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Massimo Leserri et al., JET 2018 Volume: 7

THE ARCHITECTURAL SURVEY OF CHURCH OF LORICA IN COLOMBIA

Massimo Leserri and Keilly Paola Mercado Pico
Pontifical Bolivarian University, Colombia

This study is about the Santa Cruz de Lorica's Cathedral, in the Colombian Caribbean, a region that underwent a series of social, political, hierarchical and architectural changes since mid-nineteenth century which decentralized trade main sources and direct connection, such as with Cartagena from the time when both municipalities were part of one single department. The city's political and strategic importance was vital for the department's development and military strongholds which also reflected in the town's constructions and cartographies. Its commercial and industrial splendor from the first half of the 20th century allowed the creation of its Port City conditions, nuanced by a diverse cultures atmosphere in a strategic and privileged place with main axes and genesis such as the Sinu River, the Ciénaga Grande swamp and the Caribbean Sea. It is good to remember that the historic center was once the whole city, developing itself from a rustic church, the cathedral today and the city´s growth was limited by a central axis, the Sinu River. Lorica's cathedral responds to a historical milestone and cultural identity for its inhabitants and history itself. Around this monument, in Central Square, main cultural and political activities of the municipality have been developing over time. Nowadays, it is in front of government palace, the Santa Cruz de Lorica's Town Hall. This study is based on the architectural survey associated with a history search that despite of its much oral tradition, it doesn't have enough written information. This survey is as an open system at various knowledge levels that has several activities of iconographic analysis, bibliography, direct information, etc. Though the Cathedral is the main axis of the historic center and the city itself, it lacks study and historical data, and has neither writings nor cartography; its author is unknown and has a large absence of data that allow clarifying its history and chronology. As an object, a critical, morphological and geometric analysis is made to understand the author's thought to propose comparisons with other cathedrals, styles confrontations and characteristics, to make conceptual hypotheses of the Cathedral.

massimo.leserri@upb.edu.co

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DESIGN OF SHEAR REINFORCEMENT OF BEAMS: NEW APPROACH

Abdulqader S Najmi
The University of Jordan, Jordan

Shear failure occurs suddenly in beams without properly designed shear reinforcement. A set-up of swimmer bars system takes the shape of plane crack interceptors and is employed to counteract the potential diagonal tension failure. Each counteract plane crack interceptor is formed by swimmer bars will generate a plane intercepting approximately and perpendicularly the inclined plane of the diagonal tension failure. A reference to testing programs of beams subjected to shear was used. The results obtained from testing has proved that the efficiency of using swimmer bars system in beams has increased their shear capacity to more than 250% and has decreased their deflection by increasing the stiffness of the beams in the vicinity of the concentrated loads, moreover, the nature of the shear failure becomes ductile instead of brittle and obviates sudden failure. The ultimate strength of shear is limited by the compression shear failure, which was never measured for the case of shear. The gain in ductility can reach levels matching those in flexural behaviour.

najmi@ju.edu.jo

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OPTIMAL ANALYSIS AND DESIGN OF STRUCTURES

A Kaveh

Iran University of Science and Technology, Iran

In this paper, a review of optimal analysis of structures is presented. Analysis is called optimal if the corresponding structural matrix (stiffness or flexibility) is sparse, well-structured and well-conditioned. Associating graph models to structural models transform the formation of structural matrices to those of the graph matrices. This not only provides a powerful means for the formation of matrices with the aforementioned properties but also makes the swift analysis of structures feasible. Many space structures and finite element models are either symmetric or regular. A structure is called symmetric or regular if it can be modelled as the product of graphs. Four well established graph products consisting of Cartesian, strong Cartesian, direct and lexicographic products are defined by mathematician and utilized for configuration processing of space structures. Many theorems are also proven for matrices. However, to include more general models, the existing graph products have been swift eigen solution of graph matrices like adjacency and Laplacian generalized by the author and colleagues. These generalized products have to be utilized in linear algebra to increase the utility of the graph products in science and engineering. In this paper, the recently developed methods for swift analysis of symmetric and regular structures for optimal design by metaheuristic algorithms are presented. These methods facilitate optimal design of the structures, where analysis should be performed hundred and even thousands of time. This results in substantial reduction of computer storage and time for large scale structural models.

alikaveh@iust.ac.ir

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DESALINATION: AN OPTION OF SUSTAINABLE MASS WATER PRODUCTION

Amimul Ahsan[1, 2]

[1]Swinburne University of Technology, Australia
[2]Uttara University, Bangladesh

A detailed comparison of numerical models (with and without considering humid air properties) for the estimation of water production from a solar water distillation device is presented. An extensive laboratory production experiment has been undertaken using 15 sets of external conditions to determine the evaporation characteristics and condensation coefficients to incorporate with the current evaporation and condensation models. The accuracy of the evaporation flux generated by the two current evaporation models (Dunkle's and Ueda's models) is examined using the field experimental data. The evaporation flux values given by the conventional models of Dunkle and Ueda are associated with notable underestimation and overestimation, respectively. It is revealed that the upgraded models have the smallest deviations between the model estimated values and the observed data can predict the daily production flux more accurately.

aahsan@swin.edu.au

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PHYSICOMECHANICAL CHARACTERIZATIONS OF SAND CONCRETE: PRE-STRESSED BEAMS AND HOLLOW BRICKS

El Hadji Leye Gueye[1], Seni Tamba[1], Karim Limam[2], Mamadou Lamine Lo[1] and Salah Kachkouch2

[1]Polytechnic School of Thies University, Republic of Senegal
[2]LaSIE-University of Rochelle, France

The use of the sand concrete makes it possible to carry out a concrete having physico-mechanical properties answering the structural exigences and having economic and environmental advantages compared to the classical concrete. The present study aims to connect the parameters of formulation based on Caquot formula in order to optimize the couple compressive strength/absorption of water under various degrees of hygrometry and on the other hand, more precisely to use the concrete sand in the public works sector in the prefabrication of prestressed beams and hollow bricks. The results showed the importance of the type of formulation used because it takes into account the percentages of fillers of sand which is a co-product (waste) of massive rock crushing. In addition, the use of fillerized sands, which are wastes of crushing basaltic rocks containing a small percentage of fillers, is efficient in the manufacture of prestressed beams. For the hollow bricks, fillerized basalt sand, containing a high percentage of filler, as well as a sand dune give satisfactory results.

elhadjigueye2020@gmail.com

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LIQUEFACTION POTENTIAL ASSESSMENT OF ALLUVIAL SOIL SITE USING 1D NONLINEAR GROUND RESPONSE ANALYSIS

Bhatia G S[1], Bhargava K[2], Parulekar Y M[3] and Mondal A[1]

[1]Nuclear Power Corporation of India, India
[2]Homi Bhabha National Institute-Bhabha Atomic Research Centre, India
[3]Bhabha Atomic Research Centre, India

Natural phenomenon like earthquakes can cause large amount of damage to structures as well as to human lives. Phenomenon related to earthquake like soil liquefaction pose even higher threat as its consequences can be more disastrous. It is therefore essential to characterize these ground motions, in order to predict their damage potential and to suggest concrete measures to minimize their catastrophic effects. Subsoil strata of any particular region play a vital role in understanding the effect of earthquake to substructures and super structures. In this paper, liquefaction analysis study has been carried out for a representative site situated in north India which lies in seismic zone-III as per seismic zonation map of India (IS 1893:2002). Liquefaction susceptibility of soil can be assessed by determining the factor of safety (FOS) which is the ratio of cyclic resistance ratio (CRR) and cyclic stress ratio (CSR). CRR of soil has been determined using field data obtained from standard penetration test (SPT) following the NCEER approach (2001). 95 percentile values of field data, such as, N-value, soil density and fines content have been assessed at different depths for calculating CRR. CRR is also determined by use of empirical relationships given by Seed and Idriss (1984). CSR has been assessed by performing 1D nonlinear effective stress ground response analysis with pore water pressure dissipation, and by performing equivalent linear analysis. Spectrum compatible time history obtained from site specific ground response spectra have been used to perform the nonlinear dynamic analysis using time integration technique in DEEPSOIL (2016). A comparison between equivalent linear and nonlinear approach to assess cyclic stress ratio has been conducted. The relation of factor of safety with depth of strata, obtained by the performing site specific response analysis and tests is compared with FOS obtained by the empirical procedure given by Seed and Idriss (1984) in the paper.

bhatiasgurpreet09@gmail.com

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EFFECT OF GAS OIL ON GEOTECHNICAL PROPERTIES OF ILLITE SOIL

Hossein Safehian[1], Ali M Rajabi[2] and Hasan Ghasemzadeh[3]

[1]University of Qom, Iran
[2]University of Tehran, Iran
[3]K N Toosi University of Technology, Iran

Development of the oil industry has increased the possibility of oil spillage into the soil. Oil pollution not only has serious environmental damages, but also it can change the physical, chemical and mechanical properties of soils. Clayey soils have complex behaviour in the presence of petroleum products. In order to better understand the complicated behaviour of oil-contaminated clayey soils, different laboratory tests were conducted on gas oil-contaminated illite soil. The amounts of gas oil were between 0 to 20% by soil dry weight. In this study, standard compaction and one dimensional consolidation tests were performed to evaluate the effect of gas oil on the compaction and consolidation properties of illite. Also, direct shear and unconfined compression tests were done to investigate the strength parameters of contaminated illite. In addition, scanning electron and atomic force microscopes were utilized to study the effect of gas oil on microscopic properties of illite. The results showed a decrease in maximum dry density and an increase in optimum fluid content and compressibility of illite in presence of gas oil. The cohesion, internal friction angle and unconfined compressive strength of the soil reduced when it was exposed to the organic fluid. The results revealed that gas oil has adverse impacts on the geotechnical behavior of illite.

hosseinsafehian@gmail.com

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MASSIVE FRESH WATER TRANSPORT: A NEW DIMENSION FOR INTEGRATED WATER-WASTEWATER MANAGEMENT IN NORTH CYPRUS

Hüseyin Gokcekus[1], A Iravanian[1], U Turker[2], G Oguz[1], S Sozen[3,4] and D Orhon[1, 4]

[1]Near East University Nicosia, Turkey
[2]Eastern Mediterranean University, Turkey
[3]Istanbul Technical University, Turkey
[4]ENVIS Energy and Environmental Systems Research and Development Ltd, Turkey

The fresh water transport, approximately of 75x106 m³/year from Turkey should be considered as a milestone to solve the ever ending water problems in North Cyprus. This massive water supply not only covered all the water demand of different sectors, but also offered the chance to define and implement a sustainable integrated water management strategy that would consider wastewater as an integral part of the management approach. The paper intended to identify all the essential components of the integrated water management plan and to define sustainable action strategies for these components, based on related beneficial use concept. In this context, details of the water transport system were provided. Aside from municipal water demand, agricultural use, groundwater recharge and water-contact recreation were defined as major beneficial uses for priority consideration. Innovation wastewater systems based on membrane bioreactor technology were suggested for recovery and reuse of the effluents. It was recommended that all urban wastewater treatment plants be upgraded or built as nutrient removal MBRs, where the effluent could be directly used for agriculture and/or groundwater recharge; all rural wastewaters be treated in lower-technology, extended aeration plants with sand filtration, capable of delivering effluents suitable for agricultural use. The energy potential of sewage was also underlined, proposing utilization of sewage sludge for energy recovery. Novel process alternatives with high energy capture rates, such as high rate pyrolysis, gasification etc. were suggested instead of the traditional anaerobic sludge digestion. The paper also covered a brief overview on the current status of major factors and modules likely to take part in the management strategy.

huseyin.gokcekus@neu.edu.tr

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MECHANICAL PROPERTIES OF STRUCTURE LIGHT WEIGHT CONCRETE USING STYROFOAM AS A COARSE AGGREGATE REPLACEMENT AND SUGAR CANE BAGASSE ASH AS AN ADDITIVE

Jehangir khan
Cecos University of Information Technology and Emerging Science, Pakistan

In this research work, styrofoam structure light weight concrete is prepared by partial replacement of natural coarse aggregate by styrofoam and by using sugar cane bagasse ash as an additive. Different mixes containing 0, 10 and 20% styrofoam and 10% bagasse ash are prepared. Tests are conducted for workability, flexure, modulus of elasticity and compressive strength of the mixes. The study concluded that mix which contain 10 mm size styrofoam aggregate and 10% ash as an additive give the highest strength as compare to other types of mixes after 28 days. Moreover the workability of the concrete is reduced by increasing the percentage of styrofoam as it makes the concrete mix rubbery and harsh to compact and place. Increasing the percentage of styrofoam results in decrease in flexure, compressive strength and modulus of elasticity.

jahangirkhan274291@gmail.com

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PHYSICAL AND NUMERICAL MODELLING OF SOIL STRUCTURE INTERACTION AND DAMAGE OF STRUCTURES DUE TO GROUND MOVEMENTS

AL Heib Mohamed Marwan

Institut National de l'Environnement Industriel et des Risques-Ecole des Mines de Nancy Campus Artem, France

Structures, in particular unreinforced masonry are critically susceptible to ground movements because of their low tensile strength. Ground movements due to natural and man-made settlement, underground cavity collapse or mining/tunnelling induce slight to severe damages on structures and infrastructures. The evaluation of the level of damage is still under research investigation due to the complex phenomenon of soil structure interaction. Empirical approach is generally used to evaluate the damage, but presents a serious limitation. This keynote lecture focuses on the use of advanced physical modelling (1-g and n-g) and numerical modelling (continuous and discontinuous) to better evaluate the damage due to ground movement and associated soil structure interaction. The presentation first addresses the effect (damages) of ground movement on structures and infrastructures illustrated by in situ observations, then a large overview of the use of 1-g physical and numerical models to solve geotechnical problems and soil structure interaction related to vertical ground movement will be made. The second part of the presentation will focus on the illustration of the usefulness and the advantages of 1-g physical modelling to study the masonry damage due to ground movement. A large scale 1-g physical model developed recently by Ineris with a 6 m3 container and 15 electric jacks will be presented. Thanks to physicalnumerical modelling and in situ observation, a new methodology and criterion were developed based on the local and global damage of the structure. The new equipment offers the possibility to study different geotechnical and soilstructure problems. The model uses image correlation technique to evaluate precisely the damage of the structure. The model capacity is demonstrated in the case of the analysis of damage in a masonry structure (based on a digital image correlation technique) where the influence of the position of the structure onto the subsidence through is analysed in terms of cracks density and damage level of structures.

Marwan.alheib@ineris.fr

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DEPOSITION OF COATING TO PROTECT WASTE WATER RESERVOIR IN ACIDIC SOLUTION BY ARC THERMAL SPRAY PROCESS

Mohamed Abdel Kader Ismail[1], Han Seung Lee[2] and Jitendra Kumar Singh[2]

[1]Curtin University, Malaysia
[2]Hanyang University, Republic of South Korea

The corrosion characteristics of 304 stainless steel (SS) and titanium (Ti) coatings deposited by the arc thermal spray process in pH 4 solution were assessed. The Ti-sprayed coating exhibits uniform, less porous and adherent coating morphology compared to the SS-sprayed coating. The electrochemical study i.e. electrochemical impedance spectroscopy (EIS), revealed that as exposure periods to solution were increased, the polarization resistance (Rp) decreased and the charge transfer resistance (Rct) increased owing to corrosion of the metallic surface and simultaneously at the same time the deposition of oxide films/ corrosion on the SS-sprayed surface, while Ti coating transformed unstable oxides into the stable phase. Potentiodynamic studies confirmed that both sprayed coatings exhibited passive tendency attributed due to the deposition of corrosion products on SS samples, whereas the Ti-sprayed sample formed passive oxide films. The Ti coating reduced the corrosion rate by more than six times compared to the SS coating after 312 h of exposure to sulfuric acid (H_2SO_4) contaminated water solution, i.e. pH 4. Scanning electron microscope (SEM) results confirmed the uniform and globular morphology of the passive film on the Ti coating resulting in reduced corrosion. On the other hand, the corrosion products formed on SS-sprayed coating exhibit micro pores with a net-like microstructure. X-ray diffraction (XRD) revealed the presence of the composite oxide film on Ti-sprayed samples and lepidocrocite-γ-FeOOH) on the SS-coated surface. The transformation of TiO and Ti_3O into TiO_2 (rutile and anatase) and Ti_3O_5 after 312 h of exposure to H_2SO_4 acid revealed the improved corrosion resistance properties of Ti-sprayed coating.

m.abdelkader@curtin.edu.my

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NUMERICAL INVESTIGATION OF THE SOIL REINFORCING EFFECT ABOVE TUNNEL

Nabil M Nagy
Military Technical College, Egypt

Due to increased urbanization, tunnels might pass and/or be found under or near existing buildings. Construction process of tunnels could result in a significant ground movement if care is not undertaken. Also structures that might be built above an existing tunnel might suffer from potential settlement. In this case, the increase in stresses might cause distress of the tunnel lining and results in excessive deformation. Thus, it is crucial that an improved knowledge about the interaction between surface loads and tunnels is gained in order to reduce potential risks and hazards. The interaction between the surface footings and tunnels depends upon several factors including the relative dimensions of the surface footings and tunnels as well as depth and eccentricity of the proposed tunnel to the surface loads. In order to reduce the effects of surface loads on the exciting tunnel many precautions must be undertaken in the surface construction process. One of the major objectives needed to be gained before superstructures construction is improving the characteristics of the soil between surface footing and the exciting tunnel to increase its bearing capacity and reduce its settlement, to attenuate the pressure on the tunnel. One of the techniques is soil reinforcing with Geothynthtic. In this paper, 3D nonlinear models have been used to simulate the behaviour of the soil, the tunnel and the reinforcing .The numerical investigations have been carried out to assess the effect of different factors affecting the system response with special focus on the influence of reinforcing width, layers numbers and eccentricity of the proposed tunnel to surface loads.

nabilmnagy@yahoo.com

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BEHAVIOR AND REPAIR OF RC CORBELS USING EXTERNAL PRESTRESSING

Nesreen M Kassem
Tanta University, Egypt

Corbels become common elements in construction due to the increased use of the precast reinforced concrete buildings. This paper presents experimental data of 11 reinforced concrete (RC) double corbels; some of them were repaired using external pre-stressing. Research parameters included in this study are: combined effect of pre-stressing with and without premature failure, the combined effects of pre-stressing with premature damage and corbel width, number of branches of horizontal stirrups and relative column/corbel width. In addition, a comparison between the monolithic and the precast actions of prestressed specimens is presented. A strut and tie model based on a numerical analysis are presented. The results of the experimental tests showed that number of branches of horizontal stirrups of tested short cantilevers is effective parameter on ultimate capacity, while increasing the length of column to be equal to the width of the wide corbel enhanced the crack pattern but isn't effective in increasing the ultimate capacity. The precast pre-stressed corbel has a very lower ultimate capacity than the monolithic one.

nesreenkassem@yahoo.com
nesreen.kassem@f-eng.tanta.edu.eg

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EFFICIENT LOCKING-FREE CURVED BEAM ELEMENTS USING MIXED FORMULATION

Niloofar Rajabzadeh Safaei, Amir R Masoodiand and Mohammad Rezaiee Pajand

Ferdowsi University of Mashhad, Iran

This study is dedicated to develop two efficient curved beam elements by using mixed formulation. It is worth mentioning that due to use of mixed interpolation of strain fields, the element is free of shear and membrane locking. Two elements including three and four node beam elements were formulated separately. Since a mixed interpolation of strains is employed, some essential tying points are used for this interpolation for each element. The selected points are the same as the Gauss integration points. It is obvious that the elements can be employed for tapered members. The tensorial form of the formulations is used to summarize them. In addition, the proposed elements are utilized for linear bending analysis of the Functionally Graded Beams (FGB). For this reason, a power function is used for variation of elastic modulus through the height of the beam while the Poisson's ratio is assumed to be constant. A convergence study is done to show high accuracy of the proposed elements. In addition, some other well-known benchmarks are solved to validate the formulation. Findings indicated the high performance and capability of the proposed elements.

n.rajabzadehsafaei@mail.um.ac.ir

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RELIABILITY OF PRE-STRESSED ELECTRICAL CONCRETE POLES FOR CONSIDERING MANUFACTURING DEFECTS

Sang Lyul Cha, Jae Chan Park and Hyung Jo Jung
Korea Advanced Institute of Science and Technology, South Korea

There are many precast concrete structures such as pile, box, and poles. High quality control is possible because most of them are manufactured at the factory and also, concrete structures with manufacturing defects can be eliminated by quality inspections. However, in spite of thorough quality inspections, many defective products are used. Therefore, unexpected collapses often occur. In this study, the reliability of electrical concrete poles was studied considering manufacturing defects. For this, electrical concrete poles were manufactured with different pre-stressing forces. Strain gauges were installed on the tendons to check for changes in pre-stresses. Flexural strength tests were also performed. After the tests, the poles were cut to check the position of the tendons and reinforcement steel. In addition, analysis of the electrical poles was performed. Based on the analysis and test results, manufacturing defects such as pre-stresses and steel positions must be considered in the design of the electrical poles.

maikuraki@kaist.ac.kr

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