Response to Reviewer 2 Comments

We would like to thank Reviewer 2 for taking their time to review our manuscript and providing us with feedback to improve it. Please find below our response to the individual points of the feedback:

Point 1. The concept of a circular binder should be further defined, along with its limitations and practicality.

Response 1: We have elaborated on what we mean with a circular binder by changing the start of the alinea in line 56 from "Making a circular binder of bitumen could be…" to "A circular alternative to bitumen, which has similar properties but is made from non-fossil compounds, could be…"

Furthermore, we have provided some additional insights in the practicality of the binder by comparing its production with the production of PMB by extending the sentence "The fact that the circular binder can imitate these properties with waste plastics makes it very appealing for the circular economy." in line 292 to "The fact that the circular binder can imitate these properties with cheaper waste plastics at similar processing temperatures makes it very appealing for the circular economy."

Point 2. A more related literature review should be provided in Section 1 and within the result's discussion to support the findings or argument.

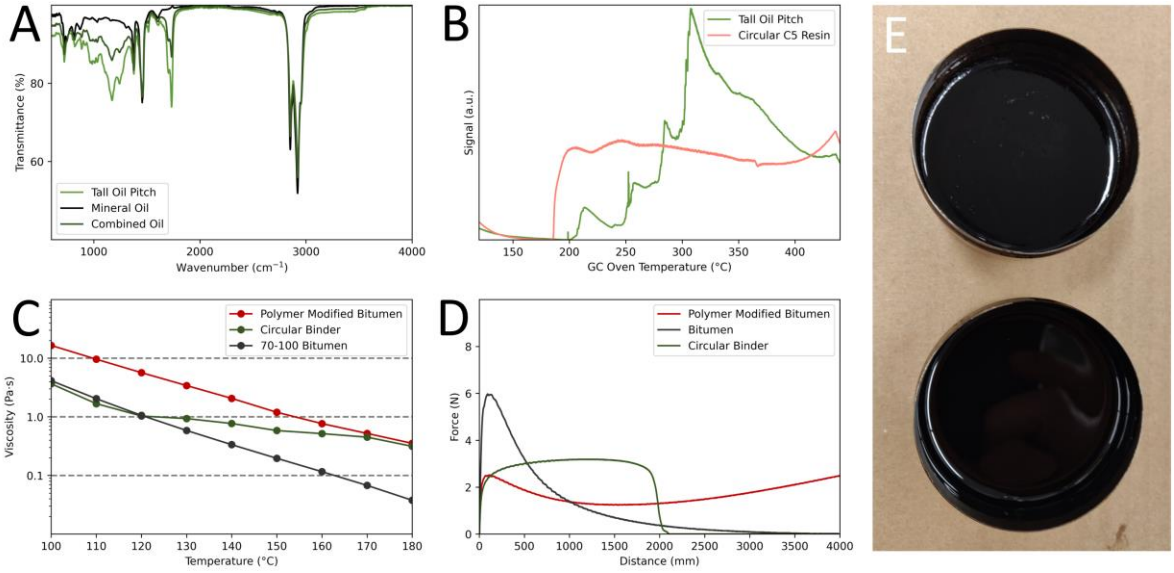
Response 2: We have added reference 19 to further relate the circular binder composed of LDPE and TOP to previous research done on these materials in relation to bitumen, as well as references 20-22 to strengthen the literature review on the influence of chemical composition.

Point 3. Material properties and characteristics should be provided.

Response 3: As the material properties are derived from a mix of different components, we have related the material properties to their molecular weight and composition. To provide further explanation for this, we have added the sentence "In general, if a functional group causes crystallinity or polar interactions it will stiffen the binder, whereas groups which prevent these interactions will soften a binder." in line 168.

Point 4. Figure 4(E) should be replaced with a better image so that the reader can appreciate their similarities or differences based on observation.

Response 4: We have retaken the picture of both binders and have put the binders themselves more in the spotlight (see example below). Moreover, we used a backlight to demonstrate the shiny reflection both binders give, an indication that the components are well dissolved as they otherwise would give a dull appearance.



Point 5. It would be great if the authors could relate to the cost, energy, and carbon emission aspects.

Response 5: We agree with the reviewer that the appeal of the circular binder is heavily dependent on its affordability, producability and positive impact on the environment. We currently are in collaboration with various contractors to apply the binder on a large scale without making any adaptations to their production process and while trying to keep the price comparable to bitumen. Moreover, a student will start in September to calculate the environmental impact of the binders we have made so far. However, adding the results of these projects to this paper would significantly delay its publication and is more suited as a follow-up on this work, as this paper is more focussed on the principle of constructing a circular binder. We have added the sentence "In doing so, these design principles could find a binder with an optimal combination between performance, cost and environmental impact, offering exciting prospects for the development of circular binders." in line 326 of our conclusion to indicate which direction this research is heading in.

Point 6. Please revise references 8 and 19.

Originally we added the note as reference 19 to prevent breaking the flow of the article. However, this is apparently not common in this journal, and thus we have removed the note and rephrased the sentence "However, it also contains a higher amount of higher molecular weight components

compared to bitumen D, making the average molecular weight of both bitumen similar." in line 149 with "And even though the GC cannot detect components with a boiling point above 430°C, it is clearly visible Bitumen E does contain a higher amount of detectable higher molecular weight components compared to bitumen D, making the average molecular weight of both bitumen similar."