PT. 2. TESTS OF SIMPLE-SPAN SKEW I-BEAM BRIDGES, BY N.M. NEWMARK, C.P. SIESS, AND W.M. PECKHAM. pdf

1: Full text of "Faculty publications and doctoral dissertations"

Tests of simple-span skew I-beam bridges, by N.M. Newmark, C.P. Siess, and W.M. Peckhampt Small-scale tests of shear connectors and composite For full functionality of ResearchGate it is.

In the earlier work, difference equations were set up from which deflections and moments could be determined in skew slab-bridges with curbs. These equations have been used in the present work to analyze a number of bridges having a roadway width of 24 ft. The results of the analyses are presented herein. The method set forth in this bulletin is not to be construed as a final form of a design procedure. The bulletin is related to past and future publications on slab-bridges in that it continues the advance from the development of methods of analysis Bulletins and toward the evolution of a final standard design procedure for skew slab-bridges. The principal object in this bulletin is to study ana- lytically the effects of variations in bridge dimensions on quantities critical for design. The step next in order will be the testing of actual structures and the comparison of test results with analytical data. Future publications will summarize the results of laboratory tests on one-half and one-fifth scale models of reinforced concrete skew slab-bridges with curbs, and will present a design procedure based on analyses and tests. Allen for his thesis, which was submitted in in partial fulfillment of the requirements for the degree of Master of Science in Theoretical and Applied Mechanics in the Graduate School of the University of Illinois. The work was done in conjunction with the investigation of concentrated loads on reinforced concrete bridge slabs being conducted in the Engineering Experiment Station in coopera- tion with the Public Roads Administration of the Federal Works Agency and the Illinois Division of Highways. The program of the investigation is guided by an Advisory Com- mittee having the following personnel. Jensen, "Analyses of Skew Slabs. This bulletin contains references to earlier literature on skew slabs. Representing the Illinois Division of Highways: Representing the University of Illinois: Consultants to the Committee, from the University of Illinois: Such moments, when used in the ordinary theory of flexure, give stresses at the bottom of the slab approximately equal to those obtained from the more exact thick-slab theory. Theoretical Basis for Analyses. Neither the derivations nor the equations themselves are repeated here. It is sufficient to state that the usual assumptions are made that the slab is of homogeneous, isotropic, and elastic material and is of constant thickness. The curb is assumed to act in the manner of an edge beam of stiffness EItl attached to the slab in such a way as to undergo the same deflection as the edge of the slab and to transmit only vertical reactions to the slab at its edge. The difference equations used in the analysis are the difference analogs of the corresponding well-known differential equations per- taining to the analysis of slabs. Their use reduces the problem from one of an infinite degree of indeterminateness to one of a finite degree by confining attention to a finite number of points on the slab. These points are chosen as the intersections of a regularly spaced network of crossing lines on the slab. Some approximation is introduced by the substitution of the dif- ference analogs for the differential equations. The percentage of error in the bending moments reduces with the closeness of the points of the network and, in general, increases with the sharpness of variation of the moments. The sharpest variation of moments occurs directly under a concentrated load. Through the introduction of a corrective term, however, the bending moments directly under a wheel load on the bridge are represented with reasonable accuracy. A considerable number of factors influence the distribution of moments in a skew slab-bridge. Among these are the following: They are limited in general to a consideration of the two-lane bridge having a roadway width of approximately 24 ft. Angles of skew up to 60 degrees are considered. Spans are limited, in general, to a maximum of 30 ft. As far as practicable, a single curb detail, adopted as standard for these studies, was adhered to. Because tests3 have shown that the slab-bridge is capable of sustaining relatively high loads before failure, working stresses were adopted as follows: Although the foregoing limitations apply in general to the results presented herein, certain departures from them are permissible; these are indicated in the detailed discussions of the various curves of bending moment. Figure 1 shows plans of the various bridges analyzed by difference equations. Supplemental data for each bridge are given in Table 1. In addition, a number of bridges of short span were studied by the application of coefficients given in Bulletin and by an influence surface for the infinite strip slab. It is not recommended for general use in an office for the design of skew slab-bridges, although it has perfectly general appli- cability to such bridges of any proportion, angle of skew, or loading. The method is recommended for special investigations. The analytical procedure is used herein to furnish an understanding of the behavior of particular skew slab-bridges and to provide curves of moment from which a simplified design procedure may be evolved. For the purpose of the investigation reported in this bulletin, the width of roadway was held constant, whereas the angle of skew and the normal span were permitted to vary. Thus, for each arbitrary angle of skew an attempt was made to analyze a range of spans up SSee for example V. It was possible to choose such spans as would permit the use of convenient networks of squares, rectangles, or equilateral triangles. Equations pertaining to slabs having various networks are given in Bulletin The procedure to be followed in making an investigation may then be outlined as follows: Select the dimensions of the bridge and the network. Width fixed by width of roadway and curb details -about 25 ft. Span variable, to suit network of points - range up to 30 ft. Select from Bulletin the equations appropriate to the given type of network and compute the values of the constants which appear in the equations. Determine influence surfaces for moments at or near the center of the slab and for moment near the center of the curb. Details are given in Bulletin Analyze the bridge for dead load, either by the influence sur- faces or by solving simultaneous equations for deflections and com- puting moments according to the appropriate equations given in Bulletin By spotting truck wheel loads at various positions on the bridge and by using the previously determined influence ordinates, obtain curves from which the maximum moments in the slab and the curb may be determined. From the calculated dead and live load moments, check the required thickness of slab. If the required thickness of slab differs considerably from the assumed value, follow one of three procedures: The various steps are illustrated in somewhat more detail in their application to slab B. Numerical data for this bridge are sum- marized on the Computation Sheet. Center to center of curbs b Corrective moment for point 13 in slab for loaded area of 1. A procedure more consistent with the definition of curb as used in calculations of curb stiffness would be to consider the junc- tion of curb and slab to be at the plane tangent to the inside face of curb. However, the total dead load effect of curbs and slab combined is independent of the definition of junction of curb and slab. The procedure illustrated is followed consistently throughout this bulletin. The dimensions of this bridge and the form of the network are shown in Fig. Since the angle of skew is 30 deg. The numbers on the points of the network indicate that 15 simultaneous equations must be solved for each symmetrical or anti- symmetrical loading considered. The required slab thickness was estimated from the mo- ment in a right bridge of identical normal span and width of roadway. For slab B the estimated over-all depth was 19 in. For this depth of slab the value of the constant J was determined to be approxi- mately 0. The equations appropriate to a network of equilateral tri- angles are given in Bulletin , Section 8, Equations 98 through Ap- plied to slab B, Fig. Since these are easily obtained from the general equations, they are not stated here. The intensity of loading at each point remains to be specified for each type of loading. The influence surfaces for M. Where a particular effect Q is a linear function of the deflections w. Applications of this theorem are described in Bulletin , Chap- ter IV. To illustrate the application of the theorem to slab B it is sufficient to consider the influence surface for M, at point The equation for M. Since the set of loads does not possess point symmetry with re- spect to the center of the slab, it is broken into two sets, one sym- SN. It is assumed that, at any point n, the distributed load p, is related to P,, as follows: The sums of the deflections due to the two systems of loads represent the influence ordinates for moment M, at point Similarly the influence ordinates for moments My and Ms, at point 13 and for Mcurb at points 4 and 7 may be obtained. As a matter of fact, in the solution of a system of equations for symmetrical or for anti-symmetrical deflections, any number of sets of loads may be handled at the same time. Each new set of loads merely adds a column to the tabulated calculations of the type described in Bul- letin , Appendix A. The bending moments in a slab under a load distributed over a small area are affected by the degree of concentration of the load. Except for the region over which the load is applied, the effect is negligible. Therefore, a correction must be made to the influence ordinates for M, and My at point 13 as determined from the difference equation analysis. The manner of determining the correction for a square network of points was described in detail in Bulletin , Sec- tions 12 and Stated briefly, the determination of the correction has the following basis. If the value of c is known it can be calcu- lated approximately for all slab networks , each of the moments may be corrected for another diameter of loaded area, cl, by the addition of a correction S -, 6 2. For the purpose of this investigation, c, was always made equal to 1. The diameter c, which is seen to be tacitly assumed in all difference equation analyses, depends upon the shape and fineness of the network used in the calculations. For slab B as well as for the other slabs analyzed, the corrected influence ordinates are given in the tables in Appendix B. Contours on the influence surfaces were drawn according to the ordinates at the points of the network. Points on the contour lines were taken from profiles of the influence surfaces. Contours on the influence surfaces for slab B are shown in Fig. The dead loads to be considered include the weight of the slab, curb, and handrail plus any pavement allowance required by the specifications. The weight of the slab and the pavement allowance are added in order to obtain the intensity of loading, p, which is con- stant for all points of the network.

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2: Modern Telemetry - PDF Free Download

Studies of slab and beam highway bridges. A report of an investigation conducted by the Engineering Experiment Station, University of Illinois, in cooperation with the Public Roads Administration, Federal Works Agency, and the Division of Highways, State of Illinois.

The Initial Step W. David Walter, Justin W. Pindos - Greece Mertzanis G. Teixeira and Rui M. This fact leads to a need of studying and understanding of these principles before the usage of Telemetry on selected problem solving. Spending time is however many times returned in form of obtained data or knowledge which telemetry system can provide. Usage of telemetry can be found in many areas from military through biomedical to real medical applications. Modern way to create a wireless sensors remotely connected to central system with artificial intelligence provide many new, sometimes unusual ways to get a knowledge about remote objects behaviour. This book is intended to present some new up to date accesses to telemetry problems solving by use of new sensors conceptions, new wireless transfer or communication techniques, data collection or processing techniques as well as several real use case scenarios describing model examples. The book is split to several sections containing one or more chapters. This section contains one very well structured chapter. Telemetry Use Cases focused on the theme of biomedical, medical, animal as well as military, are considered in following four sections containing the rest 16 chapters. These chapters deals with many real cases of telemetry issues which can be used as a cookbooks for Your own telemetry related problems. Introduction Telemetry is a technology that allows remote measurement and monitoring of data. It normally refers to one-way direction of information, that is, from the sensor to the interrogation system or data logger system. Telemetry could be defined as a sub-class of telecom, a more complex way of exchanging information such as Internet, telephone calls or video transmission. Telecommand, the counterpart of telemetry, occurs when the remote systems require remote instructions and data to operate, which means that the information goes on the other direction. Telemetry finds applications in aerospace, automotive, consumer, engineering, industrial manufacturing, medical, military, electric power industry etc. Although the term telemetry commonly refers to wireless data transfer mechanisms e. In the applications mentioned above and particularly in the electric power industry, we find normally protocols that can be either bidirectional or mono directional, such as Fieldbus, RS, Ethernet, mA, V, all working in a twisted-pair basis. These protocols, although being among us for many decades, have disadvantages, particularly when applied to the electric power industry. One of these disadvantages is that data transmitted through electric wires normally need electric energy at the sensor end, or in other words, the transducer needs to be powered in order to measure and transmit data. However, it occurs that sometimes providing electric energy at the sensor location is difficult for it could be far away from any appropriated power supply. This happens in long high voltage transmission lines or along pipe-lines or in deep ocean, for instance. The other problem with these protocols is that they electrically connect the sensor location with the interrogation location. The main consequence of this is that short circuits due to malfunctioning or atmospheric discharges can easily be transferred to the operation room and furthermore putting the substation personnel and equipment at risk. They came offering many advantages over the other technologies and soon started to be applied in telemetry with very good return in costs, maintenance and efficiency. Additionally, due to its virtually infinite capacity to multiplex, one can mix different kinds of signals in one single fiber therefore saving many kilometers of copper wires, which is also welcome by the maintenance personnel. In this article we will concentrate on applications of telemetry over optical fiber and on optical fiber sensors which encompass telemetry and sensor in one single media. At the beginning of this era, optical devices such as laser, photodetectors and the optical fibers were very expensive, adequate only to the already saturated telephone network in which companies would pay any price to transmit more information and more telephone calls. OFS can be applied in many branches of the industry but we will concentrate here their applications through our experience in the electric power industry. In this area, the operators need to measure and monitor some important physical parameters that include: The best option to avoid this catastrophic effect is the OFS, because the fiber is made of dielectric materials and therefore it is possible to be placed very close or even touch a high potential conductor and they do not necessary need electrical power at the sensor location. OFS can be built using several physical principles and materials. They have specific characteristics that are well exploited when applied to the electric power industry and in this case OFS offer a large number of advantages over conventional sensors. The most important are: RF-field and high electric and magnetic fields present in power lines. The insulation is another special requirement, because as these sensors are inherently electrically insulated dielectric and do not require external power, this means that there is no electric path from the power line to ground, which means high personnel security. Therefore the optical fiber sensors can work at high electrical potentials and in potentially explosive environments. Optical fibers can be used as sensors by modifying a fiber so that the measurand interferes on the guided light and modulate light parameters such as intensity, phase, polarization, wavelength, or transit time of light over the fiber. Sensors that vary the intensity of light are the simplest, since only a simple source and detector are required. We can divide OFS in three basic categories: Extrinsic fiber optic sensors use an optical fiber, normally multi-mode, to transmit modulated light from either a non-fiber optical sensor or an electronic sensor connected to an optical transmitter. In this case the optical fiber is used only to transmit light to and from the sensor. This kind of sensor sometimes is called hybrid sensor for it enclosures different technologies such as optics and electronics. In intrinsic sensors the light does not leave the fiber and the light modulation takes place inside the fiber. This kind of sensor presents the major benefit to have the ability to reach otherwise inaccessible places and without the need of electrical energy at the sensing location. The third category is the evanescent field based sensor. Due to the total internal reflection phenomenon that occurs in the core-cladding interface of the fiber, the light propagating in the fiber has two components - an oscillatory field in the core and an exponentially decaying field in the cladding. The latter field, referred to as the evanescent field, is the key to sensing and is based on the modulation of the light amplitude in the core of the fiber by the optical properties of the surrounding medium. When developing an OFS we can use the fiber for: An optical fiber is a thin, flexible, transparent glassy filament that acts as a waveguide, or "light pipe", to transmit light from the light source to the photodetector located at the two ends of the fiber. They are mainly used for telecom and sensing but find many uses in the industry, research sciences, medicine, entertainment etc. They proposed that the attenuation in fibers available at the time was caused by impurities that could be removed by chemical processes. They correctly and systematically theorized the light-loss properties for optical fiber, and pointed out the right material to use for such fibers â€” silica glass with high purity. This discovery earned Kao the Nobel Prize in Physics in Although polymeric optical fibers POF are around us much longer than silica fibers, only in the last decade they start to attract attention for LANs and small industrial networks and their use for sensors has just emerged few years ago. Relative comparison of diameters in different kinds of fibers. The light color represents the cladding and dark color the core. From then on several laboratories are keeping trying to decrease the attenuation in order to apply POF in telecom. Comparing POF and silica fibers by the attenuation, silica fibers are much better. However, when constructing a fiber sensor using POF instead of silica, we have some additional advantages: POFs are cheaper than their counterpart as well as the peripheral components and devices, such as connectors, LEDs and photodetectors. They also present more resistance to strain larger modulus of elasticity which means more reliable networks. Finally, many interfaces can be built in laboratory what makes the maintenance cost much lower than when dealing with silica fibers. Of course POFs have disadvantages too. POF only transmits visible and near infrared light, so we cannot use the available technology of telecommunications such as nm and nm telecom windows. Additionally, POF has a very high attenuation in the visible spectrum see Fig. The other issue is the temperature because plastic materials cannot withstand high temperatures as much as glasses. POFs can operate only up to 70 to 85oC. However, some specials POFs have been developed mainly for harsh environment such as in car networks. In these applications POFs have to withstand temperatures as much as oC. Table 1 shows some examples.

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Optical attenuation of silica fibers and POFs. The attenuation of silica fibers is negligible for sensing distances around 1 km , but when using a POF for transmitting light, the first thing to have in mind is the high attenuation the POF impinges to the light. Case studies This section will present real applications of OFS and telemetry in the electrical power industry. The techniques presented here have been tested in the field mainly in high voltage 8 Modern Telemetry transmission lines, in substation equipments and in hydroelectric generators, all in a connected-to-the-grid basis. Nevertheless, when dealing with high voltage, sometimes one cannot use conventional electric sensors particularly when working near high voltage areas. This case reports the development of a temperature sensor system using the fluorescence technique. The fluorescence effect can be used as an indicator and generate a signal proportional to a specific parameter need to be monitored. In the same way, fluorescent materials can be used as sensors. It is well known that the fluorescence decay time of some crystals is proportional to the temperature. Therefore, one way to build a temperature sensor is by the measurement of the time constant of the exponential decay that produces a linear relationship with the temperature. Optical fibre sensors offer a large number of advantages over conventional sensors such as high immunity to electromagnetic interference, electrical isolation and the absence of metallic parts, a strong requirement for sensing in electromagnetic contaminated environments, e. The sensor probes are inherently electrically insulated system and external power is not required for their operation, they can work at high electrical potentials and in potentially explosive environments. It can be made as lightweight, compact, disposable of low cost and is highly chemically inert even against corrosion. The fluorescence based sensors offer the advantage of a near-zero background, because the wavelength of the emitted light is always larger than that of the excitation light, which makes then in principle much more sensitive and error immune than those that change only the absorption when the temperature varies [Asada and Yuki, , Grattan and Zhang,]. Previously, experiments with commercial polystyrene fluorescent fibres as temperature sensor were done [Ribeiro et al. Ruby has been used for fluorescence thermometry because it is of low cost, easily available, POF compatible, requires low cost source blue or green ultra-bright LEDs , Sibased photodetection and simple electronics. Additionally it presents strong intensity and long lifetime of fluorescence signal. The fluorescence peaking at nm wavelength features a long-decay time of ms. Persegol and co-workers [Persegol et al. Two POF-probe were used, one for pumping the ruby and the other for bringing the fluorescence back to the photodetector. Low cost passive and active components as couplers, connectors, adapters, LEDs etc were used. Ruby crystals are Optical Fiber Sensors 9 geometrically compatible with standard POFs and even after cutting and polishing it remains at low cost. The LED package was polished almost reaching the semiconductor chip thus maximizing the light caption. Optical pulses of 32 ms time-width from the LED were generated to pump the ruby crystal at A miniature 1x2 POF-coupler is used to send pump pulses toward the ruby crystal glued at the end of the POF-probe and to collect the fluorescence toward the Si-photodetector. Top view picture of the temperature sensor prototype conditioning equipment.

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