Research Article

Mechanical Behavior of the Reinforced Retaining Wall under Vehicle Load

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This study primarily aims to explore the mechanical behavior and influence factors of the reinforced retaining wall subject to vehicle loads. Mohr–Coulomb model was adopted to simulate and analyze the structural characteristics of the reinforced retaining wall by the finite element method. Its mechanical behavior was investigated in accordance with relevant theories. The results showed that the vertical and horizontal maximum displacement of the reinforced retaining wall occurs at the wall surface of the retaining wall, the maximum internal soil pressure appears at the middle and lower part of the retaining wall, and the maximum tensile strain of the tension bar acts on the wall rupture surface. As impacted by static vehicle load, the largest settlement is located at the parking position, and the maximum horizontal displacement and wall stability will vary with the vehicle position. Moreover, the closer the vehicle to the reinforcement is, the greater the lateral Earth pressure will be imposed on the upper part of the reinforcement body. With the variation of the vehicle position, the tension stress of the geogrid will vary noticeably.

1. Introduction

Reinforced retaining wall is a type of flexible retaining structure, exhibiting numerous advantages (e.g., prominent overall performance, low requirements on foundation bearing capacity, and simple construction). It has been extensively applied in highway, railway, and water conservancy industry home and abroad [1, 2]. On the whole, the analysis of the reinforced retaining wall should consist of the limit equilibrium analysis, the stress state analysis at work, and so on. With the frequent economic exchanges, the road traffic volume increases heavily, and the effect of the vehicle load on the subgrade retaining structure is increasingly increasing [3, 4]. To delve into the actual action characteristics of vehicle load, the response law of the subgrade under the traffic load has been extensively analyzed [5, 6].

In the preliminary study on the force conditions of the grid under the symmetrical vehicle load and the horizontal displacement of the retaining walls with different heights, Wang and Mirmoradi analyzed the axial force of the grid; they reported that the lateral displacement of the panel displays a tight relation to its height [7, 8]. Liu and Ehrlich ascertained the rebar tensile strain of the reinforced retaining wall under vehicle load, the lateral Earth pressure acting on the wall, the lateral Earth pressure acting on the reinforced body, and the lateral deformation of retaining walls [9, 10]. According to their results, the lateral Earth pressure acting on the reinforced body was reported to be much larger than the lateral Earth pressure acting on the wall whether it was subject to the static load of the vehicle or the dynamic load of the vehicle. By inputting sine wave with different amplitudes and frequencies, He and Bourgeois [11, 12] conducted a study on the dynamic characteristics and rules of the fatigue life of retaining walls under repeated loads. In accordance with the limit equilibrium theory and parameter analysis method, Zheng, Mo, and Xiao [13–15] developed a practical calculation mode for the potential rupture plane of the stepped reinforced retaining wall. The formula can be applied to the reinforced retaining walls with different step widths. When the step width is zero, it can
2 Mathematical Problems in Engineering

2. Calculation Model and Simulation Process

2.1. Selection of Soil Constitutive Model. There have been many kinds of soil constitutive models, including elastic model, elastoplastic model, viscoelastic model, and structural model. For the simulation of foundation pit excavation, the rationality of the selected constitutive model has an important impact on the accuracy of finite element analysis. There are many models suitable for geomaterials in ABAQUS, such as Mohr–Coulomb, D-P model, extended D-P model, and modified Cambridge model. Because the Mohr–Coulomb constitutive model is a model of the rate that has nothing to do, in the booming existence under an elastic stage, when the load gets bigger, it entered the stage of plastic deformation; the deformation is unrecoverable composition, the properties and the structure calculation of deformation features, so the Mohr–Coulomb model is used to simulate the constitutive relation of soil in this paper.

This model has the following characteristics:

1. There is a stage of linear elasticity under small loads. With the rise in the load, the deformation of the material consists of irreversible components, suggesting that the materials reach the plastic phase.
2. In the initial stage, the material is isotropic.
3. The yield pressure is related to hydrostatic pressure, and the strength of the material increases with the increase of binding force.
4. The maximum value of the principal stress in the material affects the yield behavior of the material.
5. It consists of the hardening or softening processes of each identity.
6. When the volume of the material changes, the material gradually shows inelastic behavior. Subsequently, the flow law is introduced to improve the inelastic and elastic expansion shear deformation.
7. The effect of temperature can be considered, and it is assumed that the material is "rate-independent."

According to the Mohr–Coulomb yield criterion, when the shear stress at a point is equated with the shear strength of the point, the point of the material breaks and the shear strength is assumed to be linear with the normal stress acting on the surface. The Mohr–Coulomb model is proposed on the basis of the Mohr circle of the stress state shown when the material is destroyed. The failure line is a straight-line tangent to the Mohr circle of the stress state.

The yield surface of the Mohr–Coulomb model has sharp corners, which makes the direction of the plastic flow potential inconsistent, resulting in cumbersome calculation and slow convergence. To avoid the mentioned problems, the optimized Mohr–Coulomb criterion model in the ABAQUS adopts a continuous and smooth potential function, as illustrated in Figure 1.

2.2. Model Establishment. When the reinforced retaining wall is being simulated, the original structural unit geogrid in FLAC3D is employed to simulate the reinforcement in the reinforced soil, and the shell unit is adopted to simulate the panel. For an accurate simulation of the response behavior of the reinforce retaining wall under vehicle load, the analysis of the characteristics of the vehicle load should be prioritized.

The numerical analysis model is established according to the construction drawing of reinforced Earth retaining wall of K139 + 100–K139 + 400 section of National Highway 330. For the convenient calculation, the model takes the direction along the route as Y, and $Y = 8$ m. Figure 2 presents the analysis model of the reinforced retaining wall. Before the model is used for calculation, the displacements of all the bottom nodes of the model in all directions are fixed, and the displacement of the front and rear side nodes in the X direction and that of the left- and right-side nodes in the Y direction are fixed, with only the wall and the top of the model left as the free surfaces.

The mechanical parameters of the foundation and wall are listed in Table 1. The mechanical parameters of the geogrid unit are listed in Table 2. Table 3 presents the mechanical parameters of the shell unit. The shell element is employed to simulate the panel, and the relevant parameters of C30 reinforced concrete are adopted.

The traffic volume on highways has been relatively large in China. To be specific, those with large tonnages are likely to cause the more serious road damage. To make the research have a certain representativeness, the 30 t self-unloading truck is selected as the loading model. The size specifications of this type are presented in Figure 3. Table 4 gives the relevant parameter list of this type of vehicle.

In the process of driving on the road surface, the vehicle will be stimulated by the uneven road surface and subjected to forced vibration. The dynamic load generated by vehicle vibration is transmitted downward in the way of contact between the tire and the road surface, as shown in Figure 4, thus affecting the road surface and subgrade and retaining wall structure.

Vehicle vibration effect affected by many parameters, the expression in this paper considering pavement smoothness, speed, and the influence of vehicle vibration cycle of vehicle dynamic load, and half-sine vehicle load model has fully considered the influence of the three factors; besides, the effect of vehicle load is transmitted tire and road surface contact, and the action time is intermittent and very consistent with the actual situation. Based on these advantages,
Figure 1: The shape of the flow potential function on the meridional and \( \pi \) planes.

Figure 2: Dynamic analysis model of the reinforced retaining wall [19].

Table 1: Mechanical parameters of foundation and wall.

| Types      | Bulk modulus (MPa) | Shear modulus (MPa) | Density (kg/m\(^3\)) | Friction angle (°) | Cohesion (kPa) |
|------------|--------------------|---------------------|------------------------|--------------------|----------------|
| Wall       | 29.4               | 11.3                | 1950                   | 21                 | 25             |
| Foundation | 73.2               | 28.1                | 2350                   | 35                 | 28             |

Table 2: Mechanical parameters of geogrid.

| Elastic modulus (MPa) | Poisson’s ratio | Cohesive force of coupling spring (MPa) | Friction angle of coupling spring (°) | Thickness (mm) |
|-----------------------|-----------------|-----------------------------------------|--------------------------------------|----------------|
| 6 \times 10^8         | 0.33            | 1.5 \times 10^3                        | 27                                   | 3              |

Table 3: Mechanical parameters of the shell unit.

| Elastic modulus (MPa) | Poisson’s ratio | Density (kg/m\(^3\)) | Thickness (cm) |
|-----------------------|-----------------|------------------------|----------------|
| 3 \times 10^8         | 0.27            | 2400                   | 10             |
The half-sine vehicle load model is used to simulate the dynamic load action of vehicles, as shown in Figure 5, and its mathematical expression is as follows:

\[
P(t) = \begin{cases} 
P_0 \sin(\omega t), & \frac{2n\pi}{\omega} \leq t \leq \frac{(2n+1)\pi}{\omega}, \quad n = 0, 1, 2, \ldots \\
0, & \frac{(2n+1)\pi}{\omega} < t < \frac{(2n+1)\pi}{\omega}, \quad n = 0, 1, 2, \ldots 
\end{cases}
\]

\( (1) \)

### 3. Verification and Analysis of Experimental Examples

As shown in Figure 6, the lateral displacement of the middle part of the test retaining wall panel calculated using the finite element under different loads is compared with the measured results. It can be seen from the figure that when the working load is small, the calculated lateral displacement of the wall panel is basically consistent with the measured results, which also shows that the finite element numerical analysis method used in this study can reliably estimate the retaining wall panel lateral displacement.

As shown in Figure 7, the calculated assumed potential sliding surface is very close to the assumed fracture surface of the limit equilibrium theoretical system, and the distribution trend of the tensile strain of the reinforcement calculated numerically nearly complies with the distribution of the tensile strain of the reinforcement in the assumed active and passive areas of the ascertained data and limit analysis, which displays a better distribution from the panel to the interior of the soil. The last part of the tensile strain value is remarkably small, close to 0. Such result is achieved because the reinforcement is overly long and of low importance. It is suggested that the stress and strain distribution of the stiffened layer calculated using the finite element is a good verification.

| Project                          | Unit | Technical indicators |
|----------------------------------|------|----------------------|
| Vehicle gravity standard value   | kN   | 300                  |
| Front axle gravity standard value| kN   | 60                   |
| Rear axle gravity standard value | kN   | 2 + 120              |
| Wheelbase                        | m    | 1.8                  |
| Track                            | m    | 1.8                  |
| Front wheel landing width and length | m | 0.3 + 0.2            |
| Rear wheel landing width and length | m | 0.6 + 0.2            |
| Vehicle dimensions               | m    | 8 + 2.5              |
for the assumption of stress and strain distribution of the stiffened layer in the limit equilibrium design method.

4. Results and Discussion

4.1. Structural Characteristics of the Reinforced Upper Retaining Wall. After modeling, the model is first run to balance under the action of self-weight, while the section of $Y = 2\,\text{m}$ is used as the monitoring section to analyze the distribution law of stress, strain, and tensile stress of reinforced retaining wall under the action of self-weight. Figure 8 shows the displacement cloud map in the monitoring section of the reinforced retaining wall under the action of self-weight after the completion of the construction. It suggests that as impacted by self-weight, the vertical displacement cloud map in the reinforced retaining wall is layered on the whole, while the horizontal displacement cloud map of the reinforced retaining wall is presented as a range of inclined curves. It can also be noted that there is a noticeable horizontal displacement area in the foundation below the toe of the reinforced retaining wall. It therefore reveals that when the height of the designed wall is large in the design of the reinforced retaining wall, it is very necessary to check the overall slippage of the reinforced Earth retaining wall. The vertical and horizontal maximum displacements of the reinforced retaining wall occur on the

Figure 7: Calculated tensile strain distribution of reinforced layer (in this study, there are 30 layers of reinforced strip) [19].
surface of the reinforced retaining wall, and the vertical and horizontal displacements of other areas except near the wall surface are very small. Accordingly, in the design of a reinforced retaining wall, particularly for the case of vertical wall, the selection of the type of the wall should be emphasized to ensure its sufficient rigidity.

Figure 8 presents the stress cloud maps in the vertical and horizontal directions of the monitoring section after construction. According to this figure, under the effect of self-weight, the vertical stress inside the wall is distributed in layers, the vertical stress gradient between the layers changes uniformly, and the reinforced body exhibits obvious vertical anisotropy and horizontal homogeneity. The maximum value of the horizontal Earth pressure inside the wall occurs in the middle and lower part of the retaining wall. Due to the mixing effect of the reinforcement and the soil, the horizontal stress gradient on the upper part of the retaining wall changes a little, and the horizontal stress gradient on the lower part of the retaining wall changes greatly, which is consistent with the classical theory of reinforced soil.

Figure 10 plots a curve that shows the distribution of Earth pressure along the wall height behind the wall and the reinforced body, consisting of the lateral soil pressure distribution curves plotted by numerical analysis and theoretical calculation. According to the "Specification for Design of Highway Subgrades" (JTG D30-2015), in the designing process of the reinforced retaining wall, the Earth pressure imposed on the reinforced body is calculated using the Coulomb soil pressure method, and the Earth pressure acting on the wall is calculated using the variable coefficient method. The results of the analysis reveal that the lateral Earth pressure acting on the wall only appears suddenly at the bottom of the retaining wall. The Earth pressure on the back side of the upper wall in the retaining wall varies slightly with the wall height, which significantly differs from the distribution pattern of lateral Earth pressure in the theoretical calculation, while the lateral Earth pressure distribution pattern of the reinforced body is almost identical to that in the theoretical calculation. Moreover, the lateral Earth pressure values of the wall and the reinforced body are both smaller than the theoretical calculation results. It is primarily because the variable coefficient method or the Coulomb Earth pressure method considers the limited state of the soil, while the numerical model analysis does not reach the limited state, thereby resulting in a larger theoretical calculation result.

Figure 11 shows the tensile stress cloud map of the reinforcement after the completion of the construction. It is suggested that the maximum tensile stress occurs at the third layer of the reinforcement, and the location of the maximum tensile stress of each layer of reinforcement gradually approaches the surface wall along the depth of the wall. The analysis of the maximum tensile stress of the reinforcement is mainly to explore the location of the potential fracture surface in the reinforcement body. The determination of the potential fracture surface in the reinforcement body is directly related to the design of the reinforced Earth retaining wall and is an indispensable basis for designing the laying length of the reinforcement. The 0.3 \( H \) method is the commonly used simplified analysis method for the fracture surface of reinforced soil (see Figure 12). It is developed by analyzing the limit equilibrium state of the reinforced soil. Before the reinforced material is destroyed, the soil in the reinforced body is in a stable state, and the soil does not form a fracture surface. When the tensile strain produced by the reinforcement is very large, the soil that produces the maximum tensile strain is accompanied by the fracture surface, so the position where the reinforcement produces the maximum tensile stress is the position of the potential fracture surface. Therefore, the location where the reinforcement generates the maximum tensile stress is the location of the potential fracture surface. Many experts have pointed out that the shape of the potential fracture surface of the vertical wall along the wall height can be simplified into a broken line. The upper part of the broken line is a vertical line segment, and the distance from the wall surface is 0.3
times the height of the wall. The lower part of the broken line is an oblique line, and the angle between the oblique line and the horizontal plane is 45° + \( \phi/2 \) (\( \phi \) is the internal friction angle of the fill). Figure 13 shows the fitting curve of the location of the maximum tensile stress of the reinforcement after the completion of the construction. The curve in this figure shows that when the wall surface of the reinforced retaining wall is vertical, the maximum tensile stress distribution curve of the reinforcement is in good agreement with the 0.3\( H \) method.

4.2. Analysis of the Effect of Static Vehicle Load on Reinforced Retaining Wall. In the design of the retaining wall, the vehicle and crowd load at the top of the wall is usually
converted into the uniformly distributed load within the whole calculated cross section. For example, according to "Specification for Design of Highway Subgrades" (JTG D30-2015), when the height of the retaining wall is 2–10 m, the uniformly distributed load is selected by interpolation within the range of 20–10 kN/m². In practice, the mode of action of the vehicle load noticeably differs from that of the uniform load, in particular for reinforced retaining walls. When considering the uniform load, the reinforced body produces uniform settlement, and the layered settlement of the soil is relatively obvious due to the mixing effect of the reinforcement. When the actual vehicle load is imposed, the settlement of the soil within the load range will be larger than the settlement of the surrounding soil. The deformation of the reinforcement will be promoted, thereby increasing the tensile stress of the reinforcement, while affecting a certain deformation of the entire reinforcement.

Since the actual contact surface between the wheel and the roadbed is a curved surface, to simplify the analysis, the front wheel load can be converted into a uniform load of 0.3 m × 0.2 m, and a rear wheel load can be converted into a uniform load of 0.6 m × 0.2 m, which are applied above the model, in accordance with the requirements in the "Technical Standards of Highway Engineering" (JTG B01-2003) and the plane dimension drawing of the truck. The equivalent load range is presented in Figure 14. Combined with the calculated results in Table 1, the equivalent uniform load of each load-bearing area of the subgrade is 500 kN/m² when the truck acts above the model. The simulation is carried out in five times. The section of the direction at \( Y = 2 \) m is the monitoring section; the distance from the left edge of the loading area to the wall is 1 m, 2 m, 3 m, 4 m, and 5 m, respectively; thus, the response law of the reinforced retaining wall can be obtained by simulating the variations of the vehicle position.

4.3. Effect of Vehicle Position on Displacement of Reinforced Retaining Wall. Figure 15 shows the vertical displacement cloud map in the monitoring section of the reinforced retaining wall at different vehicle positions. Comparing the cloud maps under different positions of the vehicles, the maximum vertical settlement occurs at the parking position of the vehicle, and the settlement area is located in the shape of a "valley." Since the loading area is away from the wall, the "valley" settlement area gradually moves behind the wall. When the position of the vehicle is 1 m and 2 m, the layered line of the settlement cloud map intersects with the face wall, and the vertical settlement of the face wall is the maximum. Under the distance of the vehicle position from the left edge of the loading area to the wall as 3 m, 4 m, and 5 m, the layered line and the wall of the settlement cloud will be no longer intersected, and the vertical settlement at the wall will be almost constant along the depth of the wall. This is primarily because the actual working load and uniform load of the vehicle are different. When the vehicle stops on the reinforced retaining wall, the contact surface between the vehicle and the wall top will be a small, curved surface of each wheel, the load acting area will be small, and the load effect at load acting point is remarkably larger than the load effect when the uniform load is considered. Taking the monitoring section as an example, the load above the section consists of the diffusion load of the right rear wheel and the front wheel apart from the direct load of the left rear wheel of the vehicle. Accordingly, the vertical settlement near the parking point of the vehicle is noticeably larger than that of other areas.

Figure 16 presents the cloud map of the horizontal displacement in the monitoring section of the reinforced retaining wall at different vehicle positions. Such cloud map reveals that the horizontal displacement occurs largely within 4 m from the wall to the wall. Under the distance of vehicle position from the left edge of the loading area to the wall as 1 m, the maximum horizontal displacement will take place at the top of the wall. Under the distance of vehicle position from the left edge of the loading area to the wall of 2 m and 3 m, the maximum horizontal displacement will take place in the middle of the wall. As the loading area continues to go away from the wall, the maximum horizontal displacement will be no longer generated at the wall but will occur near the loading area.

Figure 17 shows the variation curve of the vertical and horizontal displacement along the wall height of the inner wall of the monitoring section at different vehicle positions. The analysis shows that under the distance of vehicle position from the left edge of the loading area to the wall of 1 m, the vehicle load has the greatest effect on the stability of the wall. As the vehicle position is far away from the face wall, the vertical and horizontal displacement of the face wall decrease greatly. Under the distance of vehicle position from the left edge of the loading area to the wall of 2 m, the vertical and horizontal displacement is about 1/3 of that generated under the distance of 1 m. This is mainly because under the distance of vehicle position from the left edge of the loading area to the wall of 1 m, the additional stress on the wall vehicle will be large due to the "cutoff" function of the wall. Besides, for the small area affected by the vertical additional stress, the reinforcement cannot fully exert the friction to resist the deformation of the reinforcement. Therefore, for the shoulder-type reinforced retaining wall, heavy vehicles
Figure 14: Schematic diagram of the equivalent load range.

Figure 15: Continued.
Figure 15: Vertical displacement cloud diagram in the monitoring section of the reinforced Earth retaining wall at different vehicle positions.

Figure 16: Continued.
should not be parked in the range of the distance from the wall as 1m. Under the distance of vehicle position from the left edge of the loading area to the wall as 3m, 4m, and 5m, the vertical displacement generated at the wall will be approximately 2mm, the horizontal displacement will be about 1.5mm, and there will be slight variation along the depth of the wall. It is suggested that the integrity of the reinforced retaining wall is highly robust.

4.4. Effect of Vehicle Position on Earth Pressure of Reinforced Retaining Wall. Figure 18 presents the cloud map of vertical Earth pressure in the monitoring section of the reinforced retaining wall at different vehicle positions. When the vehicle load is imposed on the reinforced retaining wall, there is an obvious additional vertical stress at the vehicle stop point, and the lateral additional stress spreads from the contact surface between the wheel and the top of the wall to the wall depth. Thus, the diffusion depth is about 2.5 m. Since the loading area is away from the wall, the additional stress area progressively approaches the back of the wall. Compared with the vertical Earth pressure cloud map of the reinforced retaining wall not subject to vehicle load within the monitoring section, the vehicle load in the horizontal direction also exhibits a small influencing range. In terms of the horizontal plane at the top of the wall, only at the point of application of the vehicle will the stress be generated, and the vertical stress cloud map of the soil on both sides of the vehicle maintains the original layered distribution characteristics, which is not consistent with the uniform load.
Figure 18: Vertical Earth pressure cloud map in the monitoring section of the reinforced Earth retaining wall at different vehicle positions.

Figure 19 shows the cloud map of lateral Earth pressure in the monitoring section of reinforced retaining wall at different vehicle positions. It can be seen from the figure that, like the vertical displacement cloud map, the lateral compressive stress area caused by vehicle load is also in the shape of “valley.” Besides, it gradually expands as the loading
region moves away from the wall. In the meantime, the additional contact stress caused by the vehicle load is reported to be largely concentrated in the distance range of 2.5 m from the road surface, and the lateral Earth pressure remains layered outside the range of 2.5 m along the depth direction of the wall.

Figure 20 presents the distribution curve of lateral Earth pressure along the wall depth of the monitoring section wall.
and reinforced body at different vehicle positions. According to the analysis, the lateral Earth pressure behind the wall and the reinforced body reaches the maximum at the lower part of the retaining wall. The difference between the two is that the lateral Earth pressure behind the wall is nonlinear along the depth direction of the wall, while the distribution curve of lateral Earth pressure behind the reinforced body is approximately linear along the depth direction of the wall. Compared with the lateral Earth pressure behind the wall, the lateral Earth pressure of the reinforced body is greatly affected by the position of the vehicle. The closer the position of the vehicle is to the end of the reinforced material, the more obvious the lateral Earth pressure of the upper part of the reinforced body increases. This is mainly because at the vehicle position of 1 m, 2 m, 3 m, the loading area is far away from the end of the reinforcement, and the length of the reinforcement from the loading area to the end of the reinforcement has sufficient length to function. Thus, the integrity of the reinforced body is strong. The whole reinforced body is equivalent to the gravity retaining wall to resist the back soil. Subsequently, the distribution law is that the lateral Earth pressure acting on the reinforced body is along the depth direction of the wall, which complies with the Rankine Earth pressure theory. At the vehicle position of 4 m and 5 m, the length of the reinforcement at the end of the reinforcement decreases, and the soil in the reinforced body is pressed backwards, making the lateral pressure of the upper part of the reinforced body significantly upregulated.

5. Conclusions

In this research, the finite element analysis is conducted to investigate the mechanical behavior of the reinforced retaining wall under the vehicle load; besides, the structural characteristics of the reinforced retaining wall and the effect of static vehicle loaded on the retaining wall are analyzed.

Based on the results and analysis, the following conclusions can be drawn from this research.

(1) The maximum horizontal Earth pressure inside the wall occurs in the middle and lower part of the retaining wall. Due to the mixing effect of reinforcement and soil, the horizontal stress gradient in the upper part of the retaining wall changes slightly, while the horizontal stress gradient in the lower part of the retaining wall changes greatly. In the numerical simulation, the lateral Earth pressure behind the retaining wall only increases abruptly at the bottom of the retaining wall, and the lateral Earth pressure changes little along the wall height in the middle and upper part of the retaining wall, which is very different from the distribution pattern of lateral Earth pressure in theoretical calculation. The position where the reinforcement produces the maximum tensile stress is the position of the potential fracture surface.

(2) The horizontal displacement occurs primarily within the range of 4 m behind the wall. At the vehicle position of 1 m, the maximum horizontal displacement occurs at the top of the wall. At the vehicle position of 2 m and 3 m, the maximum value of the horizontal displacement is obtained in the middle of the wall. As the loading area continues to move away from the wall, the maximum of horizontal displacement is no longer generated at the wall but occurs near the loading area.

(3) The maximum of lateral Earth pressure acting on the reinforced body and the wall is obtained at the lower part of the retaining wall. The lateral Earth pressure imposed on the wall is nonlinearly distributed along the wall depth while the distribution curve of the lateral pressure behind the reinforced body along the
the depth direction of the wall is approximately linear. Compared with the lateral Earth pressure imposed on the wall, the lateral Earth pressure acting on the reinforced body is greatly affected by the position of the vehicle. The specific performance is that at the vehicle position closer to the end of the reinforce-ment, the increase in the lateral Earth pressure located in the upper back of the reinforced body is more noticeable.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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