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Housing & Building National Research Center

## EFFECT OF CURING METHOD ON THE PROPERTIES OF BLAST- FURNACE SLAG CONCRETE

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### ABSTRACT

This research has been undertaken to study the effect of curing method on the mechanical properties and pore structure characteristics of concrete made with blast furnace slag. The results were compared with those of a control concrete made with ordinary Portland cement. The concrete mixtures were prepared with 0.4 water/cementitious materials ratio. The cement content is 400 kg/m<sup>3</sup> with sand/aggregate ratio of 0.5. The concrete specimens cured with two different methods, in the first method specimens were immersed in water while in the second method specimens maintained at 22°C and 80% Relative Humidity (RH) and sprinkled with water two times a day for seven days. The measured properties of fresh concrete cover the slump, air content, and unit weight. The properties of hardened concrete such as compressive strength, dynamic elastic modulus, and pulse velocity were measured at ages of 3, 7, 28, 90, and 180. Further, flexural strength and indirect tensile strength were measured at age of 28 days. After 28 days of curing, pore structure characteristics which involve porosity, cumulative intrusion volume, and specific pore surface area as well as pore size distributions were investigated using Mercury Intrusion Porosimeter (MIP). The results indicated that changing cement type and curing method have significant effects on the measured different properties of concrete.

### Keywords:

Portland cement, Blast-furnace slag cement, Concrete, Curing, Pore structure.

## UTILIZATION OF SEWAGE SLUDGE ASH (SSA) AS FINE AGGREGATE WITH LOCAL POZZOLANIC MATERIALS

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### ABSTRACT

The disposal of sewage sludge from waste water treatment presents highly complex problems to any municipality, due to increasingly stringent environment regulation and industrial growth that have markedly increased the disposal requirements the incineration only reduces the volume of the sludge and remaining the sludge ash. This study aims to investigate the effect of the substitution of cement and sand by fine sewage sludge ash (SSA) and fire air-cooled slag (FACS) separately at definite percentages. The workability and kinetics of hydration of hardened cement mortars were studied.

**Key words:** phosphor gypsum, air cooled slag, lime sludge, reused, costuraction material, thermal curing.

**ROLE OF REPAIRING COVENANTS IN THE CONSERVATION  
AND REHABILITATION OF HISTORIC TOWNS  
(A Case Study of Walled City Lahore, Pakistan)**

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**ABSTRACT**

Pakistan is a land of historical monuments and century's old culture and traditions. Although, the country has put in all-out efforts to maintain the artifacts it received from the times of yore, but, in this age of industrialization, globalization, and homogenization of cultures, there appear to be newly emergent threats to the existing stock of historical assets. Taking into account the case study of UC-29 of the walled city Lahore, the paper indicates that the condition of buildings and structures in the historic towns in Pakistan are putrefying not only due to aging phenomenon, but also due to rapid socio-cultural and economic changes in the society. The situation seems more alarming when we see no systematic mechanism to deal with the maintenance and rehabilitation of existing building stock. So, the research in attendance suggests the application of repairing covenants for the rehabilitation and maintenance of dilapidated structures. The repairing covenants are being practiced in many countries of the world, so, there application in Pakistan will not only restore the rundown structures but will also conserve the cultural heritage of historic towns.

**Keywords:** Dilapidation, Repairing Covenants

## THE STRUCTURAL ANALYSIS AND RATING MODULES OF A PROPOSED BRIDGE MANAGEMENT SYSTEM FOR EGYPT

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### ABSTRACT

Bridges need continuous maintenance, rehabilitation, or replacement, thus, an integrated bridge management system for Egypt is needed. A system suitable for the local Egyptian conditions was previously proposed [1,2]. This paper demonstrates the details of the structural analysis and rating sub-modules of the proposed system. The two programming languages VB and VBA are used in developing both modules. The structural analysis sub-module is developed using a commercial database software and structural analysis software. The rating sub-module reads the analysis output files and calculates the bridge rating factors based on the AASHTO Allowable Stress Rating Method. Some important conclusions and recommendations are presented in the paper.

**Keywords:** Bridge management system, Egypt, modules, structural analysis, corrosion, rating

## DESIGN INTERACTION FORMULA FOR ECCENTRIC CONCRETE COLUMNS

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### ABSTRACT

This paper presents an interaction formula for eccentrically loaded slender concrete columns. This formula considers the relationships between the slenderness and the ultimate load of the reinforcement concrete columns for variable length. The method of nonlinear analysis used to establish the ultimate load of slender concrete columns was proposed by Badr[1]. Both material and geometric nonlinearities are taken into consideration. The method applied herein investigates the column behavior with low, medium and high strength concrete, and taking into consideration changing the end conditions and different values of eccentricities. The results are compared with previous experimental and theoretical work, Poon [2,3]. The failure loads predicted by the proposed method are close to these predicted by the P-Delta method (Poon method) and show a good agreement with the experimental values. A proposed interaction formula is suggested to help the designer predicting the ultimate load of slender concrete columns of low, medium and high strength concrete. This equation is valid for a compression failure of concrete columns where  $e/t$  less than 0.4.

**Keyword:** Slender column, Buckling , Stability.

## RELIABILITY-BASED UPDATING OF BRIDGE ABUTMENT SAFETY

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### ABSTRACT

Bridge safety and reliability covers a wide range of applications of modern structural safety/reliability concept and methods to highway bridge engineering practice. Reliability analysis basically provides accurate estimate of the current strength and the remaining life time for optimum distribution of the available limited resources. In this paper, the system reliability of cantilever-type abutment is investigated. Four ultimate strength limit states and two serviceability limit states are considered; namely, overturning moment, sliding failure, bearing capacity, ultimate moment, excessive settlement and differential settlement limit states, respectively. Using the closed form of these limit states, first, second order reliability methods FORM/SORM and monte carlo simulation method, MCSM, are used for reliability calculation. Both reliability index and probability of failure are determined. The large number of loads, strength and geometrical uncertainties are cut down using some sensitivity analysis. Both component/ individual and system reliability analysis are performed, using COMREL and SYSREL codes, respectively. The relative importance of random variables as well as the limit states are evaluated. Moreover, partial safety factors are proposed to achieve desirable safety level in the design. The effect of the variability of the basic variables on the partial safety factors, the reliability index, and probability of failure are discussed. The paper shows also how the safety/reliability of the abutment can be updated based on some settlement observations using system reliability analysis. The present and anticipated reliabilities of the abutment can provide a rational decision making tool to use scarce resources more efficiently. Some recommendations are introduced for the code of practice.

**Keywords:** Bridge Abutments, Reliability, Soil Mechanics, FORM, SORM.

## MEASURING THE EFFICIENCY OF CONSTRUCTION CLAIM ADMINISTRATION IN CONSTRUCTION COMPANIES IN EGYPT

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### ABSTRACT

In the last few years the concept of "construction claims" has become more and more familiar in construction industry in Egypt. It becomes so important to find out a measuring method to determine the practice level in construction claim process in construction companies. This study outlines a measuring framework to measure the level of performance of construction claim process. Eight major construction companies were analyzed, four are public sector and the other are private sector. A sample of 42 contracts (projects) was studied to evaluate the level of performance of the projects in each construction claim process stage, to get the overall practice level for the projects, and then to determine the level of practice for the whole company. The relation between the performance in construction claim process stages and the different contract attributes individually was taken into consideration. Based on the analysis of results in this study, the main conclusions can be drawn as follows: 1) the performance of the surveyed public construction projects in construction claim process was so close and poor. It is known but not done; 2) the performance of the surveyed private construction projects in construction claim process was so close and at good level. This indicates that the private sector construction companies once in while accurately do the construction claims.

**Keywords:** Construction Claims Identification, Notification, Examination, Documentation, Presentation and Negotiation.

## DEVELOPING BENCHMARKING SCORES FOR THE EGYPTIAN CONTRACTING COMPANIES

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### ABSTRACT

In today's global competitive environment, the Egyptian construction industry is facing major challenges. The identification of the core competencies of each construction company must rely on quantitative benchmarking of performance between the company's performance data and potential global competitors. Yet, the Egyptian construction industry is still behind in the realization of competition and the methodologies utilized to increase their market share. The main dependence till now is on the traditional financial ratios which are insufficient to survive rather than to compete in the new open market. Currently the benchmarking technique is widely applied in many industrial fields (including construction) as a critical tool for their continual improvement processes. This paper introduces a newly established group of benchmarking score charts which can be considered as the first of its kind for the Egyptian contracting companies. For this sake, a field survey was performed to measure the performance of the contracting companies. These charts were accompanied by a framework for a future successful regular issuance of similar charts. The paper also compares the British performance in a certain field with the corresponding performance of the Egyptian contractors through the charts. To complete the cycle of benchmarking, Xerox benchmarking model was introduced with some adaptation to suit implementing the benchmarking process within each contracting company. Finally, the expected obstacles that would be faced are listed for the sake of avoidance.

**Keywords:** benchmarking, indicators, construction, performance, self assessment, Xerox model

## **Parametric Study of Some Factors Influencing Tunneling**

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### **ABSTRACT**

The aim of this paper is directed towards the study of some factors influencing tunneling. The effect of variation of tunnel radius, rigidity, depth below ground surface, gap parameter represented by tunnel contraction and soil rigidity on both ground subsidence and on stresses induced in the tunnel are studied. Also the effect of tunnel construction at a depth below a present shallow strip footing is studied. A plain strain finite element program is used to handle the problem. Nonlinear finite element analysis is carried out to define the pattern of ground subsidence around different tunnel conditions taking into consideration the construction sequence and interface between the ground and tunnel lining.

## Geotechnical Study of Sand-FADR Mixture for Landfill Cover and Liner

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### ABSTRACT

Engineering of waste containment facilities began in the 1970s with the introduction of clay liners and covers, which led to the sanitary landfills concept. Currently, all waste landfill systems should have covers and liners of low permeability. Consequently, the cover and liner design has undergone great changes, with new materials being introduced and new design philosophies being adopted. The main and most important component of landfill cover and liner is the hydraulic barrier layer. As clay is not readily available at many locations, different substitutions have been investigated. One of these substitutions is the sand-bentonite mixture, which achieves good performance but with relatively high cost. In this paper a new economical substitution is studied. It consists of using fatty acid distillation residuals (FADR) mixed with sand as a hydraulic barrier layer. Mixing sand with an appropriate percentage of FADR yields a mixture having low hydraulic conductivity that can be used as a hydraulic barrier layer in landfill liner and cover. In this study, direct shear and hydraulic conductivity tests have been conducted on samples with different sand to FADR ratios to get the optimum value fulfilling the landfill liner and cover requirements. The tests show that the minimum FADR percentage that achieves the required permeability suitable for most landfills is 4%. In this case the mixture possesses a permeability  $k = 1 \times 10^{-7}$  cm/sec, a cohesion  $c = 0.12$  kg/cm<sup>2</sup>, and an angle of shearing resistance  $\phi = 33.8^\circ$ . The research results indicate that the use of FADR in landfills is promising and can constitute a good landfill cover and liner alternative from the economical and technical points of view.

**Keywords:** Landfill, hydraulic barrier, sand, fatty acid distillation residuals.

## **SUSTAINABILITY AND RESIDENTIAL SATISFACTION WITHIN EXCLUSIVE RESIDENTIAL COMPLEXES IN THE CITY OF ROME**

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### **ABSTRACT**

This study aims at investigating residential satisfaction and attachment, perception of environmental quality and residential needs/expectancies in residents of peculiar urban residential complexes in the city of Rome., which can be classified at an intermediate level between the "gated communities" and the "communities of services". Taking into account two levels of environmental scale (i.e., residential complex and apartment) a questionnaire was built on and administered to a sample of residents (N=101) in two residential complexes. Perceived Residential Environment Quality Indicators (PREQIs), residential attachment, residential satisfaction toward the complex and the apartment, and expected satisfaction toward possible additional features (at a residential complex and apartment levels) were measured. Findings highlight the wishes of residential security (at residential complex level), technological systems which match sustainability criteria, and domotics (at apartment level). Six well-defined clusters of residents were discriminated on the basis of their evaluative responses.

### **Keywords**

residential satisfaction; indicators of perceived residential quality; residential attachment; assessment of common services; residential expectancies

## **CHANGES IN THE MICROBIOLOGICAL WATER QUALITY ASSOCIATED WITH USING GRANULAR ACTIVATED CARBON IN DRINKING WATER TREATMENT PROCESSES.**

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### **ABSTRACT**

Granular activated carbon (GAC) is widely used in drinking water treatment for removal of organic compounds, primarily taste, odor, turbidity and the by-products formed during disinfection process. The possibility of replacement the rapid sand filter in the conventional treatment process by activated carbon filter was considered and the effect on microbiological quality of water produced was studied. The study was carried out using columns containing different filter media. The column design and operation affect on the microbiological community structure of both the treated water and the existed microorganisms on activated carbon granules. GAC provide a suitable attachment site for microbial proliferation and biofilm formation which may slough out causing high microbial content in the effluent.

Microbial growth has raised the concern about potential health risk associated with the possibility of presence of opportunistic pathogens among the bacterial population. In addition these microorganisms may resist the disinfection process or antagonists to coliform detection.

The duration period of using the filter media was studied as an important factor in determining the life time of GAC after which replacement or washing and reactivation is necessary.

This work will assist to make a good decision whether to use GAC as a replacement for conventional media or to design and build a new system specifically for GAC.

## THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE THERMAL PERFORMANCE OF A PRE-FABRICATED CONCRETE FLAT IN 15- MAY CITY

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### ABSTRACT

This study deals with the thermal performance of a pre-fabricated concrete flat in 15-May City, south Helwan, Cairo, Egypt (29° 25' N latitude and 31° 20' E longitude). It is about 80 m above sea level. The climate of this city is characterized by; aridity, high summer daytime temperature, large diurnal temperature variation, low relative humidity and high solar radiation in individual. In such conditions, an individual loses his ability to work and to contribute effectively to the development plan due to the high thermal stress affecting him. This study deals with a comparison between the theoretical and experimental analysis of the thermal performance of a pre-fabricated concrete flat under the effect of external climatic conditions in 15-May City, Cairo, Egypt. The measurements were taken for two flats; one in the third floor (unexposed roof) and the second was in the fifth floor (exposed roof). Measurements included external environmental climatic conditions (outdoor air temperature, wind speed, relative humidity, and solar intensity) and internal environmental climatic conditions (indoor air temperature, wind speed, and wall surface temperatures). The admittance procedure is a technique for estimating cooling/heating load and temperature changes under cyclic conditions by using the thermal characteristics (Y-value,  $\lambda$ ,  $\phi$ , Sf) of the building structure. It dependent on determining the daily means value and the swing about the mean. The admittance method was used and a computer program was developed to predict the heating and cooling load as well as the indoor air temperature. The results show that a reasonable agreement between the theoretical and experimental indoor air temperature of the flat is achieved. Also shading devices, insulating materials, and suitable orientation help to achieve a harmony between the building and environment.

### Key words

15-May City, thermal characteristics, internal/external environmental, thermal stress, thermal performance, thermal damping factor, admittance procedure