Dom techniky ČSVTS Bratislava

MEDZINÁRODNÉ SYMPÓZIUM

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COMPOSITE STEEL CONCRETE STRUCTURES

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SUMMARY AND CONCLUSIONS

1. The advantages of composite construction in offshore structures has already been realized. The objective of this study was to investigate the use of composite steel concrete sandwich plates as exterior walls in caisson structures instead of traditional structural steel systems.
2. The behaviour of selected specimens which simulated the actual structure was the subject of an experimental and theoretical investigation.
3. A scheme based on Limit States Method has been proposed in order to allow the assessment of the reliability conditions with regard to carrying capacity and serviceability.
4. Loading, response of the structure to the loading and limit values were expressed in terms of forces, pressures, deformation, strain and energy.
5. With regard to the loading three ranges of response were considered: common loading conditions, expected ice loads, and exceptional ice loads.
6. The applied reliability conditions are based on a conscious utilization of elasto-plastic behaviour considering large deformations.
7. This paper focuses on the wider application of Limit States Method beyond the current interpretation. This is still a subject of further research.

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RECENT RESEARCH AND DEVELOPMENT OF POLYMER CONCRETE-STEEL COMPOSITE STRUCTURES

1. Introduction

Most engineering concepts reveal the constraints imposed by the properties of the materials used. Indeed, engineering can be regarded as a progressive quest to exploit the properties of materials. Construction engineering is a classic example and polymer concrete is its most noteworthy material. In several countries a lot of effords have been made to develop an economic application of polymer concrete [1].

Our research has been directed toward mechanical and fatigue properties. The effect of polymer concrete on flexural strength and the behaviour of structures under static, cyclic or fatigue loading has been investigated.

2. Test specimen and statical testing

Twenty-four polymer concrete-steel (PCS) beams with rectangular cross-section were tested. The dimensions of the beams can be seen in Table 1.

thickness (mm)	width (mm)	length (mm)	end conditions	
			free-free	clamped-clamped
			model No.	
3-25-3	75	1200	1	4
3-40-3			2	5
3-60-3			3	6
2-25-4		600	7	
2-40-4			8	
2-60-4			9	

Table 1. Model dimensions

Thickness 3-25-3 means 3+3 mm steel plate faces, 25 mm PC core. We determined the statical behaviour of the PCS beams, the ultimate loads, when the loads are acting at midspan. It has been found, that if the stresses in steel faces are larger that 144÷148 MPa, there were large residual deflections. At the PC core, in these cases, the stresses were 8÷13.5 MPa.

3. Dynamic investigations

The forced vibration technique has been applied to examine the dynamic and fatigue behaviour of beams with Brüel-Kjaer devices (Fig.1.). The loss factors of beams (η) have been determined by means of half-power bandwidth method according to Oberst [2] for various stresses, eigenfrequencies and core thicknesses.

Fig.2. shows an acceleration-frequency diagram, using a linear frequency growth at the forced vibration. Fig.3. shows a loss factor-face stress diagram for model 2. at eigenfrequencies F1, F2, F3. Fig.4. shows a loss factor-frequency diagram, where the loss factors are valid at the eigenfrequencies with different stresses. Fig.5. shows a core thickness-eigenfrequency diagram for models 4.5.6.

The dynamic characteristics of the core material were measured by using the method of Jones and Parin [3]. The average value of PC's loss factor is $\beta = 6.06 \cdot 10^{-3}$ and that of dynamic shear modulus is $G_d = 731.2$ MPa.

This results make it possible to calculate the loss factor of PCS beams using the Ungar's [4] formula and the eigenfrequencies of the beams according to Yin [5], as it was used at the analysis of sandwich beams in [6], [7].

It can be concluded that the PCS beams may be used not only for static loads, but also for dynamic excitations. The loss factors of the beams (η) were between 0.01÷0.11. Fatigue tests have been carried out to determine the fatigue behaviour of core and connections between layers. There were some problems relating to the scatter of the strength of connections. We found, that if the PCS manufacturing technology is satisfactory, then the delamination of layers does not occur.

The aim of our research and model investigation was to determine the usability and efficiency of PCS structures at punch presses, at revolution presses. We have measured the stresses, deflections, vibrations and noises on the bridge and table of a 130 ton revolution press. These structural parts have been constructed from stiffened, welded steel plates.

A PCS type bridge is under production and we will investigate the static and dynamic properties of this bridge, the vibrations and noises during operation. A new generation of revolution press family could be developed on the basis of our investigation.

4. References

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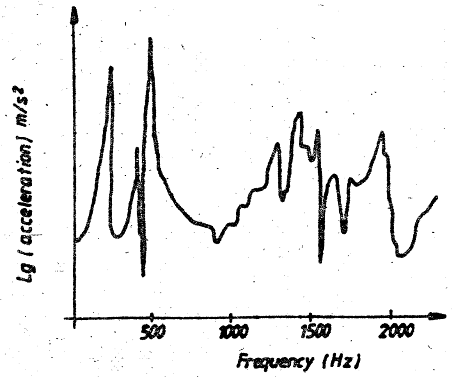

Fig. 2

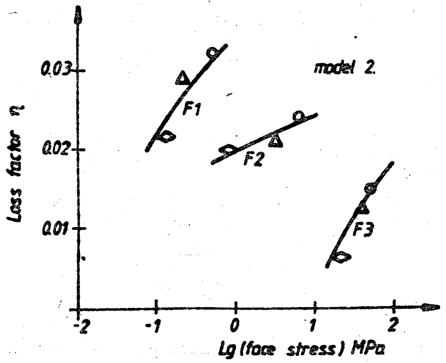

Fig. 3

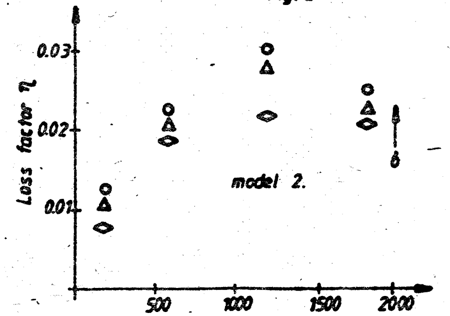

Fig. 4

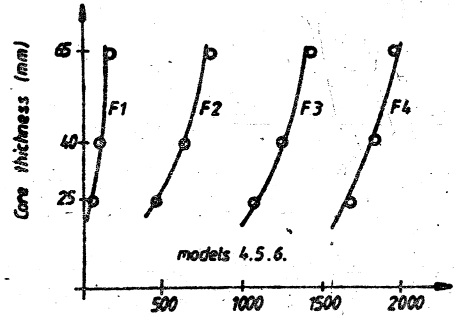

Fig. 5

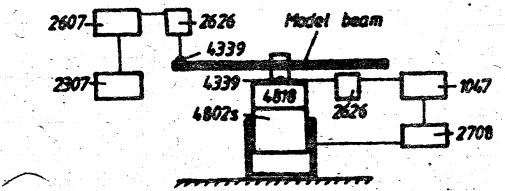

Fig. 1

Dynamic measurements on a model beam with the following Brüel and Kjaer measuring instruments: 4802 S, exciter body; 4818, exciter head; 4339, accelerometer; 2626, conditioning amplifiers; 1047, exciter control; 2607, low-noise measuring amplifiers; 2307, level recorder.

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STRENGTHENING OF SHIELD STRUCTURE ACCORDING TO THEORY AND DESIGN CONCEPTION

1. Introduction

Necessity of concrete and reinforced concrete shield structures strengthening is frequent appear in building carry wall construction and in engineering building. The problem takes place in the following cases:

- not to obtain planning concrete resistance in realization
- dimentional and assembling deviation
- necessity of load capacity increase during modernization of using objects.

Symmetrical or unsymmetrical enlargement in thickness of walls, by concreting external layers can be the one way of walls strengthening. Mating of concreting external layers can be provided by:

- natural adhesion or gluing
- mechanical joint with several types of connectors.

Distribution of internal forces, relocations in combined wall layers and shearing forces in surface of joint must be known for carrying out strengthening construction. Theoretic analyze in this type of constructions is faced with some difficultes. The difficultes are mostly going from necessity of including differential course of rheologycal effects, which are depending from: the advancing degree of loading at strengthening moment, the quality and age of concrete, and the way of joint layers. Nonlinearity of elastic strain and rheo-