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Soil-Structure Interaction Models for the Reinforced Foundation System – A State-of-the-Art Review

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Abstract : Challenges of weak soil subgrade are often resolved either by stabilization or reinforcing it. However, it is also practiced to reinforce the granular fill to improve the load-settlement behavior of over weak soil strata. The inclusion of reinforcement in the engineered granular fill provided a new impetus for the development of enhanced Soil-Structure Interaction (SSI) models, also known as mechanical foundation models or lumped parameter models. Several researchers have been working in this direction to understand the mechanism of granular fill-reinforcement interaction and the response of weak soil under the application of load. These models have been developed by extending available SSI models such as the Winkler Model, Pasternak Model, Hetenyi Model, Kerr Model etc., and are helpful to visualize the load-settlement behavior of a physical system through 1-D and 2-D analysis considering beam and plate resting on the foundation respectively. Based on the literature survey, these models are categorized as 'Reinforced Pasternak Model,' 'Double Beam Model,' 'Reinforced Timoshenko Beam Model,' and 'Reinforced Kerr Model.' The present work reviews the past 30+ years of research in the field of SSI models for reinforced foundation systems, presenting the conceptual development of these models systematically and discussing their limitations. Special efforts are taken to tabulate the parameters and their significance in the load-settlement analysis, which may be helpful in future studies for the comparison and enhancement of results and findings of physical models.

Keywords : geosynthetics, mathematical modeling, reinforced foundation, soil-structure interaction, ground improvement, soft soil

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