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Commentary

Development and Field Estimation of Fast Rail Line Test Bank Based on Indian Sweeping Soil Dark Cotton Soil

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COMMENTARY

The railway embankment applied to high-speed railways is required to have high performance in terms of strength and deformation characteristics. Especially in the case of railway embankments that support slab tracks, the allowable settlement is very small. There are two technical challenges in constructing high-speed rail embankments to support slab tracks in India. The first challenge is dealing with problematic black cotton soil (BCS), which is widely distributed in India but very unusual soil in Japan. The second challenge is posed by the strict deformation requirement in the construction of the embankments. In this study, a 6 m-high test embankment was constructed on BCS in India. The deformation of the embankment and changes in water content were measured over a period of 18 months. In the construction of the test embankment, two different BCS countermeasures were applied. The results of the tests on this embankment were compared with those from an embankment without countermeasures. Complicated deformation behaviors, including settlement and the uplift of embankment, were observed in the section without countermeasure.

However, in the embankment with cement-mixed gravelly soil (CGS) slab improvement with geosynthetics, the much lower amplitude of embankment deformation is evidence of the effectiveness of this countermeasure. The cohesive non-swelling soil (CNS) layer applied immediately below the embankment to reduce the water content fluctuation of BCS was not effective enough for use for high-speed railway embankment. Besides determining the technical challenges for the BCS countermeasures, the results of this study confirmed that a high-performance embankment can be constructed with Indian embankment material by performing sufficient compaction management.

Rapid economic development in India has brought in an era of construction, with many transportation projects undertaken, including high-speed railways, high grade freight corridors and highways. The railway embankment applied to high-speed railways is required to have high performance in terms of strength and deformation characteristics. While slab tracks are often applied to reduce the maintenance cost, the allowable settlement of railway embankments that support these slab tracks is very small. In Japanese railway design standards the allowable settlement for serviceability and the maintenance of slab track is 10 mm/10 years. These limits are very strict for earth structures. In order to achieve this, the strength of the supporting ground, the type of embankment material, and the compaction management method are prescribed in the standard. One of the problems encountered when constructing a high-speed rail embankment that supports slab tracks in India is the presence of black cotton soil (BCS), a problematic soil widely distributed throughout India but almost non-existent in Japan. Another problem is meeting the strict deformation requirements.

The swelling of BCS is known to result in many problems, such as subsidence and the tilting of structures, and the uplifting and cracking of slabs due to swelling pressure, especially in the rainy season. For these reasons, it is necessary to evaluate the swelling properties of BCS and propose appropriate countermeasures for constructing railway embankments on this problematic soil. It is hard to get excellent dike materials, like all around evaluated rock, in India. Japan's numerous rocky regions furnish the Japanese development industry with promptly accessible excellent bank materials. For the future development of railroad banks in India, it is important to affirm the exhibition of dike made of Indian material with Indian compaction strategies. Accordingly, in this review, a 6 m-high test banks was developed in Amod, focal India, where BCS are broadly dispersed. The twisting of the bank and changes in the water content were estimated over a time of year and a half (from June 2016 until October 2017). Two distinct countermeasures were applied on various segments of the test bank as BCS countermeasures. The aftereffects of the tests on the banks with and without countermeasures were analyzed.

The most predominant strategies used to assess the enlarging properties of soil in India are the conventional techniques, alluded to as the "Free Swell (FS) Test" and the "Differential Free Swelling". These techniques are broadly used to get commonsense meanings of BCS in India. There is clear potential to set up a pragmatic strategy to assess the enlarging properties of BCS, or to assess the need of applying countermeasure for the BCS, by joining the file

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clarified above, for example, the movement and dirt substance, with the customary Indian file got by the supposed FS technique or DFS strategy. The strategies above center around utilizing down to earth list which can without much of a still up in the air from information got at the building site.

There are, notwithstanding, different elements which could impact the outcome, for example, test planning (just reconstituted tests were ready in this review), thickness, the impact of pull (soil–water trademark bend) and the strategy used to gauge the expanding pressure. It is likewise conceivable that the level of the countermeasure, for example, the width of the CGS layer and the strength of the geosynthetic organized in the CGS layer, can be changed considering the enlarging properties of the BCS and required execution of the bank. Further examination is important to quantitatively assess the expanding properties of BCS so the selection of countermeasures can be upgraded by the necessary exhibition of dike. In a new report, proposed an equation to foresee the expanding pressure which thinks about the measure of enlarging minerals by thinking about the material's free swell record (FSI). An exact methodology legitimate for FSI up to 60% may have incredible potential as an aide for picking proper countermeasures.