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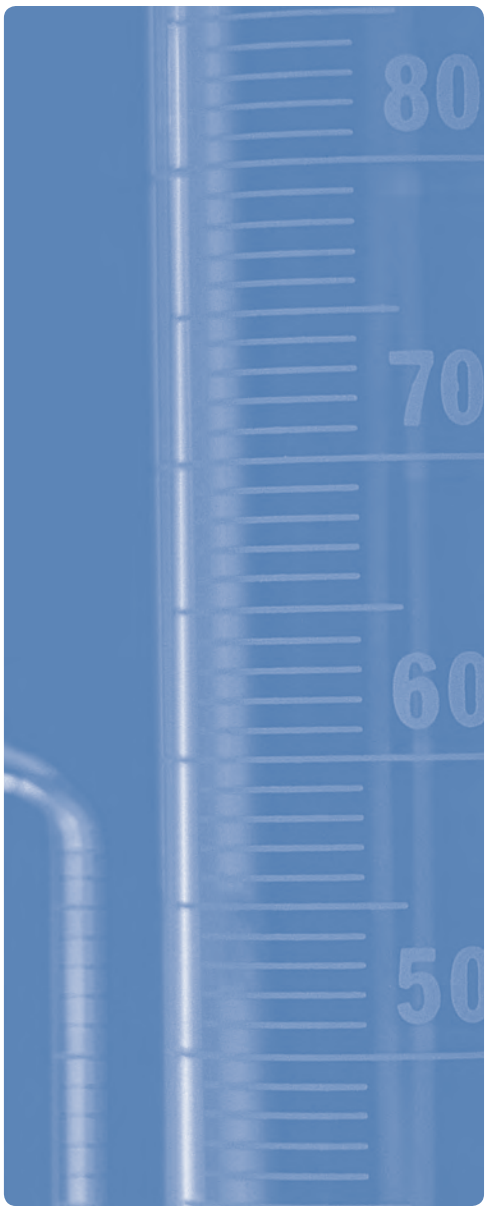

Journal of Testing and Evaluation

Contents:

SPECIAL ISSUE ON SUSTAINABLE TECHNOLOGIES AND MATERIALS FOR TRANSPORTATION INFRASTRUCTURES

Guest Editors: Julius Joseph Komba, Dar Hao Chen, Shen-En Chen, and Jinyuan Liu

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Some issues, in whole or in part, may be Special Issues focused on a topic of interest to our readers.

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The high quality of the papers that appear in this publication is a tribute not only to the obvious efforts of the authors represented but to the unheralded, though essential, efforts of their reviewers. It is to the reviewers dedication to upholding the high standards of their profession that this note pays tribute. On behalf of ASTM International and the authors as well, we acknowledge with appreciation their important contribution to the success of this journal.

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Overview

Special Issue on Sustainable Technologies and Materials for Transportation Infrastructures

Economic and social developments of any country rely heavily on sustainable transportation infrastructures. However, engineers are increasingly faced with the challenge of designing, constructing, and monitoring the performance of the transportation infrastructures, due to many factors, including the effects of severe weather resulted from climate changes. Innovative technologies and materials offer unique opportunities to solve many challenging problems regarding transportation infrastructures including pavements, bridge structures, railways, tunnels, materials, soils improvement, excavations, and slopes stability.

This special publication of the ASTM's *Journal of Testing and Evaluation* contains 30 papers that deal with sustainable technologies and materials used in transportation infrastructures. All papers published in this special issue have undergone rigorous peer review. The materials covered in this publication include asphalt, soils, concrete, steel, as well as technologies for characterization of materials and monitoring the structural condition of infrastructures. The publication includes experimental research based on laboratory and field studies, analytical modeling, and investigations on innovative technologies and materials. The papers dealing with asphalt address reflective cracking of asphalt pavements, rheological properties of asphalt mixtures, modelling of linear-viscoelastic properties of asphalt, and investigations into the burning properties of asphalt mixtures. For soils, the papers address the use of innovative materials, such as geotextile to improve strength, modelling plastic strain in subgrade soils, metal contaminants, and expansive clay. The papers dealing with concrete cover plastic concrete and pervious concrete for use on pavements and seawall utility. For steel, the method for monitoring of the internal cable force on long-span bridges is presented in the publication. The papers dealing with the seismic response of materials and infrastructures address vibration responses of the pavements, detection, and classification of the seismic events and the use of seismic analysis to assess the performance of municipal solid waste. Other topics in the publication include the use of TiO_2 waterborne epoxy resin as fog seal, analysis of X-ray CT images to characterize the morphological features of aggregates, analysis of crack initiation and propagation mechanism on asphalt mixtures, dynamic stress and dynamic pore pressure in the drainage base of large stone porous asphalt mixtures, and the deformation characteristics of sensors under load and measurement of the interface shear strength between the steel bridge deck and the asphalt concrete overlay.

Five papers discuss asphalt related topics. The work by Geng et al. focused on the use of rubber modified asphalt to tackle the problem of reflective cracking of asphalt pavements. Fire safety is an important consideration for the selection of pavement materials used in highway tunnels. Li et al. evaluated the effects of flame retardant on the pavement performance and burning properties of asphalt mixtures. The authors showed that the evaluated flame retardants are effective for preventing the burning in asphalt mixtures. Zhang et al. investigated the influence of aggregate morphological characteristics on rheological properties of asphalt mixtures. Asifur Rahman et al. developed a regression-based predictive model to estimate dynamic modulus of asphalt concrete from the dynamic shear modulus and phase angle of the asphalt binder. The authors demonstrated that accurate estimation of dynamic modulus of asphalt concrete can be obtained using the developed predictive model. Finally, Ramirez Cardona et al. studied the influence of moisture on the linear-viscoelastic properties of bituminous mixtures for use in railway track bed. The 2S2P1D rheological model was used to simulate the experimental results in light of typical railway loading conditions, which allowed identifying the complex modulus values at specific frequencies by the train traffic.

There are six papers that discuss bearing capacity and soils characterization. Geotextile materials are widely used in geotechnical engineering as a reinforcement to improve the strength and stability of soils and foundations. Lai and Yang studied the bearing capacity and loading behavior of strip footing reinforced with geotextile. Laboratory tests and finite difference program were used to simulate the load-settlement behavior of the geosynthetic reinforced footing using Mohr-Coulomb and Double-Yield models. The authors concluded that the Double-Yield model simulates the loading behavior of strip footing better than the Mohr-Coulomb model. Wang et al. studied the tensile strength and deflection of steel-plastic geogrid. The results showed that the steel-plastic geogrid has a potential to control deflection on the bottom layers of pavements and sidewalls. Construction of pavements in soft soils is problematic due to their compressibility nature and weak strength. Kiptoo et al. conducted a laboratory study to investigate geosynthetic-reinforced pavement under static and dynamic loading. The results showed that there was a significant improvement in bearing capacity and reduction in settlement due to geosynthetic. The work by Yang and Chang focused on the plastic strain properties in subgrade soil under repeated loading. A predictive model using a genetic programming method was developed. The authors demonstrated that the performance of the predictive model is better than the traditional prediction methods when applied to predict plastic strain in subgrade soils. It is well-known that clayey soils exhibit volume variations due to moisture content fluctuations. The movement of expansive soil may cause significant damage to infrastructures. The work by Chittoori et al. investigated the relationship between pore characteristics and unit weight of clayey soils. Finally, the work by Moghal et al. investigated the sorptive response of two metal contaminants, namely hexavalent chromium and mercury. These chemicals from mining, refining, and electroplating industries may cause significant damage to the natural soil system by altering its physico-chemical geochemistry.

Seismic and dynamic responses of materials and infrastructures are discussed in four papers. The work by Yao et al. focused on the characterization of the vibration responses of cement concrete pavement surface slabs with different interlayers under a moving vehicle load. The authors demonstrated that the rubber sheet and the geotextile interlayers significantly damp vibrations, hence improving the vibration responses of the pavements. Seismic events can cause significant damage to infrastructures. Guo et al. investigated the coupling relationship

between ionospheric variations and great earthquakes through measurements of the total electron content anomalies to improve the accuracy of earthquake prediction. The exploration of deep resources and underground spaces may increase rock bursts and rock instability resulting in damages to infrastructures and equipment. Using singular value decomposition technique, Li et al. investigated two types of seismic signals often misclassified in practice, namely seismic events and quarry blasts. The authors demonstrated that singular value decomposition technique can effectively extract signal features and better classification of seismic events may be achieved. Seismic risk characterization is highly dependent on the shear wave velocity profile. The shear wave velocity profile is measured using various methods, such as the spectral analysis of surface waves method. Finally, the work by Ramaiah and Ramana used seismic analysis to assess the performance of municipal solid waste dump sites. The authors concluded that amplification potential of municipal solid waste should be taken into account while designing the final cover system, assessment of permanent displacements, and global stability for the dumpsite during their closure plans.

Monitoring the structural condition of underground structures may be a challenging exercise due to the fact that some of the ground areas are inaccessible for the inspection team. In this publication, six papers discussed the use of advanced techniques for infrastructure monitoring. The work by Negi et al. investigated the possibility of using the electro-mechanical impedance technique to detect and quantify load-induced damage in dry and saturated conditions in the underground structures. Flexible cables primarily carry loads on long-span bridges. As such, an accurate method for monitoring of the internal cable force is critical to ensure safe functioning of bridge structures. The work by Wang et al. proposes an accurate approach for monitoring cable force on bridge structures. The proposed approach was successfully used to monitor a cable-stayed bridge and a special-shaped steel arch bridge. Chiu et al. studied the stability and slipping behavior of the slopes using the particle image velocimetry method. The authors demonstrated that the particle image velocimetry method can quickly identify the major moving zones and displacement fields when compared with traditional methods. Sinkholes are one of the major hazards that have resulted in the loss of human lives and infrastructures. Perez et al. studied the mechanism of sinkholes formation that is triggered by groundwater flow. The authors concluded that a pattern change of groundwater flow can be used as an input to pre-detect sinkhole formation. The dissolution characteristics of limestone play a crucial role in the development of sinkholes. The work by Wang et al. focused on developing a quantitative tool for evaluating the dissolution ability for sinkhole formation. Finally, Huang et al. studied the dynamic response of pre-stressed high-strength concrete pipe-piles in liquefiable soil. It was found that the peak displacement responses of piles in saturated soil are larger than the peak displacements in unsaturated soil.

Concrete and cement are discussed in two papers. The work of Kazemian and Ghareh focused on plastic concrete, which is commonly used for sealing in foundations of earth and gravel dams. The authors investigated the effect of the ratio of mixture proportions, cement, and the quality of bentonite materials on mechanical properties of plastic concrete. On the other hand, Lee et al. studied the characteristics of pervious concrete for use on pavements and seawall utility. The authors showed that the comprehensive strength of pervious concrete complies with the requirements of normal concrete. Pervious concrete is considered to be a green material due to its ability to keep the runoff of rainwater, hence preserving water and reducing the effects of heating.

Pavements and other transportation infrastructure-related issues are discussed in six papers. Hu et al. investigated the feasibility of using TiO_2 waterborne epoxy resin as fog seal and exhaust degradation material in asphalt pavements. The authors concluded that TiO_2 waterborne epoxy resin fog seal can maintain the skid resistance and improve the impermeability of the pavements. Aggregate morphological properties are known to influence the performance of pavements. Gong et al. developed a MATLAB-based approach for the analysis of X-ray CT images to characterize the morphological features of aggregates including shape, angularity, and texture. Zhang et al. took advantage of advanced technology to develop a model that combines a digital image processing technique and extended finite element methods to analyze the crack initiation and propagation mechanism on asphalt mixtures. The developed model was validated with laboratory test results and theoretical solutions, after which the model was successfully used to investigate the crack initiation and propagation in the asphalt mixtures. Cui et al. studied the time histories of dynamic stress and dynamic pore pressure in the drainage base of large stone porous asphalt mixture, under moving vehicle forces. The authors concluded that the dynamic pore pressure due to moving vehicle forces might cause significant damages in asphalt pavements. Pavement performance monitoring involves the measurement of parameters such as stress, strain, and temperature with sensors. To ensure accurate results, the deformation characteristics of sensors under load must be compatible with that of asphalt mixtures. The work by Zhang et al. investigated the mechanical properties and electrical resistivity of the polyethylene terephthalate-graphite composite. The authors concluded that the strength of polyethylene terephthalate-graphite composite is similar to that of asphalt and is suitable for the production of sensors for monitoring the condition of asphalt pavements. Finally, Yao et al. developed a steel-concrete interface shear test for measuring the interface shear strength between the steel bridge deck and the asphalt concrete overlay. The repeatability of the test was found to be good, and the test was successfully used to investigate the strength of three types of interfaces.

Lastly, the Technical Note by Tsai et al. demonstrated the use of time–frequency domain analysis for estimating the dispersion curve of a Rayleigh wave.

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TECHNICAL NOTE