become feasible and viable .
6. Noise dampening	• Re-evaluate noise dampening plates • Determine a better configuration on new concept • Consider traditional plastic closed wheel arch covers	• Desirable solution • Improves noise dampening • Potentially compensates added weight
7. Remove mechanical hinges  (Source: Renault)	• Develop mechanism that locks the bonnet in place and is fixated to the chassis with a secured line. • Review situation of Renault Twingo	• Compensates the added weight of the other elements. • Lowers costs • Vehicle ownership is maintained
8. Follow industry standards	• Obtain certifications that can improve brand image and market position • Creating a roadmap can help communicate the priorities from the conclusion to relevant stakeholders	• These standards tests the value of long-term sustainability, meaning a high viability. • Can increase funding
Additional step: Implementing mould in repair process 	• Use mould in repair process • implement a hardwood mould and a heating element in the workshop • This application is theoretical but could be a desirable solution for the service works, lowering difficulties during repair	• Adds repair possibility • Applicable during redesign stage • Increasing circularity by reusing existing bumper in redesign. • Futureproofing the design capabilities.

- The final concept of the elements will provide a road safe VIANOVA in urban situations
- Follow the steps slowly.
- Not directly viable or feasible but implementing the final concept over a time period could increases the feasibility and will create a viable product in the future.
- Implement the insights of this project in a roadmap to clarify the communication towards relevant stakeholders.