

## Optimal Control of Single-Degree-of-Freedom Systems Dynamically Interacting with Elastic Soil<sup>†</sup>

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### ABSTRACT

*In this paper, a numerical algorithm is proposed to analyze optimally controlled soil-structure interaction system. In the proposed algorithm, the control force is obtained first using a fixed-base system in time domain, and then it is converted to frequency domain by Fourier Transform to be used in the equations of soil-structure interaction system. The lateral displacement and rocking of foundation are obtained from the equations of soil-structure interaction system containing the control force, and then converted to time domain by Inverse Fourier Transform. Secondly, the control force is calculated again by using the combination of lateral acceleration of the system, foundation rocking and earthquake ground acceleration. In recent studies, optimal control of structures has been generally studied by using a fixed-base system rather than the system supported on flexible soil which is usually analyzed in frequency domain. In this study, a more realistic dynamically interacting soil-foundation system has been considered.*

**Keywords:** *Optimal control, soil-structure interaction, foundation impedances.*

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## Reliability Assessment of Existing Equations Predicting the Shear Strength of Reinforced Concrete Beams without Stirrups<sup>†</sup>

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### ABSTRACT

*Codes keep the probability of shear failure low in order to prevent a reinforced concrete member from reaching its ultimate strength through shear failure, which is sudden and brittle. Numerous equations for predicting the cracking shear strength of a reinforced concrete beam without stirrups have been proposed in the previous studies. In this study, performance functions related to the equations given by four codes and seven researches are developed considering beams with various geometrical and material properties. The reliability of these equations is assessed based on the performance functions by using second-moment approach. According to the failure probabilities based on different distributions, it is observed that the equation given by EN92 is the most reliable one.*

**Keywords:** Reinforced concrete, beam, shear strength, probabilistic, reliability, failure.

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## Determining the Critical Tire and Axle Configuration for Flexible Pavements Based on Mechanistic Analysis<sup>†</sup>

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### ABSTRACT

*While the tire contact pressure and contact surface area are important concerns in pavement performance, the number of contact points per vehicle and their spacing are also critical. In this study axle loads from field measurements, heavy vehicle tire, and axle configurations were modeled by utilizing a 3D dynamic finite element. The most critical axle and tire types have been determined based on the vertical and horizontal stress and strain values. Single axle and single super tire were found to be the most critical tire and axle configuration in terms of rutting and fatigue damages.*

**Keywords:** *Tire and axle configurations, stress, strain, mechanistic-empirical design.*

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## Evaluation of Traffic Management Strategies Implemented During the FSM Bridge Maintenance<sup>†</sup>

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### ABSTRACT

*Rising traffic congestion is an inescapable condition in large metropolitan areas across the world. The goal of this study is to evaluate the traffic management strategies implemented during the maintenance of the FSM Bridge in 2012. To this end, the analysis of traffic parameters and peak-hours of the study area, the effect of the number of toll booths and toll policies on the traffic, the changes in vehicle classes, traffic flow on the alternative routes and the number of incidents are performed. It is demonstrated that while average speeds are decreased by 40% due to work zone, average speeds are increased by 58% after the implementation of the management strategies. While at the first stage of the maintenance constructions, vehicles traveled 14 hours a day at speeds below 20 km/h; the time spent at this speed is reduced to only 2 hours a day after the implementation of work zone management strategies. After the construction with the implemented measures, the number of accidents at toll booths and on the FSM Bridge is decreased by nearly 80%.*

**Keywords:** Work zones, traffic management strategies, traffic detectors, traffic flow analysis.

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## **Examination of Relationships Between Menard Pressuremeter, Standard Penetration and Laboratory Tests Data on The Silty Soil (Kastamonu, Turkey)<sup>†</sup>**

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### **ABSTRACT**

*Determining the deformation characteristics of soils is one of the most important parameters of geotechnical designs. Since the laboratory tests could not represent soil masses and obtaining reliable specimens is expensive, various in-situ tests have been developed. Menard pressuremeter test gives realistic results, but it requires excessive time, cost and experience. Hence, cheaper methods are needed to obtain parameters indirectly. In this study correlations between Menard pressuremeter, standard penetration and some laboratory tests data are investigated during a research conducted for the sandy silt in Kastamonu. Equations were derived with regression analyses which yielded high coefficients of correlation.*

**Keywords:** *Menard Pressuremeter Test, Standard Penetration Test, Laboratory Test, Correlation, Silty Soil, Turkey.*

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## Rapid Loss Estimation Methodology for Single Storey Reinforced Concrete Industrial Buildings<sup>†</sup>

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### ABSTRACT

*Estimating earthquake losses is an important issue which affects many areas, mainly insurance applications. In this study, a rapid earthquake loss estimation methodology has been developed for single storey reinforced concrete industrial buildings by using parameters determined after investigating more than 100 industrial building projects. 384 analytical loss estimation curves were obtained by using non-linear structural performance analysis method proposed in 2007 Turkish Seismic Code. As a result of the study, it was observed that the buildings, which have the same seismic performances according to the existing methods, could correspond to different damage levels when this new methodology is used.*

**Keywords:** Reinforced concrete industrial buildings, rapid earthquake loss estimation method, non-linear structural analysis, earthquake PML (Probable Maximum Loss).

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## Computer-Aided Design of Armoring Type Bridge Scour Countermeasures<sup>†</sup>

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### ABSTRACT

*Local scouring at piers of river bridges affects the bridge safety adversely. Proper design and implementation of scour countermeasures can limit potential bridge failures. This study deals with the description of a computer program developed in VB.Net language to design armoring type bridge scour countermeasures. This program is applied to a bridge located in Rize, Turkey. To this end, flow, bed material, and bridge structural characteristics are defined to determine the maximum depths of scour at bridge elements. Using this information, various alternatives are tested from constructional, geotechnical, hydraulics, and economic feasibility viewpoints. Based on a selection index, partially grouted riprap is found to be a suitable countermeasure for the mentioned project.*

**Keywords:** Bridge, pier, scour countermeasure, riprap.

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## Use of Basalt Aggregate in Concrete Marine Structures<sup>†</sup>

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### ABSTRACT

*Very high strength marine concrete, that can be placed without the use of vibrators, made up of CEM-I cement, blast furnace slag, silica fume and containing carboxylic admixture and including basalt coarse aggregate instead of limestone was experimentally investigated. The experiments carried out with the basalt specimen showed that the basalt used did not have alkali reactivity and also had comparable qualities with respect to limestone. Considering that there are different types of basalt in nature which can be defective, it must be emphasized that the successful results obtained in this study cannot be generalized without adequate preliminary investigations and applied to all kinds of basalt.*

**Keywords:** Basalt, limestone, coarse aggregate, high strength, workability, petrography, alkali-silica.

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## Evaluation of Ground Snow Loads in Turkish Codes Through Statistical Analysis of Turkey Snow Data<sup>†</sup>

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### ABSTRACT

*In Turkey many roofs exposed to snow loads exceeding the design snow loads are damaged or collapsed. Roof snow load specified for structural design in Turkish codes is calculated as the product of a ground snow load multiplied by the conversion factors that depend on the roof properties. In this study, the ground snow loads in Turkish codes are evaluated via statistical analysis of Turkey snow data obtained from 92 Turkish State Meteorological Service stations. The probability plot correlation coefficient test for Gumbel, lognormal and Weibull distributions are used to determine the best fit of the probability distribution considering the snow data. 50-year design ground snow loads and snow depths of the stations determined by using the selected distributions are compared to those proposed in Turkish codes. It is concluded that TS 498 is unsafe for Eastern Black Sea and Eastern Anatolia regions and Gumbel distribution used in TS 7046 does not represent half of the snow data.*

**Keywords:** Roof snow load, ground snow load, statistical analysis, TS 498, TS 7046.

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## Modeling and Model Calibration of Traffic Flow on Freeway: Istanbul O1 Example<sup>†</sup>

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### ABSTRACT

*Many traffic control tools such as Variable Speed Limits (VSL), Ramp Metering, etc are applied to improve freeway traffic flow and through these tools various undesirable phenomena like shock waves and queues on traffic flow can be eliminated or reduced. The aim of this study is to analyze a 2.5 km section of O1 Freeway in Istanbul and to model it analytically with a macroscopic analytical traffic flow model METANET. The section under consideration has two merges. Traffic congestion, shock waves and queues that occur on the section in rush hours. The fundamental parameters of METANET were estimated by using MATLAB. Data needed (speed and density) to estimate METANET parameters were collected from CORSIM simulation software calibrated for this section. The calibrated METANET model was able to represent traffic flow on the section successfully. It is expected that the calibrated METANET model can be used for performing studies on traffic control for a forecasting model.*

**Keywords:** METANET, traffic flow, simulation, calibration.

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