Pengaruh waktu pemeraman terhadap kuat geser tanah ekspansif daerah Cikarang, Jawa Barat yang distabilisasi dengan semen, pasir dan kapur = the effect of curing time to the shear strength of expansive soil which stabilized by cement, sand, and lime in the region of Cikarang, West Java / Ishlah Habibi

Ishlah Habibi, author

Abstrak

[ABSTRAK
Pada umumnya kerusakan pada strukstur ataupun kontruksi jalan biasanya disebabkan oleh tanah dasar yang mempunyai kemampuan kembang susut yang cukup tinggi atau yang sering disebut tanah ekspansif. Tanah ekspansif mempunyai sifat yang berbeda dari tanah pada umumnya seperti nilai plastisitas yang cukup tinggi, potensi kembang susut dan kemampatan atau perubahan volume yang cukup besar, selain itu tanah ini mempunyai kekuatan geser yang rendah. Untuk mengurangi kerusakan yang disebabkan oleh tanah ekspansif, maka diperlukan suatu studi penelitian untuk stabilitasi tanah baik yang sudah dilakukan sebelumnya maupun yang telah dilakukan saat ini. Stabilitasi tanah ekspansif yang murah dan efektif adalah dengan menambahkan bahan kimia tertentu, dengan penambahan bahan kimia dapat mengikat mineral lempung menjadi padat, sehingga mengurangi kembang susut tanah lempung ekspansif. Oleh karena itu dalam penelitian ini menggunakan beberapa zat stabilisasi antara lain pasir, semen dan kapur yang mudah didapat dan cukup efektif untuk stabilisasi tanah ekspansif. Dengan penambahan zat tersebut diharapkan mampu memperbaiki sifat-sifat tanah ekspansif yang kurang baik.
Pengujian pada tanah ekspansif yang diambil di daerah cikarang, jawa barat ini meliputi pengujian sifat fisis dan mekanik. Untuk tanah asli dilakukan uji laboratorium meliputi Spesivic gravity, Atterberg Limit, Grain size, Compaction standard, Unconfined compression test (UCT) dan Triaksial Consolidated Udrained (CU). Untuk pengujian tanah campuran baik pasir dan kapur (10% pasir + 5% kapur, 10% pasir + 10% kapur, 10% pasir +15% kapur) maupun pasir dan semen (10% pasir + 5% semen, 10% pasir + 10% semen, 10% pasir +15% semen) dilakukan pengujian SG, atterberg limit, Compaction standard, pengujian kuat tekan bebas (UCT) dan Triaksial Consolidated Undrained (CU). Pengujian akhir yang dilakukan untuk mendapatkan kekuatan geser tanah adalah dengan uji unconfined compression test (UCT) atau uji kuat tekan bebas dan Triaksial Conolidated Undrained (CU) dengan terlebih dahulu melakukan pemeraman selama 0, 4 ,7, 14 hari. Hasil yang didapat untuk triaksial CU kemudian dianalisa dengan metode Critical state concept.
Hal ini dilakukan dengan tujuan untuk menganalisa sejauh mana pengaruh waktu

pemeraman terhadap kuat geser tanah tanah lempung ekspansif yang distabilisasi dengan semen, kapur dan pasir. Membandingkan parameter-parameter kuat geser tanah tanpa bahan campuran dan dengan campuran. Mengetahui persentase variasi campuran pasir dan semen, pasir dan kapur untuk stabilisasi tanah ekspansif yang baik dan efektif setelah pengujian laboratorium.
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Hasil yang diperoleh adalah Tanah ini termasuk ke dalam tanah lempung anorganik dengan plastisitas tinggi, tanah ekspansif (CH). variasi campuran kapur dan pasir dapat menurunkan nilai indeks plastisitas tanah, begitu pula dengan campuran pasir dan semen. Namun penggunaan campuran pasir dan semen terbukti lebih efektif (dengan perentase yang sama) dalam menurunkan indeks plastisitas tanah dibandingkan dengan pasir dan kapur. Adanya perubahan konsistensi dari tanah asli setelah dicampur dengan bahan stabilisasi ditambah dengan waktu pemeraman yang menunjukkan adanya perbaikan tanah. Percobaan unconfined baik campuran pasir dan semen maupun pasir dan kapur setelah pemeraman menunjukkan kenaikan nilai qu, semakin lama waktu pemeraman semakin besar nilai kenaikan nilai qu nya yang ditandai dengan masa pemeraman 14 hari adalah yang terbaik. Untuk pengujian UCT maupun triaksial CU, masa pemeraman 0 hari kurang menunjukkan hasil yang berarti. Dari hasil UCT Pencampuran 5% Semen+10% Pasir dengan pemeraman jauh lebih baik dibandingkan dengan campuran 15% Kapur + 10% Pasir dengan waktu pemeraman yang sama. Sedangkan campuran 15% semen + 10% pasir memberikan hasil yang sangat signifikan dalam nilai qu nya jika dibandingkan dengan campuran tanah 15% Kapur + 10% pasir namun dari segi biaya cukup mahal, disisi lain campuran 15% kapur + 10% pasir juga dapat memperbaiki tanah dalam hal stabilisasi yang lebih ekonomis. Pengaruh pencampuran 15% Kapur + 10% pasir untuk pengujian triaksial CU terbukti dapat meningkatkan nilai parameter kuat geser tanah,terutama nilai sudut geser tanah asli mengalami peningkatan sebesar 11.41o dari 12.940 menjadi 24.350 setelah waktu pemeraman 14 hari namun nilai kohesi tidak banyak berubah dari tanah asli, hal ini disebabkan pasir yang bersifat lepas menurunkan kohesi tanah namun menaikkan nilai sudut geser.;
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ABSTRACT
In general, the damage of structures or road consructions are caused by sub grade that has capability to shrunk and expand highly, or often called as the expansive soil. Expansive soil has different properties from other type of soil in general, such as the high plasticity index, the shrinkage potential and the congestion or significant change in volume; however, it has a low shear strength. To reduce damage caused by expansive soil, there is an urgent need to conduct more research regarding its stability. The relatively cheap and effective way to stabilize expansive soil is by adding chemical agents that will bind clay minerals,

thereby reducing shrinkage. Therefore this study uses several stabilizing substances such as sand, cement and lime that are easily available and quite effective to stabilize this type of soil. The addition of these substances is expected to improve the properties of expansive soil.

Experiment of expansive soil samples from Cikarang, West Java, consisted of a series physical and mechanical properties tests. The original soil was examined with laboratory tests: Spesific gravity, Atterberg Limits, Grain size, Compaction standard, unconfined compression test (UCT) and Triaksial Consolidated Undrained (CU). And the mixture of sand and limestone (10% sand + 5% lime, 10% sand + 10% lime, 10% sand +15% lime); and sand and cement (10% sand + 5% cement, 10% sand + 10% cement, 10% sand cement +15%) were examined with similar tests as the original soil except the grain size. The final test to obtain soil shear strength was the Unconfined Compression Test (UCT) and Triaxial Consolidated Undrained (CU). Prior to the tests, curing was performed for 0, 4, 7, and 14 days. The results from the triaxial CU were then analyzed by the critical state concept method.

The objectives of this study are to analyze the extent of influence of curing time on shear strength of expansive clay soil stabilized with cement, lime and sand; to compare the soil shear strength parameters with and without mixture; and to investigate the optimum percentage of mixture variation (sand-cement and sandlime) from laboratory experiment.

From the experiment, the soil is categorized as anorganic clay with high plasticity index, expansive soil (CH). The Mixture of variation sand ? lime and sand - cement can reduce soil plasticity index. However the variaton sand ? cement (in same persentation) mixture more effective to reduce soil plasticity indeks than variation sand ? lime mixture. Moreover, the alteration of original soil consistency after mixed with stabilizing agent and the increasing of curing time demonstrate a soil improvement.

Unconfined test both for sand-cement and sand-lime mixture after curing showed an increased value of qu, the longer the curing time the greater the increase in value, in which 14 days curing time gains the greatest result. From UCT and triaxial CU tests, 0 days curing period showed less significant result. The mixture of 5% cement + 10% sand with curing is better than the mixture of 15% lime +10% sand with same curing time. The mixture of 15% cement +10% sand gives significant result in improving qu rather than the mixture of 15% lime + 10% sand though quite expensive. The mixture of 15% lime +10% sand can also improve soil in more economical term. The effect of mixing 15% lime + 10% sand from CU triaxial test proved to increase the value of shear strength parameters, especially soil shear angle values increased after 14 days curing time for 11.41o from 12.940 to 24.350. However, the cohesion value decreased 6,13 Kpa, in which quite similar from the original soil. This is due to the characteristic

of loose sand that reduces soil cohesion while at the same time increases soil shear angle., In general, the damage of structures or road consructions are caused by sub grade that has capability to shrunk and expand highly, or often called as the expansive soil. Expansive soil has different properties from other type of soil in general, such as the high plasticity index, the shrinkage potential and the congestion or significant change in volume; however, it has a low shear strength. To reduce damage caused by expansive soil, there is an urgent need to conduct more research regarding its stability. The relatively cheap and effective way to stabilize expansive soil is by adding chemical agents that will bind clay minerals, thereby reducing shrinkage. Therefore this study uses several stabilizing substances such as sand, cement and lime that are easily available and quite effective to stabilize this type of soil. The addition of these substances is expected to improve the properties of expansive soil.

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