Reviewer's Responses to Questions:

Question 1 – In Decision on submission: 1. Are the objectives and the rationale of the study clearly stated?

Reviewer #1: The objectives of the study are clearly stated, but the rationale of the study is not very clear. In the introduction : 1. Why was this methodology used for the study? 2. A clear summary of existing research to highlight the innovations of this work. These two aspects can be improved.

Os últimos parágrafos da introdução foram estendidos com mais detalhes do que será feito, a metodologia e as contribuições.

Question 2 – In Decision on submission: 4. Could the manuscript benefit from additional tables or figures, or from improving or removing (some of the) existing ones?

Reviewer #3: Put color scales to Figure 13.

Essa Figura foi eliminada.

Question 3 – In Decision on submission: 5. If applicable, are the interpretation of results and study conclusions supported by the data?

Reviewer #3: No comparison with any case studies.

Reviewer #5: Yes, but they need to be significantly improved - see attached pdf file.

Foi melhorada as comparações com soluções analíticas.

Question 4 – In Decision on submission: 6. Have the authors clearly emphasized the strengths of their study/theory/methods/argument?

Reviewer #1: No. 1. Emphasized in the introduction; 2. Further elaboration in the methodology section; 3. Comparison with traditional methods in results.

Reviewer #2: No, please see the comments in detail as follows.

Reviewer #3: I understand the authors have spent many hours fighting against ANSYS and get those results. However, there is no comparison with case studies. Generally, speaking, it is

difficult to publish a manuscript stating just calculation using a commercial software as a full paper.

Reviewer #4: not much novelty in methods

Reviewer #5: NO - it must be improved.

A introdução e os modelos constitutivos foram reescritos para dar menor ênfase ao uso do software comercial.

Question 5 – In Decision on submission: 7. Have the authors clearly stated the limitations of their study/theory/methods/argument?

Reviewer #3: No, they haven't. Excavation sequence should be better followed. One tunnel advances and the other follows. This is a natural sequence and should be simulated in particular for inelastic analyses. In other words, if they don't simulate these sequences, there are almost no advantage of complex visco-elasto-plastic analyses. Comparison with case studies should be done. Consideration of discontinuities and pore water is very important.

A escavação sincronizada foi assumida como uma limitação no item (e) da seção 2. Comparações foram feitas com soluções analíticas apenas. Limitações referente a descontinuidade e poropressão estão descritos nos itens (b) e (c) da seção 2. Além disso, no inicio das análises paramétricas é dado algumas informações sobre os parâmetros constitutivos que torna esse modelo utilizável.

Question 6 - In Decision on submission: 8. Does the manuscript structure, flow or writing need improving (e.g., the addition of subheadings, shortening of text, reorganization of sections, or moving details from one section to another)?

Reviewer #1: Yes. "7. Numerical Results and Discussion" This section is too long and not clear. Dividing it into sub-sections, e.g., 7.1 and 7.2, maybe helpful.

A seção de resultados numéricos e discussão foi subdivida.

Reviewer #4: paper is too long

Ficou maior.

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.

The title highlights the plasticity and time-dependent constitutive models. The importance of plasticity and time dependence needs to be explained at the appropriate places in Sections 3 and 4.

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.

Foi corrigido para 0.4.

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.

Foi visto o pdf com os comentários.

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

Foi ajustado.

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...

Nesse último parágrafo foi adicionado as principais contribuição do ponto de vista do material e da análise de túneis. No material foi falado sobre o modelo acoplado EPVP. E falado também do revestimento e o processo de escavação da galeria.

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

Foi alterado pra limitações.

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

Foi corrigido.

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.

Foi reelaborada essa limitação no item (b) da seção 2.

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.

Foi reelaborado, e virou item (f) da seção 2.

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

Foi reelaborado, e virou item (i) da seção 2.

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

Foi corrigido.

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

Foi corrigido: potential

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

Foi dada a referencia.

Page 4 of 28: "In this study's coupled analysis,…" study's?

Foi corrigido: "In the coupled analysis,…"

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

Foi reelaborado indicando de onde vem a expressão.

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

Foi reelaborado o parágrafo indicando o esquema genérico da geometria do problema.

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.

Foi reelaborado o parágrafo indicando o esquema genérico da geometria do problema.

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 ?

Na sequencia, as analises com soluções analíticas foram melhoradas.

Page 6 of 28: "we apply the initial stress condition $\sigma_0 = -p\mathbf{1}$ at…" please elaborate this initial stress condition - how you calculate this? And where exactly it is prescribed?

Foi reelaborado.

 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...

Foi reelaborado.

Page 7 of 28: "…is the influence of the spacing d_1 between longitudinal tunnels of the twin tunnel." influence on…what ?

Foi corrigido. Influência na convergência.

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.

Foi corrigido. Influência na convergência.

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.

Foi ajustado a tabela para ficar em função do raio.

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

Foi ajustado a tabela para ficar em função do raio.

Page 12 of 28: for the case with c = 5 MPa, d_1 = 5 m, $\sigma_x = \sigma_y$ = 30 MPa. is it the boundary condition p?

Foi ajustado a expressão das condições de contorno. Não tem mais a condição hidrostática p.

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

Explicado que é consequência da profundidade de caracterização da argila.

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 ?

O termo foi ajustado para Notational size.

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.

Foi adicionado mais análises e comentários sobre o efeito da ovalização.

Page 21 of 28: "This Figure shows"

Foi alterado para the results shows.

Page 21 of 28: "…without gallary"

Foi corrigido.

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.