◆Dissertation Abstract◆

Effects and Numerical Simulation of Rain Infiltration on SRA Slope Stability

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Degree: Ph.D.
Obtain Time: 2007.1

The landslide in the tiger head mountain of Dragon-tiger pass is a type of SRA landslide, so the paper has a chance to study SRA.

SRA is originated from landslide deposits, slope wash, weathering residues, diluvial deposits etc, and is made of rock and soil. SRA is different from soil and rock, which is inhomogeneous and discontinuous and is a composite of high-strength rock and low- strength soil. And rock has different random position. Rock and soil have different strength and rigidity, and SRA has the interface between rock and soil, which leads to the SRA's discontinuous. In order to obtain the nature of the SRA, the paper studies the seepage of SRA base on the above characters.

Many methods such as in-situ tests, numerical simulation are used in SRA research. The mathematics arithmetic creating the SRA is given in the paper, then the computer program is made. And the paper analyses the rainfall and seepage, the self stability, the supporting stability of the landslide in the tiger head mountain of Dragon-tiger pass.

In the tiger head mountain of Dragon-tiger pass, many watered horizontal shear tests are made, and water content of SRA is measured in the field. And the definition of the water content of SRA is given. At last, the stress-strain curve is gained. In the horizontal tests, the stress-strain curve is changing from ductility to brittleness with the rock content rising, and is changing from brittleness to ductility with the water content rising, and the strength of SRA is rising with the rock content rising, and is diminishing with the water content rising. The cohesion is rising with the rock content rising, while is diminishing with the water content rising, which influence becomes less and less with the rock content rising. When the rock content is high and the water content is low, the strength, the cohesion and the friction angle are high, and at the same time, the sliding surface is short, which is closely connected with the whole strength of SRA. The sliding surfaces is chosen the weak path, and shorten the distance to the upside surface of SRA example.

The difficulty in research on SRA is that the materials are not created well, so the paper give s a new geometry arithmetic, which can create SRA well that researchers need. The rock is replaced with polygons, and the sum of angles between the corner of new rock and one of old rocks must less than 360° . On the other hand, the distance between the shape's centres of the two rocks. The computer program is given, which can create SRA with the different rock content, the different polygon and different distributions.

The paper gives the numerical simulation results of the watered horizontal shear tests, which is similar to the results of the field experiments. The paper gives the numerical simulation progress and the results of SRA. The maximum horizontal press is rising with the rock content increasing, but decreasing with the water content increasing. The displacement of SRA is increasing with the rock content increasing, but decreasing with the water content increasing. From the numerical simulation results of SRA, the rock's displacement is less than the soil's. During the horizontal shear, the rock's movement is the translation and rotation movement with the circumjacent soil, but the stress is very little. The destroy of SRA is one

of the soil between the rock when soil enters into the plastic state, but the rock does not enter into the plastic state, so the future computing does not consider the plastic deformation of rock, but elastic one. The sliding surface is formed in the soil between rocks, which steers clear from the above or the under the rock when the surface meets the rock, at last to the SRA up-surface. Because of the rock in SRA, the sliding surface is not smooth and is sawtooth. The plastic district is spreading with the increasing of the horizontal shear press, which is discontinuous. The discontinuous plastic district marks that the rock strengthens the SRA, which can support more press. But the strengthening degree is finite, because the shear surface reappears after the rock. So the rock does not completely block the weak surface. From the analysis, the interface between the rock and the soil breaks away. Rock has the high strength and little deformation and even its deformation is ignored. Rock has good integrity, rock's movement is translation and rotation movement with the circumjacent soil, and the deformation of rock and soil is not consistent, which proves that it is the full understand about SRA, if the interface is considered. When the rock content is little according to the paper's 10%, 20% and 30%, the shear press is not great effected SRA and the change is little. But the press is increasing with the rock content increasing. Water content has a great effect on the press of SRA, which is great increasing when the water content decreases. In this paper, the deformation of SRA is increasing with the rock content increasing. And the deformation of SRA is increasing with the water content decreasing. If the horizontal press is increasing, the example is destroyed.

The water content has a great effect on SRA, which reason is that the water content greatly affects on the mechanics parameters of SRA. With the water content increasing, that the horizontal shear press is less and less is because water reduces the cohesion and friction angle. On one side, the water content increasing leads to the reduction of the mechanics parameters, such as the cohesion and friction angle, on the other hand, the analysis is not convergent and does not get the result.

The paper introduces the seepage equation of unsaturated soil, rainfall research and boundary condition. The finite-element solution of unsaturated soil is given. The program is made, which can solve the change of the two boundaries in Neumann boundary condition. In laboratory, the seepage of SRA in Dragon-tiger pass is measured, as follows,

$$K = 0.001522C_u^{0.851}R^{1.444} \quad (\mathrm{cm/s})$$

From the above research, the paper gives the analysis about seepage, stress of the landslide in the dragon's head mountain of Dragon-tiger pass and gives the supporting method. Dragon-tiger landslide has threes special geological bodies, which are SRA above it, rock body underground and overburden integrity rock. And the paper full considers the interface of rock and soil. The safe factor is given according the gravity reduction. The observation shows the method good.

A series of rainfall seepage research method on SRA are set up.

The main innovation of the paper shows as follows,

(1) The random structure model of SRA is given, according the graphics. The computer program is made to generate the SRA with the random structure of rock, which is made as the base for the future research.

(2) The field experiment is made, about the SRA with the special geological material in the different water content and different rock content, and the mechanics characteristic is obtained of the SRA in different water content and different rock content.

(3) The theoretical derivation about the rainfall seepage in the unsaturated SRA is made. And the computer program made deals the problem about the boundary transform. The numerical simulation about the rainfall in the SRA is given, and the water content of different depth in different rainfall condition is obtained. In laboratory, the infiltration experiment is made about different rock content, and the function

between permeability coefficient and rock content and non-uniform coefficient of rock is obtained.

（4）The numerical simulation about SRA with the different water content and different rock content is made. The simulation result is compared with the filed experiment. The mechanics characteristic is obtained in the horizontal push-shear in-situ text under different water content and different rock content

Key words: Soil-Rock aggregate(SRA), Seepage, Random Structure, In-Situ Test, Numerical Simulation