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SEMI-RIGID BEAM-TO-COLUMN CONNECTIONS

Third Period 01-01-91 / 30-06-91

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Project number: DCT99.1904

Project leader: Prof. dr. ir. J. Wardenier

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Title research programme	:	Semi-rigid beam-to-column connections.
Period	:	Jan 1991 - Jul 1991
Projectnumber	:	DCT99.1904
Research team	:	ir. H.D. Rink ir. G.D. de Winkel Prof.dr.ir. J. Wardenier (Project leader)
Start project	:	01.01.1990
End of project	:	31.12.1993
Research location	:	Delft University of Technology Faculty of Civil Engineering Stevin II laboratory for Steel Structures

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2 PROJECT SUMMARY

The aim of the research programme is the development of design recommendations for semi-rigid multiplanar connections between I-section beams and circular hollow section columns. The influence of a concrete infill of the column and the interaction with composite concrete floors is also taken into account.
Today no evidence is available for the designer for these types of connections. For the development of the design recommendations a parametric study will be carried out, by means of numerical simulations. The numerical simulations will be calibrated at experimental results.
In this period the literature survey on semi-rigid connections and preliminary finite element calculations are reported.

3 STAFF

Two full time academic staff members are working on the project. There been no mutations. Ir. G.D. de Winkel is working since January 1990, ir. H.D. Rink is working on the project since January 1991.

4 EQUIPMENT AND SOFTWARE

During the report period no investments have been done and no new software have been installed. There have been no problems with the two Sun workstations of the project.
Expenditure during this period:
10 tapes for backup purposes: Dfl. 575,--
1 Extra cable to connect a harddisk: Dfl. 325.88

5 OTHER EXPENDITURE

In May mr. de Winkel attended an excursion to Stockholm, Sweden, organised by the Project Analyse Bureau. During the excursion several projects with composite steel-concrete structures have been visited as well as the Institute for Metal Researchs, and the designer of one of the most used steel-concrete systems in Sweden.
Also in May mr. de Winkel attended a seminar in Brussels about computer applications for technical users.
Expenditure:
Sweden excursion: Dfl. 1708,--
Brussel seminar: Dfl. 569,--

6 LITERATURE SURVEY

The literary survey describes the information available on the static strength of unstiffened I-beam to hollow section column connections. Other topics related to the subject are also included in the survey. These topics covers plate to hollow section column connections, the influence of concrete filled tubes, and other semi-rigid connections.
Some information on stiffened connections is also included. The literature has been grouped, based on the most important research programmes.
The literature survey is reported in Technical Report Nº. 1. "LITERATURE SURVEY".

7 PRELIMINARY NUMERICAL INVESTIGATION.

In order to establish the sensitivity of FEM analyses for different ways of modelling the welds between the I-beam and the tubular column, and also to investigate the effect both on the results and on the computertime needed of using different element types, a number of analyses are performed. As no experimental data is available at the time of this investigation, to calibrate numerical model, no verdict on the quality of the different solutions can be made, only a comparison between the different methods is possible. As results from experiments become available, this study will help to make a quick and accurate calibration possible.
It is shown that the choosen element type as well as the fact if the weld is modelled, or not, has a big influence on the stiffness of the connection, even in the linear elastic part of the load-deformation diagram.
The study is reported in the Technical Report Nº. 2.

8 EXPERIMENTAL WORK

The experimental work will be done in the framework of the ECSC research programme on "Semi-rigid I-beam to high strength steel tubular columns". The fabrication of the test specimen will commence in September 1991. The test rig will be build in September. The first tests be carried out in October 1991.

9 TIME SCHEDULE

Period 4: Jul - Dec 1991:

- Start experimental research in the framework of the ECSC programme.
- Scheme of the numerical research. Determination of the number of parameters,etc. The total amount of parameters that can be examined is dependent on the available computer time.
- Numerical simulations.

Period 5: Jan - Jun 1992:

- Experimental research in the framework of the ECSC programme.
- Numerical simulations

Period 6: Jul - Dec 1992:

- Experimental research in the framework of the ECSC programme.
- Numerical simulations
- Setting up design recommendations
- Statistical parameter research

Period 7: Jan - Jun 1993:

- Numerical simulations
- Statistic parameter research
- Design recommendations
- Start Final Report

Period 8: Jul - Dec 1993:

- Finishing Final Report