Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 113-122, Research Note

- Received 5 July 2017; received in revised form 14 October 2017; accepted 28 November 2017.

Abstract

The buildings structures around the world suffer from terrorist attacks and bombings. This justifies the need to study the effect of blast loading on structures and the methods to prevent collapse of structures in order to save human lives and minimize financial losses. In this study, effects of the passive viscous dampers and base isolators on structures which are subjected to blast loading are separately investigated. Blast load is applied on the structures with a pressure wave. This pressure wave has many uncertainties specified in different codes. For the sake of simplicity, this pressure wave is applied on different faces of the structure. Herein, only loading on the façade or the structure is considered and the loading on the other faces of the structure are neglected as the structure doesn't have any severe irregularities. In the 1st case, viscous dampers are added to the structure adding damping of the structure between 5 to 25% and the effect of this added damping is studied through the paper. For the 2nd case, base isolators are designed according to UBC-1997 code. Numerical simulations are carried out in the SAP environment using nonlinear time-history analysis. Moreover, they are studied with different stiffness coefficients and the uncertainties in yielding force of these tools have been considered in numerical simulations. These passive control devices are mainly designed such that they can perform well under earthquake loads. Viscous dampers conform to the first mode of vibration of the structure and base isolators are designed according to seismic codes. Numerical simulations show that base shear in the optimum specifications of viscous dampers and base isolators compared to bare frame showed 60% increase and 50% decrease, respectively. However, drifts are minimized to 1.7% for added damping values of 25%. This value is hard to reach with base isolators as the values of drifts in this case have a minimum value of 2%.

Key Words: Blast load behavior, concrete structures, viscous damper, base isolation.

WATER FOOTPRINT MODEL OF CEMENT PRODUCTION: A CASE STUDY IN WESTERN IRAN

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 123-133, Research Note

- Received 15 July 2017; received in revised form 5 November 2017; accepted 14 November 2017.

Abstract

Cement production is of particular importance in the construction industry. However, cement production is dependent on water consumption. Iran is located in a dry region; thus, investigating water consumption of Iranian cement production and providing solutions for water crisis of such production is of high interest among cement industry practitioners. Few studies have considered virtual water consumption and water footprint of cement production in Iran and all of the world. This paper addresses this knowledge gap. It proposes a comprehensive model for evaluating water footprint of cement production based on the type of energy consumption, transportation, and human's effect using a system boundary analysis. The relationship between water footprint and energy consumption is highlighted, and solutions to the water consumption problem of cement production are provided. To demonstrate the application of the proposed method, a cement manufacturer located on the western Iran as a case study is analyzed. A sensitivity analysis is conducted to show the effects of considered parameters on the proposed water footprint model. The paper shows that the total water footprint among the selected cement manufacturer accounts for $3614 \times 10^3 m^3$ in 2017, highlighting a high contribution to cement production in water consumption and risk of maintaining the cement industry in dry regions. The paper also shows that, for the selected cement manufacturer, virtual water footprint is estimated to be 11 times more that direct water consumption, which contributes to 90 percent of the total water footprint. In addition, the paper demonstrates that water consumption intensity in the selected case study is estimated to be $2.126 m^3$ per each ton of cement produced, while direct water consumption of each ton of cement is estimated to be $0.2 m^3$. The paper's findings cast a new insight into water consumption of cement production wider than currently available. This paper contributes to producing environmentally-friendly cement in Iran and all of the world.

Key Words: Water footprint, energy consumption, cement production, water saving.

ratios of the slabs were 0.45% and 1.02%. After 28 days of curing, all the specimens were tested. The objective of this study is to investigate the modes of failure, the load-deflection relationships, and the effectiveness of adding steel fibers to flat slabs. Based on the results of this study, it was concluded that adding 1.5% of steel fibers improved punching shear strength up to 34% and 64% depending on the ratio of reinforcement. In addition, it was shown that the depth of the flat slabs could decrease up to 38% and 40% in comparison to the slabs with plain concrete. Furthermore, increasing the ratio of reinforcement from 0.45% to 1.02% led to the enhancement of punching shear strength and improved toughness. The test results indicated that with fiber volume fractions of 0.5, 1, and 1.5, the shear punching strength increased by 49%, 30%, and 23% due to the enhancement of flexural reinforcement from 0.45% to 1.02%, respectively.

Key Words: Steel fibers reinforced concrete, punching sear strength, flat slab.

EVALUATION OF SEISMIC DEFORMATIONS OF GOTVAND DAM DURING EARTHQUAKE

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 99-111, Research Note

- Received 7 June 2017; received in revised form 23 September 2017; accepted 18 October 2017.

Abstract

Monitoring and evaluating earth-rock fill dams in different stages of their lifetime including construction impounding, rapid drawdown and earthquake occurrences are important for improvement of dam monitoring, safety control and stability. Historically, earthquakes have caused severe damages and human losses. The destruction of infrastructures, such as dams, is of high concern because of financial and human losses caused by water flowing downstream into densely populated human settlements. Based on the world's earthquake data, rock fill dams showed different behaviors under earthquake conditions, ranging from minor damage and deformation to complete destruction. In the present study the Gotvand dam, one of the largest rock fill dams in Iran has been focused on. In this study, the largest dams' cross-section was modeled and evaluated using two dimensional finite- element software, FLAC4.0. The back analyses results compared with data collected from instrumentation and characterized materials' properties exactly. In numerical analysis, regarding the nonlinear nature of geo-mechanic materials such as soil, the Mohr-Columb constitutive rule and the hardening- softening models used to simulate the material behavior in foundation and dam body respectively. Under elastic conditions, the main assumptions include; 1) increasing the internal friction angle with increasing the plastic strain; 2) dependence of material's elastic modulus and dilation angle on confining pressure; 3) bulk modulus of water dependence in a medium tension stress of the elements during the construction and first impounding to estimate the pore water pressure correctly and saturation collapse simulation during the first impounding. The model was ran for five years after impounding until it reached a steady state. The Mohr-Columb nonlinear constitutive model through Massing-Finn rules was used to simulate the nonlinear and hysteretic behavior of soil and rock materials under earthquake condition. The dynamic analysis is performed to predict the displacement of the Gotvand dam under the maximum credible earthquake (MCE) condition. The type of acceleration time history and the magnitude of input acceleration are also investigated to predict the dynamic behavior of the dam including deformations on the design based earthquake (DBE), the maximum design earthquake (MDE), and MCE. The maximum settlement of the dam core due to application of the Manjil earthquake is equal to 1.94 meters, and the maximum horizontal deformations are 1.30 and 1.19 meters in upstream and downstream shells, respectively. The results showed that the dam deformations were highly influenced by the magnitude of the earthquakes and the acceleration time history.

Key Words: Gotvand dam, dynamic analysis, settlement, displacement, MCE, DBE, and MDE earthquakes.

COMPARING BLAST LOAD BEHAVIORS OF REHABILITATED CONCRETE STRUCTURES USING VISCOUS DAMPER AND BASE ISOLATOR

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and the effect of the liquefied sub-layers on the seismic site response de-amplification was studied from different points of view. Consequently, experimental and numerical studies of this research showed that the liquefaction of sub-layers could effectively reduce the intensity of seismic waves and earthquake-induced force.

Key Words: Liquefied soil sub-layers, shaking table test, nonlinear numerical modeling, site effects.

PUBLIC PARKING SPACE ISSUES FOR TEHRAN CITIZENS

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 83-90, Research Note

- Received 3 March 2017; received in revised form 3 September 2017; accepted 28 October 2017.

Abstract

Public parking is an inseparable element of the cities. Parking shortage brings many direct and indirect negative impacts on the citizens' life, including wasting citizen's time while seeking barely found parking spots, and increasing vehicle traffic and air pollution. Our analysis of the supply and demand of parking spaces in Tehran, Iran shows Tehran lacks about 40% of its parking spaces causing the citizens to suffer daily. Assessment of unfavorable impacts of the parking shortage and the way citizens deal with it can be used for better parking management by the city managers and policymakers. To this end, in this research, we conduct a questionnaire survey to extract and assess Tehran citizens' opinions on different aspects of the issue. A 19-question survey with five main categories was designed. These categories include, 1)the extent of the wasted time for finding free parking spaces, 2) citizens' priorities for the type of the parking spaces, 3) price of the parking spaces, 4) type of complementary facilities, and 5) the main sources of the public parking issues. The results achieved in the survey indicate severe impacts of the parking issue on the citizens' life. For example, 74% of the respondents indicated that on average they spend more than 10 minutes for finding free parking spots in the city while 65% of them suffer from high tension and stress during this time. About 66% of people expressed they have witnessed or even have been involved in the street fights and quarrels on free parking spaces. The lack of free parking space, with the frequency of 78%, and the poor public transportation, with the frequency of 42%, were found in the survey as the main sources of the parking issue on the citizens' point of view. In the current situation, parking price, type of parking space and complementary facilities in the parking buildings are not the citizens' main concerns. Though, being able to find a parking space, not so far from their destination, is the main preference.

Key Words: Public parking, parking shortage, urban management, citizen's issues.

PUNCHING SHEAR STRENGTH OF STEEL FIBER-REINFORCED CONCRETE TWO-WAY SLABS

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 91-97, Research Note

- Received 24 April 2017; received in revised form 18 October 2017; accepted 23 October 2017.

Abstract

Concrete is a brittle material with a low strain capacity. The addition of randomly distributed discrete fibers in concrete significantly improves the flexural behavior of structural concrete elements because of its enhanced tensile properties and crack control. In this paper, an experimental program was carried out to study the punching shear strength of flat slabs reinforced with steel fibers. The addition of steel fibers generally contributes to the improvement of punching shear strength of flat slabs. The experimental work consisted of 8 rectangular specimens measuring 100 mm in depth, 1000 mm in length, and 1000 mm in width, six of which consisted of hooked-end steel fibers. The concrete mixtures were cast using ordinary Portland cement with a water-cement ratio of 0.41. During the punching shear tests, the load and the maximum deflection were recorded on a computerized data recording system; as a result, the load-displacement curve was drawn. The main variables considered include the volume fraction of steel fibers as well as the steel bar reinforcement ratio. The fibers were used at the volume fractions of 0.5%, 1%, and 1.5%, and the reinforcement

THE ASSESSMENT OF EFFECT OF INERT MATERIALS ON THE BEHAVIOR AND SHEAR STRENGTH OF FRESH AND AGED MUNICIPAL SOLID WASTES

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 59-69, Original Article

- Received 12 August 2017; received in revised form 20 November 2017; accepted 23 December 2017.

Abstract

This study were conducted to investigate the effect of inert materials of waste using large scaled triaxial tests on fresh and aged waste samples in the Kahrizak landfill of Tehran by adding aggregates with varying fracture percentages by 15% in weight to samples. The results indicated that the presence of inert material section leads to increase in shear strength of the waste mass up to three times than the initial values and as the inert materials have more roughness and rigid surfaces, shear strength increases consequently. The impact of the inert materials on new samples is more than the older samples due to the nature of the waste components, but the shear strength of old samples under same conditions was determined to be higher up to 50%. Also, the inert material portion have a greater effect on the increasing of the internal friction parameter (Φ) and can increase it up to three times than the initial value.

Key Words: Shear strength, municipal solid waste, fresh waste, aging, triaxial test, inert materials, MSW.

EXPERIMENTAL AND NUMERICAL MODELING ON SEISMIC RESPONSE OF LIQUEFIABLE SUB-LAYERS

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 71-82, Original Article

- Received 9 October 2017; received in revised form 28 November 2017; accepted 5 December 2017.

Abstract

Soil liquefaction is caused by strong ground motion and causes loss of shear strength, lateral spreading, foundation failure, sand boiling and post-earthquake settlement. These liquefaction mechanisms have been studied intensively. Although the seismic site response is affected by the liquefiable soils, there is no comprehensive study of it in the technical literature due to the complexity of this issue. However, different physical and numerical modeling methods have been conducted to develop guiding principles for the seismic response analysis in liquefied sites. Nevertheless, some major restrictions pertain to these models such as ignoring the effects of the depth of liquefiable layer and unsuitable constitutive models. In this study, the seismic behavior of liquefiable sub-layers has evaluated what affects the seismic site response strongly. In this regard, using the shaking table model tests, the initial seismic response was obtained in the soil profile consisting of a liquefiable sub-layer. The sub-layers of the shaking table models were built with different densities, and the models were subjected to specific record motions of varying intensity. Acceleration and pore water pressure were measured in the soil profiles during all the tests. The influence of the liquefiable soil layers on the seismic site response during shaking was discussed comprehensively. Afterwards, in order to use the compatible constitutive model in numerical analysis, a series of 1D effective stress numerical models were employed, while the results were verified adequately with the results of the shaking table test. Note that the multi-yield surface model was utilized in the current study as a suitable constitutive model. Finally, the seismic response was processed,

MWCNTs to improve flux of the membranes and to reduce the fouling which is the main concern of the similar studies. Multi-walled carbon nanotubes (MWCNTs) were exposed to acid solution containing HNO_3 and H_2SO_4 to synthesis of oxidized MWCNTs and used for preparation of piperazine-based polyamide thin film nanocomposite nanofiltration membrane. Both raw and oxidized MWCNTs were applied in the fabrication of the membranes with four different concentrations of 0.001, 0.002, 0.005, and 0.01 wt% in the piperazine solution. Salt rejection, permeation, and antifouling properties of unfilled, raw and oxidized MWCNTs embedded membranes were investigated. Water flux for 0.005 wt% oxidized MWCNTs was 65.7 L/m^2h which increased significantly due to this fact that membrane hydrophilicity improved as a result of functionalization of MWCNTs. Contact angle measurements confirmed the improvement of hydrophilicity by adding oxidized MWCNTs to the membranes. Surface SEM images illustrated that the MWCNTs made surface of the membranes smoother and macro-voids enlargement leads to water flux enhancement. The antifouling properties were investigated using bovine serum albumin (BSA)/salt solution. The results showed that the membranes with a smoother surface had a better resistance against the fouling. The salt rejection performance exhibited that by embedding of the raw MWCNTs and oxidized MWCNTs, improvement in rejecting of Na_2SO_4 salt can be observed. Rejection for 0.005 wt% oxidized MWCNTs was 97.9% which was the highest among all of the membranes. It can be stated that the addition of raw and oxidized MWCNTs could enhance the performance of the nano filtration membranes in all characteristics of fouling, salt rejection and flux. Moreover, the addition of oxidized MWCNTs could improve the flux rate without any depletion in the salt rejection and also with an improvement in the antifouling properties.

Key Words: Nanofiltrarion, nanocomposite, salt rejection, MWCNTs.

THE EVALUATION OF GENERAL CONDITION OF CONTRACT FROM THE PERSPECTIVE OF THE COMPLIANCE WITH THE CONCEPT OF GREEN BUILDING AND PROPOSING SOME SOLUTIONS FOR IMPROVEMENT

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 47-57, Original Article

- Received 12 August 2017; received in revised form 7 October 2017; accepted 28 October 2017.

Abstract

The lack of resource energy and increasing in the cost of energy whether in the construction or in the operation period, lead to the establishment of new concepts such as green building. Although this concept would be effective in reducing the consumption of energy rate but it is important to make some logical mechanism for its implementation in Iranian construction industry. So the authors aim to firstly introduce the concept of green building and its present condition in Iran and next bring some changes in the General Conditions of Iranian Contract (named code 4311), as one of the most popular codes in Iranian construction industry, for better implementation of green building concept. In this study according to the literature survey and past researches many criteria of green building were chosen. Because of the large number of criteria, the authors chose ten main criteria based on a logical approach to use in the process of evaluation of General Conditions of Contract and proposing some suggestions. According to those criteria a questionnaire was generated in two parts. The questionnaires distributed among 25 engineers as a pretest and after confirming the validity and reliability of the questionnaire, it was distributed among 325 engineers by applying a group sampling method and Cochran's equation. According to the results obtained by applying some stochastic analysises such as Kruskal-Wallis, binominal test and etc. some suggestions for changing General Conditions of Contract for using in green buildings were proposed. Results showed that the present Genral Condition of Contract is not capable enough to force different contract parties to use the green building concept in their works. The paper introduced some cluases which are very effective on promoting the capability of General Conditions of Contract for implementing the green building concept. Finally the reliability of results were confirmed by applying another questionnaire which was designed and distributed among 30 experts. In this study presenting.

Key Words: Green buildings, green materials, sustainable development, building contracts, general conditions of contract.

subjected to uniform shear deformation on the upper boundary. The second example is a slope failure problem, which includes a downward displacement applied to the middle of a rigid block on the top of a slope. The shear band path and the force-displacement curves are plotted for both examples and have good agreement with the reported results.

Key Words: Finite element, zero thickness element, shear band, modeling, strain localization.

ESTIMATION OF THE LONGITUDINAL AND TRANSVERSE DISPERSION COEFFICIENTS OF SAND SEDIMENTS IN SATURATED STATE

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DOI:10.24200/J30.2019.20923

Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 33-38, Original Article

- Received 24 June 2017; received in revised form 3 September 2017; accepted 28 October 2017.

Abstract

Groundwater resources play an essential role in water supply for drink, agriculture, and industry sectors. Nowadays, for various reasons, such as urban and population growth, indiscriminate use of fertilizers and chemical poisons, groundwater resources have been populated. Therefore, studying the pollutions and their fate and preventing groundwater resources from the pollutants is necessary. In this research study, a laboratory physical model has been designed and performed in order to obtain enough data of pollution movement in homogeneous porous media. In other words, the main aim of this paper is to track the distribution of a conservative tracer in porous media in a laboratory-scale model to estimate the longitudinal and transverse dispersion coefficients. In this study, non-cohesive sands were used to create the porous media body in the laboratory model, and the grain diameter of the sand was 1-2.5 mm. Salt with concentrations of 5, 7.5, and 10 gr/l was used as a tracer. The porosity of the sand was measured equal to 39%, and the hydraulic conductivity of that was measured equal to 172.26 cm/hr using the constant load test. In order to control changes of flow velocity, to minimize test errors, a constant head of water was created over the entrance of the sand body. The flow velocity was measured equal to 1.21 mm/sec. An EC-meter apparatus was used to measure the EC values of the tracer inside model; then, these data were used to calculate the concentration of tracer in different points over time, during each test. Then, the values of the concentration were compared with those of concentration which were obtained from the analytical solution of Fick's second law. Root Mean Square Error criterion (RMSE) was used to compare the measured and calculated mentioned data. According to the results, the values of the longitudinal coefficient tracer for the studied conditions, concentrations of 5, 7.5, and 10 gr/l, obtained 3.36e-6, 3.08e-6, and 3.52e-6 for transverse coefficients 6.58e-7, 6.49e-7, and 6.79e-7 m2/s, respectively.

Key Words: Groundwater pollution, tracer, analytical solutions, physical model, longitudinal and transverse dispersion coefficients.

TREATMENT OF SALINE WATER BY NANOFILTRATION PROCESS WITH A MODIFIED POLYAMIDE MEMBRANE MULTI-WALLED CARBON NANOTUBES

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 39-46, Original Article

- Received 25 June 2017; received in revised form 9 December 2017; accepted 17 December 2017.

Abstract

The object of this paper is the synthesis and modification of piperazine-polyamide NF membranes using

tions at the upstream weirs; this matter predicted that this alternative to rectangular weirs could improve sediment at the upstream weirs. Turbulence analyzation showed that turbulence decreased from channel wall to crest center. In addition, in the cosine weirs, turbulence in crest center is higher than that in the rectangular weirs. This consolation is used to solve the sedimentation of the problems at the upstream weirs.

Key Words: Cosine weirs, acoustic doppler velocity, confection discharge, turbulence intensity.

ACTIVE STRUCTURAL VIBRATION CONTROL BY UTILIZING SINGLE ACTUATOR AND APPLYING CRITICAL DAMPING CONCEPT IN TWO VIBRATION MODES

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 13-23, Original Article

- Received 19 June 2017; received in revised form 13 August 2017; accepted 14 October 2017.

Abstract

In this paper, a new active structural vibration control procedure is presented using the developed critical damping theory. This strategy utilizes the critical damping concept i.e. CD method. In conventional CD algorithm, the effect of first vibration mode was incorporated to formulate the actuator force. Here, the critical damping concept is developed so that the actuator force is calculated by applying the effects of both first and second vibration modes. This strategy improves the efficiency of the critical damping technique. Since the total damping matrix corresponding to the dynamic system should be semi positive definiteness, a novel approach is suggested here for determining the actuator and sensor locations. According to the proposed concepts, a new active control algorithm is obtained. Efficiency and stability of the proposed method is assessed by active control of vibrations of some shear buildings subjected to various dynamic loads. Results demonstrate considerable merit of the proposed active control algorithm compared to the common critical damping method.

Key Words: Smart structure, active control, critical damping.

A NEW METHOD FOR MODELING OF SHEAR BAND PROPAGATION USING ZERO THICKNESS ELEMENTS

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 25-32, Original Article

- Received 19 June 2017; received in revised form 26 November 2017; accepted 10 December 2017.

Abstract

A shear band is a narrow zone of intense shearing strain within a largely unsheared matrix. During the shear band formation, relative tangential displacement of blocks of material on two sides of the band occurs. Width of this region varies from a few to hundreds of microns. Despite the infinitesimal width of the band, its relative tangential deformation may extend to several centimeters and may even lead to exertion of macroscopic influence on the medium.

In this paper, a new method for modeling of shear band is presented. A bifurcation analysis is used to detect the onset of localization in an element to determine the geometry of the localized deformation modes. Therefore, a computational procedure is discussed for detecting the onset of localization and determining the localization directions and the shear band path. A zero thickness element is utilized to simulate the slip surface in the shear band.

Plane strain condition is assumed in numerical simulations, and elasto-plastic finite element method is used in analysis.

When the onset of localization is detected, the zero thickness element is added to the shear band path, which closely reproduces the shear band response. The proposed methodology is applied to two numerical examples, and the results are compared with the other existing methods which demonstrate the ability of the method to resolve the geometry of localized failure modes and reproduce the shear band response.

The first example is a simple shear problem that includes a rectangular solid with fixed supports in its bottom,

Abstracts of Papers in English

COMPARISON OF HYDRAULICS PARAMETER BETWEEN HALF CYCLE COSINE WEIRS AND RECTANGULAR WEIRS

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Sharif Civil Engineering Journal
Volume 35, Issue 3.1, Page 3-12, Original Article

- Received 30 May 2017; received in revised form 28 November 2017; accepted 5 December 2017.

Abstract

Weirs are widely used in agricultural and hydraulic engineering for measuring and regulating flow. Various shapes of weirs give rise to their special characteristics. One of the Weirs problems in irrigation system is the change of hydraulic characteristics when upstream of the weirs is filled by sediments. This study introduces a novel sharp-crested weir design with a cosine weir and investigates physical models of cosine sharp-crested weirs of different widths. The analysis aims to establish the head discharge relationship and inspect velocity distribution and the hydrodynamic characteristics of flow in the vicinity of the weir plate. The hydraulic behavior of the cosine weirs is compared with that of rectangular sharp-crested weirs. The results showed that the turbulence intensity in the vicinity of the cosine weirs was stronger than that in rectangular weirs. In addition, turbulence intensity, r, is sidewall cosine weirs more than the rectangular weirs. Therefore, this type of weir could provide the sediment transport at the upstream weirs. Result showed that the increasing water head at the upstream with $y/P > 0.78$ confection discharge was diminished (y is the height of water on crest weir, and P is the height of weirs from bottom to crest). In addition, with $y/P < 0.78$, this factor increased. In the collection, turbulence intensity used the function (Welcox., 1993). Therefore, components velocity in some beam was counted, and turbulence intensity was collected in reticulation upstream of weirs. Results showed the cosine weirs could increase the turbulence and distribu-