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Foreword

The conclusions of the 8th Congress of the International Association for Bridge and Structural Engineering, held at New-York in September 1968, concerning the design of thin walled deep structures, read as follows :

1. The linear theory of plate stability is not an adequate basis for design of struts and girders consisting of thin-walled sections. Such design method must consider the initial geometrical imperfections of the plates as well as the residual stresses and the different yield stresses over the section and over the length of the structural member.

2. The presented test results and theoretical investigations for stiffened plates in the postcritical range are rather incomplete and we still lack a general mathematical approach to establish a design method taking into account all important parameters of the system and considering also the geometrical and structural imperfections of the sheet.

Furthermore, the Association has recommended to its three Working Commissions that the themes of preceeding Congresses should continue to be studied and that this research wherever possible be developed into practical design procedures.

As a result of these conclusions and recommendations, Professor BEER, Chairman of Working Commission II, devoted to metal structures, invited Professor MASSONNET, who had been responsible for the preparation of the New-York general report concerning plate girders, to present to the Meeting of this Commission held in London in September 1969, some recommendations about the practical design of plate girders in the postbuckling range. Professor MASSONNET proposed to organize a very restricted Colloquium, reserved to research men who were actively engaged in the related field. Commission II accepted this proposal and made further recommendations as follows:

Place of the Colloquium: London, at the Institution of Civil Engineers.

Date: Two days, in the Spring of 1971.

Sponsor: Commission II of IABSE.

Languages: english, french, german.

Organizing Committee: Professor C.E. MASSONNET, Chairman,
Professors L.S. BEEDLE and K.C. ROCKEY, members.

In addition, Commission II established a first list of research men to be invited and asked the Organizing Committee to complete this list.

The Organizing Committee choose as official title of the Colloquium:

Design of plate and box girders for ultimate strength

and defined as follows the

Purpose of the Colloquium:

- 1) to bring together research men actively engaged in the field of plate girders for exchange of information ;
- 2) to stimulate and pinpoint needed work, and to avoid unnecessary duplication;
- 3) to publish Colloquium reports so that information is made available to the engineering profession.

The invited reports had to deal with the following items:

1. Tests up to collapse on plate and box girders ;
2. Effect of transverse local loads ;
3. Theoretical studies on postcritical behaviour up to collapse of plates and box girders panel ;
4. Fatigue problems due to the "breathing" of the web.

It was hoped that, in addition to reports dealing with symmetrical homogeneous girders, reports be presented covering the fields of plate girders with tubular flanges, girders with unequal flanges used in composite construction, and hybrid girders.

The final list of participants, arranged in alphabetical order of related continues, was as follows :

Belgium: Professor C.E. MASSONNET
East Germany: Professor G. BÜRGERMEISTER and Dr. STEUP
France: Professor H. GACHON
Great-Britain: Professor K.C. ROCKEY and Dr. A.R. FLINT
Italy: Professor G. CERADINI
Japan: Dr. T. FUJII
Professor Y. FUKUMOTO
Professor S. KOMATSU
Professor Y. MAEDA
Poland: Professor R. DABROWSKI
Sweden: Professor A. BERGFELT
Dr. T. HOGLUND
Professor H. NYLANDER
Switzerland: Dr. K. BASLER
Professor P. DUBAS and B. THÜRLIMANN
Tchecoslovakia: Dr. M. SKALOUD
U.S.S.R.: Professor S. ILYASEVITCH
Professor S.V. OSIPOV
U.S.A.: Mr. P.S. CARSKADDAN
Professor C. CHERN
Dr. J.W. CLARK
Professor P.B. COOPER
Professor A. OSTAPENKO
Professor J.E. STALLMEYER
Professor S. TOPRAC and Dr. LEW
Professor B.T. YEN and Dr. HUANG
Western Germany: Professor K. KLÖPPEL and Dr. BILSTEIN
Professor O. STEINHARDT

The invitations addressed to the U.S. researchers were made under the auspices of Task Group 16 (Built-Up Girders) of the Column Research Council.

Every participant was invited to present a research report to the Colloquium and to circulate copies of this report among the other participants so as to reach them before December 31, 1970.

Besides participants, the Organizing Committee decided to invite to act as observers :

- Mr. G.B. GODFREY (England)
- Mr. R. DELESQUES (France)

- Dr. I.M. VIEST (U.S.A.)

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Some participants could not present their research report in due time, so that the list of reports effectively presented is that given at the end of the Summary Report and arranged in the alphabetical order of the participating countries.

For various reasons, some of the invited persons, namely MM. BÜRGERMEISTER STEUP, CERADINI, DABROWSKI, NYLANDER, THURLIMANN, ILYASEVITCH, OSIPOV, CARSKADDAN, CHERN, TOPRAC, LEW, YEN, HUANG, KLOPPPEL and BILSTEIN could not attend the Colloquium.

The attendance list looks as follows :

Belgium: C.E. MASSONNET, Professor, University of Liège, Chairman of the Colloquium.

France: H. GACHON, Professor, Ecole Nationale Supérieure d'Arts et Métiers, Paris.

R. DELESQUES, Attaché au Centre Technique Industriel de la Construction Métallique, Paris.

England: K.C. ROCKEY, Professor, University College of Cardiff, Member of the Organizing Committee of the Colloquium.

A.R. FLINT, Partner, Flint and Neill, Consulting Engineers, London

G.B. GODFREY, Constructional Steel Research and Development (Constrado) of the British Steel Corporation.

Japan: T. FUJII, Dr., Chief Research Engineer, Research Institute Ishikawajima-Harima Heavy Industries Co., Ltd.

Y. FUKUMOTO, Associate Professor, Nagoya University

S. KOMATSU, Professor, Osaka University

Y. MAEDA, Professor, Osaka University

Sweden: A. BERGFELT, Professor, University of Göteborg

T. HÖGLUND, Dr. , Institute of Technology of Stockholm

Switzerland: K. BASLER, Partner BASLER and HOFFMANN, Consulting Engineers, Zürich.

P. DUBAS, Professor, Federal Swiss Polytechnic School of Zürich

Tchecoslovakia: M. SKALOUD, Docent, Institute of Applied Mechanics of the Tchecoslovakian Academy of Sciences.

U.S.A.: L.S. BEEDLE, Professor, Lehigh University, Member of the Organizing Committee of the Colloquium

J.W. CLARK, ALCOA Research Laboratories, Pittsburgh

P.B. COOPER, Associate Professor , Kansas State University

A. OSTAPENKO, Professor, Lehigh University.

Western Germany: O. STEINHARDT, Professor, University of Karlsruhe.

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The Colloquium was divided into four Working Sessions:

Session I : Thursday 25 March, 9 h.15' - 12h. 30' :

Topic: Ultimate strength of plate girders subjected to shear - plate girders without intermediate stiffeners.

ReportsN°: 5, 8a, 10, 12, 13, 15, 17, 21, 23, 27, 31, 34, 37

Session II : Thursday 25 March, 14 h. 00 - 17 h. 00

Topic: General analytical methods - Ultimate strength of plate girders subjected to bending or to shear and bending.

ReportsN°: 3, 4, 6, 8b, 8c, 9, 19, 22, 23

Session III: Friday 26 March, 9h 15' - 12 h. 30'

Topic: Hybrid girders, fatigue problems, effect of concentrated loads, box girders - Special problems such as curved webs, curved girders, plate girders with web holes.

Reports N°:11, 14, 16, 18, 20, 29, 30, 32, 33, 35, 36, 38, 39

Session IV : Friday 26 March, 14 h. 00 - 17 h. 00

Topic: General Discussion of a provisional synthesis version report prepared by C. MASSONNET and K.C. ROCKEY, in view of the preparation of the Summary Report of the Colloquium.

In each of the three first sessions, 6 minutes were allocated to a presentation of the main conclusions of each report, and were followed by a 10 minutes discussion. Approximately one hour could in this way be reserved for the general discussion of the topics

The reports and contributions to the prepared discussion reproduced in present volume are those circulated before the Colloquium or condensed versions thereof.

The account of the free discussions of the three first Working Sessions has been written by the Organizing Committee on the basis of his notes and of tape records of the sessions.

The European representatives on the Organizing Committee, Professor Charles Massonnet (Chairman) and Professor K.C. ROCKEY have edited the free discussions which took place at each of the first three Working Sessions on the basis of the tape recordings and notes taken at the time. All Delegates were given the opportunity of editing their own contributions prior to the final co-ordinating and editing by Professors Massonnet and Rockey.