**Comentários para os autores**

**Reviewer #1**

Page 2 of 28, "… making three-dimensional finite element analyses essential…". From the Introduction I can get that "developing a realistic and safe design for tunnel junctions" is important, but why is using 3D finite element analysis? From the Introduction, it does not seem to understand that 3D finite element analysis is essential.

Page 2 of 28, "…but little research has been done on twin tunnels, especially with a gallery". It is hard for me to get useful information. It is recommended to summarize the issues that need to be solved in twin tunnels to highlight the focus of this paper. So what is the novelty of this paper? This should be stated clearly in the Introduction.

Page 5 of 28, "E0 is the modulus of elasticity of the concrete aggregates and microscopic particles of the cement paste" Is the modulus of elasticity of both the concrete aggregates and microscopic particles of the cement paste equal to E0? The microscopic particles of the cement paste include both hydration products and unhydrated cement particles and are not equal to the elastic modulus of the aggregate.

Page 5 of 28, Eq. (7). How is D\* determined?

Page 13 of 28, "7. Numerical Results and Discussion". This section is too long and not clear. Dividing it into subsections, e.g., 7.1 and 7.2, maybe clear. The "Results and discussion" of the following paper may be helpful. <https://doi.org/10.1016/j.cemconres.2023.107267>.

What is the mechanical behavior of concrete of the lining? What are the causes of shrinkage and creep of concrete here? External loads or due to cement hydration?

In the Conclusion, it is helpful to define the acronyms that appear.

The serial numbers in the references are missing and the reference numbers in the manuscript do not start at [1]. In addition, the number of references seems inadequate.

Line numbers are missing, resulting in some specific problems I can't easily point out.

**Reviewer #2**

There are numerous discussions in the paper on well-established phenomena, such as the impact of liner stiffness and tunnel distance on convergence. Unfortunately, the discussions have not yielded any novel or insightful conclusions. As a result, the manuscript reads more like an engineering report than a research paper.

The mesh effect of the FEM model should be considered and checked. Especially, in this paper, the liner is discretized into two layers. And, there is no information provided in the paper regarding the adequacy of the mesh size for both the rock and tunnel structures.

The size effect is crucial due to the nonlinear material properties. However, there are concerns about the model's geometry. The tunnel radius is only 1m, which is unreasonably small. Furthermore, the tunnel is in a circular shape, which deviates from the typical geometry of rock tunnels. Therefore, the applicability of the numerical results is questionable.

**Reviewer #3**

Why is Poisson's ratio of rock is 0.498? This is a very eccentric value.

**Reviewer #4**

Thanks for submitting your work to RMMS. the authors conducted parametric analysis on deformation behavior in twin tunnels considering different constitutive modes. However, this is pure an application study using commercial software. Limited novelty can be found in this paper regarding the methodology or numerical techniques. The authors assumed isotropic stress state, which could hardly be the case in reality. Therefore, the conclusions drew from those analysis may not be reliable. The result analysis part is too long and somehow reductant and the findings are pretty common sense with limited novel findings. Based on this, I cannot recommend this paper for further consideration for RMMS.

**Reviewer #5**

Dear Authors, I have carefully read your paper and to be honest: on one hand it is quite interesting, but on the other one there is so much doubt and assumptions that are not clearly described. Furthermore after reading your paper, beyond all my remarks summarized in attached file, I do not really know how your paper impacts the filed of numerical analyses in tunneling. Most of the finding in conclusions seem to be very predictable without making calculations. To be honest I was hesitating between "rejection" and "major revision". Finally I decided to give you the chance to improve the paper, so my decision is "major revision". Please find my comments in pdf file. Regards.

Page 2 of 28: “[…] They recognizing […]”. Please revise this sentence.

Page 2 of 28: “The long-term effect has been investigated for single tunnels, but little research has been done on twin tunnels, especially with a gallery. Therefore, in this work, the aim is to investigate the influence of the distance between the tunnels and the effect that the gallery has on the long-term convergence profile of deep-lined twin tunnels, considering various constitutive laws for the rock mass and the lining.”

Please extend this paragraph as the reader gets more details on what you exactly propose, what is novel in your approach, what methods you use or formulate, etc...

Page 2 of 28 : “…some delimitations…”. Are you delimitation is the proper work? I think limitations fits better here.

Page 2 of 28: “…the rock mass’s…”. I am native English speaker but pls verify this.

Page 2 of 28: “...discontinuities, we simplify its overall behavior by treating it as a continuous medium.”

With this assumption application of your results and findings to engineering practice may be very limited - please elaborate this. Note also that whether the rock mass is terated as continuos or discontinuous is not only about the presence of joints. Jointed rock mass can also be assumed to be constuous if the number of cracks is large and the characteristic block size is small in the relation to the chcaracteristic sie of the tunnel. i am not really sure what you exaclty assume here. Please comment on this.

Page 3 of 28: “…speed for full, flat, and vertical excavation with homogeneous concrete lining with constant thickness...” it's not clear what you exactly assume.

Page 3 of 28: “…We also adopt the hypothesis of small perturbations.” what you exactly mean by this ? Please elaborate.

Page 3 of 28: “This model concern a serial association…” concerns ?

Page 4 of 28: “multiplier and 𝑔 is a potencial flow analogous to 𝑓” ?

Page 4 of 28: “utilize the Perzyna model as follows:” reference

Page 4 of 28: “In this study’s coupled analysis,…” study’s?

Page 5 of 28: “The CEB-FIP MC90 formulation also [5] determines the shrinkage component.” you refer to what ?

Page 5 of 28: “…as shown in Fig. 3.” Is this a case study? i mean the twin tunell with gallery

Page 5 of 28: “Figure 3: Problem domain” please provide some fundamental dimensions as the reader is able to find out how large, in general, the domain is.

Page 6 of 28: have you verified the correctness of mesh density? I mean have you done some preliminary analyses to verify the mesh density is OK ?

Page 6 of 28: “we apply the initial stress condition 𝝈0 = −𝑝𝟏 at…” please elaborate this initial stress condition - how you calculate this? And where exactly it is prescribed?

Page 6 of 28: “…thickness of the lining.” How the lining is modelled? Classicla elements or maybe beam elements? is there any interface between lining and ground? Is lining only elastic? Elaborate this...

Page 7 of 28: “…is the influence of the spacing 𝑑1 between longitudinal tunnels of the twin tunnel.” influence on...what ?

Page 10 of 28: In Table 1 Ri = 1. As I understand well, the radius of the main tunnels is 1 meter? So the diameter is only 2 meters? In relation to engineering practice what kind of tunnel it is? This is too small to represent for example road or railway tunnels.

Page 10 of 28: In Table 1 Thickness of the lining e1. I can't find any information what kind of lining is that? Concrete? What is the method of tunneling that you assume here? This must be included in the paper.

Page 11 of 28: “…solution considering 𝑅𝑖 = 4 m”. in table above it is 1 meter ?

Page 12 of 28: for the case with 𝑐 = 5 MPa, 𝑑1 = 5 m, 𝜎𝑥 = 𝜎𝑦 = 30 MPa. is it the boundary condition p?

Page 13 of 28: “…an isotropic initial stress state of 9 MPa is considered…” it is assumption? or a consequence of something?

Page 13 of 28: “…and the excavation speed is 12.5 m/day”. which method of tunneling is assumed? This is connected also with the lining - is it final or temporary one ?

Page 14 of 28: Table 2. Fictitious thickness. what do you mean by fictitious ?

Page 14 of 28: • Observation 1: All the results presented in the following analyses pertain to the point located at the top of the tunnel section (crown), and we will monitor its convergence throughout the excavation process. Fig. 14 presents this point. Likewise, we will only analyze the convergence of the point located at the crown of the gallery.

not sure it is observation - rather your assumption. but why you do not want to monitor all displacement profile ? Or the convergence in chosen points on two oppoiste points of the profile? It is as we usually do in practice. Monintoring of just one point on the profile is not sufficient information in my opinion.

Page 21 of 28: “This Figure shows”

Page 21 of 28: “…without gallary”

Page 27 of 28: “The fundamental role of the stiffness of the concrete lining in the convergence profile of twin tunnels is understood from the analyses. Depending on the value of this stiffness, it is possible to condition the restriction of viscous effects that tend to manifest over time after the completion of the excavation process.

please extend conclusions with:

- how your work ipmacts on existing literture of this subject,

- where is the novelty,

- what you work gives for practical engineering?

please refer this to the particular method of tunneling - I mean type of the lining.