Response to Reviewer 2 Comments

Dear Editor and Reviewer,

The authors would like express gratitude for considering their work for publication in Materials. The authors thank the reviewer for providing insightful comments and helping us improve the content of manuscript and providing comprehensive suggestions. The comments have been addressed and revisions to all issues raised by the reviewer have been made.
The comments given by the reviewer appear below in sequence with response shown in blue color font and changes in the manuscript in red.

Thanking you

Yours sincerely
Dr. Kumar Avadh
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General Comment:
The authors have presented a very well-written article about an area of interest to the practicing engineer, especially as global infrastructure continues to age. The authors do present the strengths and limitations of their design, though I feel there are a few areas where the authors need to be clearer in this regard.

Comment 1:
One item I would like to see addressed by the authors concerns the specimen design. The window cut into the concrete will provide a portion of the bar where corrosion products will not induce tensile stress in the concrete, potentially altering the bond behavior. This is an unavoidable effect of needing to use DIC, but I'd like to see its effects discussed.

Response:
Thank you for the comment. The bond behavior in the window section will change but according to authors it is an acceptable trade off as the window allows direct observation

and recording of the interaction at the interface. The manuscript has been modified as follows to mention this demerit.

Line 180-185:

"Adding a window in the center of the specimens causes sudden changes in the stress distribution along the reinforcing bar due to break in symmetry and decrease in effective bonding area, thus modifying bond behavior. However, previous studies have shown limited effect on the global response of the specimen. Hence, it is an acceptable arrangement, as it facilitates direct observation of bond interaction at the interface [32]."

Comment 2:

Corroding the reinforcement prior to casting in concrete will remove the effect of tensile stress from the buildup of corrosion products, as the authors note in the introduction. Why was this method chosen as opposed to corroding the bar cast in concrete?

Response:

Thank you for your comment. The primary objective of the experimental study was to investigate the effect of reduction in rib height and presence of corrosion product on bond interaction at the interface. Also, the effect of loss in confinement around the reinforcing bar due to corrosion induced concrete cracking as already by investigated and simulated in detail. Keeping this in mind, the experimental scheme was designed to corrode the reinforcing bar prior to placing it inside the specimen. Following changes have been made in the manuscript to further clarify this.

Line 88-94:

"….concrete. As mentioned earlier, corrosion of reinforcing bar leads to damages in concrete and reinforcing bar. The combined effect of these two damages modifies the bond interaction in a complicated manner. Hence, in order to enhance the understanding develop and improve bond degradation models, it is important the separate the two damages. The effect of loss in confinement around the reinforcing bar due to corrosion induced concrete cracking has been investigated and simulated in detail [11,13], hence, it is necessary to investigate the effect of damage in reinforcing bar. The objective…."

Comment 3:

The concrete mesh size seems large relative to the spacing of ribs on most reinforcement.

Did the authors conduct a sensitivity analysis of the effect of mesh size?

Response:

Thank you for the comment. In discrete analysis, the crack evolution and development is dependent upon mesh size and arrangement. Therefore, the authors have selected the current mesh size as its applicability to the bond behavior has already been confirmed in previous publications as listed below:

1. Avadh K, Jiradilok P, Bolander JE, Nagai K. Mesoscale simulation of pull-out performance for corroded reinforcement with stirrup confinement in concrete by 3D RBSM. Cem Concr Compos 2021;116:103895. https://doi.org/10.1016/j.cemconcomp.2020.103895.
2. Jiradilok P, Wang Y, Nagai K, Matsumoto K. Development of discrete meso-scale bond model for corrosion damage at steel-concrete interface based on tests with/without concrete damage. Constr Build Mater 2020;236:117615. https://doi.org/10.1016/j.conbuildmat.2019.117615.

Comment 4:

20% corrosion is quite high, and well above what will cause significant damage in reinforced concrete. Did the authors consider intermediate cases?

Response:

Thank you for the comment. The changes in bond interaction for the intermediate cases was considered in the experimental study. However, since the objective of this study is to analyze and confirm the applicability of current 3D RBSM in simulating post corrosion bond interaction, only extreme cases were considered for this study. The following statements have been added in the manuscript to further clarify.

Line 209-212:

"The objective of this study is to investigate the effect of reduction in rib height and presence of corrosion product at the interface using the current bond degradation model in 3D RBSM. Hence, to conduct this investigation and identify the improvements required in this bond degradation model, cases with extreme degree of corrosion were selected. From the from the experimental…."
