**Reviewer #2:** The research work is based on pure theoretical derivation and simulation analysis. Many mature commercial software has good calculation and analysis functions. Therefore, the innovation of the research work is insufficient, and the practical guiding role of the project is insufficient. In addition, there are too many sections and too long length. It is suggested to carry out targeted research on an innovative problem to avoid lengthy discussion. Unfortunately, the existing manuscript cannot be supported.

Dear Reviewer,

Thank you for your thorough feedback on our manuscript. We appreciate your observations and would like to address the concerns raised:

Regarding the novelty of the study, we emphasize that the key innovation lies in the integration of coupled plasticity-viscoplasticity for rock and aging viscoelasticity for the concrete lining within a fully three-dimensional finite element framework for the twin tunnels with a transverse gallery. This allows for a more realistic assessment of the time-dependent interactions, which is not comprehensively addressed in existing studies of these structures. Furthermore, while commercial software provides mature analysis tools, our work requires the development of these constitutive models and implementation within ANSYS, as these specific materials are unavailable in standard commercial solutions.

To make this clearer, we have changed the last paragraph of the introduction to:

“Existing literature addressing the mechanical interaction in deep twin tunnels with connecting transverse galleries has mainly focus on the response associated with instantaneous reversible-irreversible behavior of the rock mass and lining constituent materials. It is however well established that creep is an essential component of rock deformation in deep tunnels, leading to progressive development of tunnel convergence and lining loading during the construction phase and extending over months or even years. Additionally, the shotcrete/concrete exhibit time-dependent behavior due to creep and shrinkage phenomena. Despite the significance of these effects, the integration of coupled constitutive models - such as plasticity-viscoplasticity to capture both instantaneous and delayed irreversible rock deformation, and aging viscoelasticity for concrete lining – within a fully three-dimensional finite element framework remains largely unexplored in the context of twin tunnels. In this regard, the purpose of the present study is to investigate the implications of time -dependent constitutive properties of rock and support shotcrete/concrete materials on the short-term and long-term structural behavior. Therefore, these constitutive models were developed and implemented within ANSYS through a specific UPF/USERMAT procedure. The finite element modeling developed in this paper can be viewed as a specifically devised tool for addressing the three-dimensional interaction induced by the construction process of closely-spaced twin tunnels with transverse gallery junction. […]”

We acknowledge that the manuscript is extensive, as it aims to provide a thorough investigation of the problem. However, based on your suggestion, we will streamline the discussion, removing XXXXX while maintaining the necessary depth to support the findings. Additionally, we will further highlight the study’s practical implications, particularly regarding tunnel deformation control and design considerations for twin tunnel configurations with transverse galleries in the conclusions. XXXXX

We value your constructive comments and will use them to improve the manuscript significantly. We hope that these revisions will address your concerns and allow for reconsideration of the study.

Thank you for your time and valuable input.