



PROCEEDINGS
OF THE
SECOND
HYDRAULICS
CONFERENCE

June 1-4, 1942

Edited by
J. W. HOWE
and
HUNTER ROUSE

University of Iowa
Studies in Engineering

Bulletin 27
No. 400

PUBLISHED BY THE STATE UNIVERSITY OF IOWA

Proceedings of the Second Hydraulics Conference

June 1-4, 1942

Arranged by the
IOWA INSTITUTE OF HYDRAULIC RESEARCH
STATE UNIVERSITY OF IOWA

Under the Sponsorship of the
AMERICAN SOCIETY OF CIVIL ENGINEERS
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

Edited by

J. W. HOWE

*Head of Mechanics and Hydraulics Department
State University of Iowa*

and

HUNTER ROUSE

*Associate Director in Charge
Iowa Institute of Hydraulic Research*

Published by the University
Iowa City, Iowa
1943



SECOND HYDRAULICS CONFERENCE

Front row: P. H. Bliss, R. F. Stellar, R. F. Leeper, B. V. Bhoota, J. K. Mayer, E. W. Lane, A. M. Konrad, Harry Wedler, D. H. Harker, G. F. Wislicenus, G. E. Hyde, C. W. Thornthwaite, J. W. Howe.

2nd row: K. F. Tupper, G. K. Morikawa, J. M. Robertson, W. E. Wilson, T. B. Hunter, A. T. Ippen, J. H. Dawson, Arno Lentz, G. N. Cox, Hunter Rouse, J. H. Morgan, H. C. Heckman, Merrill Bernard, K. G. Tower.

3rd row: M. A. Mason, H. B. Blodgett, Frank Swenson, E. W. Schoder, C. E. MacQuigg, P. R. Sheer, J. S. McNowyn, V. A. Kowler, L. E. Nelson, E. T. Schuleen, T. C. Hanson, T. R. Camp, F. W. Greve, J. K. Vennard, F. C. Christopherson.

4th row: Wallis Hamilton, A. A. Kainske, C. W. Hubbard, C. A. Lee, G. A. Makela, A. N. Huff, S. H. Anderson, F. W. Blaisdell, H. A. Einstein, G. H. Hickox, J. E. Warnock, R. J. Pafford, E. E. Foster, J. V. B. Wells, W. S. Eisenlohr.

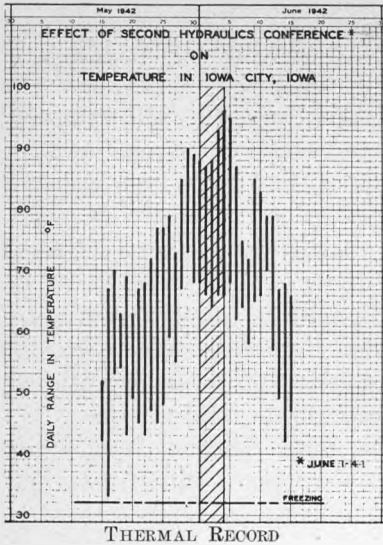
5th row: J. B. Sufegal, L. A. Butler, B. S. Barnes, Verne Alexander, J. C. Kennedy, G. H. Dupstian, E. L. Waterman, W. H. Munk, H. U. Sverdrup, A. M. McLeod, W. E. Steys, J. F. Eppler, L. J. Snell, J. H. Montgomery.

Rear row: C. J. Posey, Robert Follansbee, L. L. Laine, T. W. Robinson, C. G. Paulson, J. O. Letts, C. A. Wright, L. C. Crawford, J. H. Robert, B. A. Bakhaneteff, L. E. Conrad, J. C. Stevens, G. L. Whitaker, M. M. Munk, W. C. Krumbein, P. C. Benedict, Morris Muskat, M. L. Albertson, D. A. Parsons, R. T. Knapp, M. L. Johnson, N. W. Connet, H. O. Croft, J. C. Harrold.

TABLE OF CONTENTS

	PAGE
FOREWORD	v
SCOPE AND IMPORTANCE OF FLUID MECHANICS	
<i>Session Chairman:</i> F. M. DAWSON, University of Iowa	
"The Significance of Fluid Mechanics to the Hydraulic Engineer," BORIS A. BAKHMETEFF, Columbia University	1
"The Role of Fluid Mechanics in Modern Warfare," THEODORE VON KARMAN, California Institute of Technology	15
MODERN METHODS OF RESEARCH	
<i>Session Chairman:</i> J. C. STEVENS, Stevens and Koon	
"Recent Developments in Hydraulic Laboratory Technique," JOSEPH B. TIFFANY, JR., U. S. Waterways Experiment Station	31
"Principles of Towing-Tank Research," L. A. BAIER, University of Michigan	51
"General Aspects of Wind-Tunnel Investigation," A. M. KUETHE, University of Michigan	71
"Measurement of Sediment Transportation," E. W. LANE, University of Iowa	83
MECHANICS OF FLUID RESISTANCE	
<i>Session Chairman:</i> H. O. CROFT, University of Iowa	
"On the Study of Shape Resistance," MAX M. MUNK, Catholic University	95
"Evaluation of Boundary Roughness," HUNTER ROUSE, University of Iowa	105
"The Flow of Solid-Liquid Mixtures," H. E. BABBITT and DAVID H. CALDWELL, University of Illinois	117
"Liquid Flow through Porous Media," MORRIS MUSKAT, Gulf Research and Development Company	130
CAVITATION PHENOMENA	
<i>Session Chairman:</i> J. K. VENNARD, New York University	
"Cavitation Problems and Their Effects upon the Design of Hydraulic Turbines," J. M. MOUSSON, Rustless Iron and Steel Corporation	146

	PAGE
“The Hydraulic Problem of Cavitation in Pumps,” G. F. WISLICENUS, Worthington Pump and Machinery Corporation	171
“Cavitation on Baffle Piers Below Dams,” HAROLD A. THOMAS, Carnegie Institute of Technology, and WILLIAM J. HOPKINS, U. S. Engineer Office	192
PROBLEMS OF WAVE MOTION	
<i>Session Chairman:</i> MERRILL BERNARD, U. S. Weather Bureau	
“The Experimental Study of Oscillatory Waves,” MARTIN A. MASON, Beach Erosion Board	210
“Flood-Wave Characteristics as Related to Flood Routing,” CHESLEY J. POSEY, University of Iowa	224
“Waves in the Atmosphere and Application to Forecasting,” HARRY WEXLER, U. S. Weather Bureau	234
“Gas-Wave Analogies in Open-Channel Flow,” ARTHUR T. IPPEN, Lehigh University	248
ENGINEERING ASPECTS OF FLUID TURBULENCE	
<i>Session Chairman:</i> A. F. SPILHAUS, New York University	
“The Role of Turbulence in River Hydraulics,” A. A. KALINSKE, University of Iowa	266
“Atmospheric Turbulence and the Measurement of Evaporation,” C. W. THORNTHWAITTE, Soil Conservation Service	280
“Density Currents: Their Mixing Characteristics and Their Effect on the Turbulence Structure of the Associated Flow,” ROBERT T. KNAPP, California Institute of Technology	289
SEDIMENT TRANSPORTATION	
<i>Session Chairman:</i> C. G. PAULSEN, U. S. Geological Survey	
“The Effect of Turbulence in Retarding Settling,” THOMAS R. CAMP, Massachusetts Institute of Technology	307
“Fundamental Attributes of Sedimentary Particles,” W. C. KRUMBEIN, University of Chicago	318
“Flow on a Movable Bed,” H. A. EINSTEIN, Soil Conservation Service	332
“Wind Influences on the Transportation of Sand over a Michigan Sand Dune,” HELMUT LANDSBERG and N. ALLEN RILEY, University of Chicago	342



technical sessions, however; indeed, several other events may be equally well remembered. As the guests arrived on Sunday, they were taken to Dean Dawson's home, where a buffet supper was served and an opportunity was provided for introductions and visiting. On Monday evening Dean Dawson presided at a banquet at which Dean Stoddard, the recently - appointed Commissioner of Education for the State of New York, made the priniepal address. All of Tuesday afternoon was devoted

to an inspection of the Institute laboratory, where apparatus used in instruction and in experimental research projects was in operation. That evening, a collection of research films was shown; John S. McNown of the University of Minnesota, Thomas R. Camp of the Massachusetts Institute of Technology, Robert Knapp of the California Institute of Technology, and Hunter Rouse and A. A. Kalinske of the University of Iowa gave comments and explanations as films from their respective laboratories were projected. Perhaps the high point of the Conference was the banquet Wednesday night. Hunter Rouse as toastmaster called, in turn, upon J. C. Stevens, H. U. Sverdrup, and B. A. Bakhmeteff, each of whom gave brief but unusually interesting talks ranging from Shakespere through Arctic exploration to world affairs.

The valuable papers and the stimulating personal contacts which have come from the First and Second Hydraulics Conferences emphasize the desirability of holding further meetings of this type. In the period immediately ahead, great progress will undoubtedly be made in the field of fluid motion, and material for another Conference program will soon become available. It is therefore with considerable anticipation that the Institute looks forward to its Third Hydraulics Conference, even though the intervening period may be prolonged by war conditions. J. W. HOWE.

PROCEEDINGS OF THE
SECOND HYDRAULICS CONFERENCE

