

# CONTENTS

## PAPERS

No.		PAGE
2171	<b>DEVELOPMENT OF TRANSPORTATION IN THE UNITED STATES.</b>	
	By J. E. Teal.....	1
	Discussion:	
	By FRED LAVIS.....	24
	WILLIAM J. WILGUS.....	25
	JOSEPH B. EASTMAN.....	29
	J. L. CAMPBELL.....	30
	W. W. CROSBY.....	32
	W. B. IRWIN.....	34
	F. R. SCHANCK.....	36
	J. E. TEAL.....	40
2172	<b>STABILITY OF GRANULAR MATERIALS.</b>	
	By R. E. Glover and F. E. Cornwell.....	46
	Discussion:	
	By R. G. HENNES.....	64
	STANLEY U. BENSCHOTER.....	65
	A. HRENNIKOFF.....	69
	D. P. KRYNINE.....	72
	R. E. GLOVER AND F. E. CORNWELL.....	78
2173	<b>DRAINAGE OF LEVEED AREAS IN MOUNTAINOUS VALLEYS.</b>	
	By Gordon R. Williams.....	83
	Discussion:	
	By MERRILL BERNARD.....	97
	L. K. SHERMAN.....	98
	C. O. CLARK.....	100
	W. W. HORNER.....	103
	WALTER T. WILSON.....	108
	W. B. LANGBEIN.....	109
	GORDON R. WILLIAMS.....	112
2174	<b>TIMBER FRICTION PILE FOUNDATIONS.</b>	
	By Frank M. Masters.....	115
	Discussion:	
	By E. H. CONNOR.....	141
	GLENN B. WOODRUFF.....	142
	JACOB FELD.....	143
	G. G. GREULICH.....	144
	G. S. PAXSON.....	145
	RAYMOND D. MINDLIN.....	147
	JOHN W. SOLOMON.....	149
	A. E. CUMMINGS.....	162
	FRANK M. MASTERS.....	170
2175	<b>ALLOCATION OF THE TENNESSEE VALLEY AUTHORITY PROJECTS.</b>	
	By Theodore B. Parker.....	174
	Discussion:	
	By MALCOLM ELLIOTT.....	188
	E. L. CHANDLER.....	189

IV

No.		PAGE
	EUGENE L. GRANT.....	202
	SHERMAN M. WOODWARD.....	203
	ALBERT R. ARLEDGE.....	205
	C. W. WATCHORN AND F. A. ALLNER.....	210
	THEODORE B. PARKER.....	215
2176	<b>BENDING MOMENTS IN THE WALLS OF RECTANGULAR TANKS.</b>	
	By Dana Young.....	217
	Discussion:	
	By I. K. SILVERMAN.....	231
	DANA YOUNG.....	232
2177	<b>DESIGN OF SIGN LETTER SIZES.</b>	
	By Adolphus Mitchell and T. W. Forbes.....	233
	Discussion:	
	By GUY KELCEY.....	243
	CHARLES M. NOBLE.....	244
	ADOLPHUS MITCHELL AND T. W. FORBES.....	245
2178	<b>LATERAL STABILITY OF UNSYMMETRICAL I-BEAMS AND TRUSSES IN BENDING.</b>	
	By George Winter.....	247
	Discussion:	
	By ROBERT K. SCHRADER.....	261
	H. N. HILL.....	264
	GEORGE WINTER.....	266
2179	<b>REDUCTION OF MINERAL CONTENT IN WATER WITH ORGANIC ZEOLITES.</b>	
	By R. F. Goudey.....	269
	Discussion:	
	By JAMES M. MONTGOMERY.....	281
	GEORGE L. DAVENPORT.....	283
	ROBERT SPURR WESTON.....	284
	HARVEY F. LUDWIG AND RUSSELL G. LUDWIG.....	286
2180	<b>UNUSUAL EVENTS AND THEIR RELATION TO FEDERAL WATER POLICIES.</b>	
	By W. G. Hoyt.....	290
	Discussion:	
	By EDWARD H. SARGENT.....	304
	DANA M. WOOD.....	304
	JAMES S. SWEET.....	306
	J. L. CAMPBELL.....	307
	DAVID J. GUY.....	309
	ALBERT S. FRY.....	312
	W. G. HOYT.....	314
2181	<b>EFFECT OF VARIATION OF ELASTIC CHARACTERISTICS ON STATIC UNKNOWNNS.</b>	
	By A. Hrennikoff.....	317
	Discussion:	
	By A. H. FINLAY.....	340
	STEFAN J. FRAENKEL.....	343
	JOSEPH A. WISE.....	345
	A. HRENNIKOFF.....	350
2182	<b>BASIC ECONOMIC CONSIDERATIONS AFFECTING SINGLE AND MULTIPLE PURPOSE PROJECTS.</b>	
	By Otis M. Page.....	353
	Discussion:	
	By G. B. PILLSBURY.....	363

No.		PAGE
2183	<b>ANALYTICAL AND EXPERIMENTAL METHODS IN ENGINEERING SEISMOLOGY.</b>	
	By M. A. Biot.....	365
	Discussion:	
	By GEORGE R. RICH.....	386
	N. J. HOFF.....	388
	MERIT P. WHITE.....	390
	N. H. HECK.....	394
	FRANK NEUMANN.....	395
	JACOB FELD.....	397
	GEORGE W. HOUSNER.....	398
	HOMER M. HADLEY.....	402
	ROBERT E. GLOVER.....	405
	M. A. BIOT.....	405
2184	<b>HYDRODYNAMICS OF MODEL STORM SEWER INLETS APPLIED TO DESIGN.</b>	
	By G. S. Tapley.....	409
	Discussion:	
	By RALPH W. POWELL.....	444
	G. S. TAPLEY.....	445
2185	<b>MECHANICS OF CREEP FOR STRUCTURAL ANALYSIS.</b>	
	By Joseph Marin.....	453
	Discussion:	
	By A. HRENNIKOFF.....	470
	C. A. P. TURNER.....	472
	RALPH W. STEWART.....	477
	JOSEPH MARIN.....	479
2186	<b>PROFILE CURVES FOR OPEN-CHANNEL FLOW.</b>	
	By Dwight F. Gunder.....	481
	Discussion:	
	By CARL ROHWER.....	489
	C. J. POSEY.....	489
	J. C. STEVENS.....	492
	BORIS A. BAKHMETEFF AND NICHOLAS V. FEODOROFF.....	492
	HUNTER ROUSE.....	502
	DWIGHT F. GUNDER.....	504
2187	<b>THE GREASE PROBLEM IN SEWAGE TREATMENT.</b>	
	By Almon L. Fales and Samuel A. Greeley.....	507
	Discussion:	
	By ARTHUR D. WESTON.....	525
	HARVEY F. LUDWIG.....	535
	W. S. MAHLIE.....	537
	DENIS DICKINSON.....	537
	CHARLES R. VELZY.....	538
	F. M. DAWSON.....	539
	ALMON L. FALES AND SAMUEL A. GREELEY.....	541
2188	<b>DESIGN OF ST. GEORGES TIED ARCH SPAN.</b>	
	By J. M. Garrelts.....	543
	Discussion:	
	By R. W. ABBETT.....	555
	JACOB KAROL.....	555
	ALEXANDER DODGE.....	558
	CARLOS A. BEJARANO.....	566
	A. A. EREMIN.....	568

VI

No.		PAGE
	A. M. FREUDENTHAL.....	569
	C. H. GRONQUIST.....	570
	HAROLD E. LANGLEY.....	572
	J. M. GARRELTS.....	573
2189	<b>RELATIVE ANGULAR, LINEAR, AND TRAVERSE ACCURACIES IN CITY SURVEYS.</b>	
	By S. A. Bauer.....	577
	Discussion:	
	By CLEVELAND B. COE.....	591
	W. H. RAYNER.....	592
	PHILIP KISSAM.....	594
	GEORGE D. WHITMORE, C. C. MINER, AND W. O. BYRD.....	598
	G. BROOKS EARNEST.....	600
	S. A. BAUER.....	601
2190	<b>EARLY CONTRIBUTIONS TO MISSISSIPPI RIVER HYDROLOGY.</b>	
	By C. S. Jarvis.....	605
	Discussion:	
	By ROBERT FOLLANSBEE.....	629
	R. W. DAVENPORT.....	629
	CHARLES SENOUR.....	633
	JOHN C. HOYT.....	637
	GEORGE O. GUESMER.....	638
	H. T. CORY.....	638
	C. S. JARVIS.....	639
2191	<b>CLASSIFICATION OF IRRIGABLE LANDS.</b>	
	By W. W. Johnston.....	656
	Discussion:	
	By R. EARL STORIE.....	672
	WALTER W. WEIR.....	672
	W. L. POWERS.....	675
	W. W. JOHNSTON.....	675
2192	<b>MOMENT BALANCE: A SELF-CHECKING ANALYSIS OF RIGIDLY JOINTED FRAMES.</b>	
	By R. J. Cornish.....	677
	Discussion:	
	By D. D. MATTHEWS.....	685
	WILLIAM A. LARSEN.....	690
	A. A. EREMIN.....	690
	L. E. GRINTER.....	691
	B. J. ALECK.....	693
	FREDERICK S. MERRITT.....	694
	RALPH W. STEWART.....	696
	G. W. STOKES.....	698
	BRUCE JAMEYSON.....	700
	R. E. BOWLES.....	703
	WILLIAM MORRIS.....	704
	JOHN MASON.....	706
	R. J. CORNISH.....	710
2193	<b>PERMEABILITY OF MUD MOUNTAIN DAM CORE MATERIAL.</b>	
	By Allen S. Cary, Boyd H. Walter, and Howard T. Harstad.....	719
	Discussion:	
	By F. H. KELLOGG.....	729
	J. E. CHRISTIANSEN AND MILTON FIREMAN.....	733
	WILLIAM P. CREAGER.....	735
	ALLEN S. CARY, BOYD H. WALTER, AND HOWARD T. HARSTAD.....	736

VII

No.		Page
2194	<b>RESISTANCE OF SOFT FILL TO STATIC WHEEL LOADS.</b>	
	By W. Watters Pagon.....	738
	Discussion:	
	By JACOB FELD.....	756
	W. WATTERS PAGON.....	757
2195	<b>VISCOSITY AND SURFACE TENSION EFFECTS ON V-NOTCH WEIR COEFFICIENTS.</b>	
	By Arno T. Lenz.....	759
	Discussion:	
	By A. A. KALINSKE.....	783
	GLEN N. COX AND F. J. GERMANO.....	784
	EMERY H. WILLES.....	785
	RALPH W. POWELL.....	792
	G. H. HICKOX.....	796
	ARNO T. LENZ.....	797
2196	<b>MODEL TESTS ON STRUCTURES FOR HYDROELECTRIC DEVELOPMENTS.</b>	
	By L. M. Davis.....	803
	Discussion:	
	By EMIL P. SCHULEEN.....	824
	C. M. ALLEN.....	828
	ADOLF A. MEYER.....	828
	L. M. DAVIS.....	829
2197	<b>STRESS CONCENTRATIONS IN PLATES LOADED OVER SMALL AREAS.</b>	
	By H. M. Westergaard.....	831
	Discussion:	
	By GEORGE R. RICH.....	857
	DANA YOUNG.....	858
	A. NÁDAI.....	860
	L. A. MACCOLL.....	863
	L. W. TELLER AND EARL C. SUTHERLAND.....	864
	D. L. HOLL.....	868
	C. A. P. TURNER.....	881
	H. M. WESTERGAARD.....	884
2198	<b>HYDRAULIC DESIGN OF DROP STRUCTURES FOR GULLY CONTROL.</b>	
	By B. T. Morris and D. C. Johnson.....	887
	Discussion:	
	By JOHN HEDBERG.....	919
	L. STANDISH HALL.....	919
	J. E. CHRISTIANSEN.....	921
	WALTER T. WILSON.....	926
	N. A. CHRISTENSEN AND DWIGHT GUNDER.....	927
	BORIS A. BAKHMETEFF AND NICHOLAS V. FEODOROFF.....	930
	G. H. HICKOX.....	932
	B. T. MORRIS AND D. C. JOHNSON.....	935
2199	<b>DISTRIBUTION GRAPHS OF SUSPENDED-MATTER CONCENTRATION.</b>	
	By Joe W. Johnson.....	941
	Discussion:	
	By H. A. EINSTEIN.....	957
	G. C. DOBSON.....	958
	THOMAS R. CAMP.....	959
	FRANK S. BAILEY.....	960
	JOE W. JOHNSON.....	960

## VIII

No.		PAGE
2200	EARTH PRESSURE AND SHEARING RESISTANCE OF PLASTIC CLAY: A SYM- POSIUM.....	965
	FOREWORD.....	966
	LINER-PLATE TUNNELS ON THE CHICAGO (ILL.) SUBWAY. By Karl Terzaghi.....	970
	EARTH-PRESSURE MEASUREMENTS IN OPEN CUTS, CHICAGO (ILL.) SUB- WAY. By Ralph B. Peck.....	1008
	EARTH PRESSURE ON TUNNELS. By W. S. Housel.....	1037
	Discussion: By RALPH H. BURKE.....	1059
	L. G. LENHARDT.....	1061
	GEORGE E. SHAFER.....	1062
	M. E. CHAMBERLAIN.....	1064
	A. A. EREMIN.....	1066
	A. E. CUMMINGS.....	1067
	D. M. BURMISTER.....	1072
	GREGORY P. TSCHEBOTARIOFF.....	1075
	D. P. KRYNINE.....	1078
	L. F. COOLING.....	1086
	KARL TERZAGHI.....	1090
	RALPH B. PECK.....	1097
	W. S. HOUSEL.....	1103
2201	STATISTICAL ANALYSIS IN HYDROLOGY. By L. R. Beard.....	1110
	Discussion: By L. STANDISH HALL.....	1122
	H. ALDEN FOSTER.....	1127
	PAUL V. HODGES.....	1128
	JOE W. JOHNSON.....	1130
	R. H. BLYTHE, JR.....	1137
	R. W. DAVENPORT.....	1139
	EDWARD J. BEDNARSKI.....	1141
	RALPH W. POWELL.....	1144
	E. J. GUMBEL.....	1144
	L. R. BEARD.....	1154
2202	NUMERICAL PROCEDURE FOR COMPUTING DEFLECTIONS, MOMENTS, AND BUCKLING LOADS. By N. M. Newmark.....	1161
	Discussion: By BRUCE JOHNSTON.....	1189
	M. S. KETCHUM, JR.....	1193
	JOHN B. WILBUR.....	1194
	RALPH W. STEWART.....	1198
	STEFAN J. FRAENKEL.....	1201
	ALFRED S. NILES.....	1206
	CAMILLO WEISS.....	1208
	A. A. EREMIN.....	1211
	MYRON L. GOSSARD.....	1212
	ROBERT A. WILLIAMSON.....	1220
	I. OESTERBLOM.....	1224
	C. W. DUNHAM.....	1224
	N. M. NEWMARK.....	1227

IX

No.		Page
2203	<b>FUNDAMENTAL ASPECTS OF THE DEPRECIATION PROBLEM: A SYMPOSIUM.</b>	1235
	<b>FOREWORD.</b>	
	By Maurice R. Scharff .....	1236
	<b>RELATIONSHIP TO REGULATED INDUSTRY.</b>	
	By J. A. Walls .....	1237
	<b>RELATIONSHIP TO COMPETITIVE INDUSTRY.</b>	
	By Eugene L. Grant .....	1242
	<b>RELATIONSHIP TO PUBLIC WORKS AND GOVERNMENT FINANCE.</b>	
	By Roy W. Crum and Robley Winfrey .....	1255
	Discussion:	
	By EDWIN F. WENDT AND L. T. FLEMING .....	1262
	ANSON MARSTON .....	1264
	WILLIAM G. ATWOOD .....	1268
	GEORGE E. GOLDTHWAITE .....	1269
	NATHAN B. JACOBS .....	1272
	H. J. FLAGG .....	1274
	NELSON LEE SMITH .....	1276
	C. BEVERLEY BENSON .....	1278
	PAUL T. NORTON, JR. ....	1282
	H. L. RIPLEY .....	1284
	CARROLL A. FARWELL .....	1286
	THOMAS R. AGG .....	1287
	CONDE B. MCCULLOUGH .....	1289
	W. V. BURNELL .....	1293
	ROGER L. MORRISON .....	1296
	WALLACE B. CARR .....	1297
	W. L. WATERS .....	1300
	A. G. MOTT .....	1301
	DAVID A. KOSH .....	1303
	E. G. WALKER .....	1307
	K. LEE HYDER .....	1311
	JAMES T. RYAN .....	1314
	JOHN C. PAGE .....	1316
	JOHN S. WORLEY .....	1321
	JOHN F. MILLER .....	1322
	FRED ASA BARNES .....	1323
	ROBERT F. LEGGET AND ERWIN E. HART .....	1326
	KERNAN ROBSON .....	1329
	J. A. WALLS .....	1331
	EUGENE L. GRANT .....	1335
2204	<b>ENERGY LOSS AT THE BASE OF A FREE OVERFALL.</b>	
	By Walter L. Moore .....	1343
	Discussion:	
	By MERIT P. WHITE .....	1361
	BORIS A. BAKHMETEFF AND N. V. FEODOROFF .....	1364
	CARL E. KINDSVATER .....	1373
	J. E. CHRISTIANSEN .....	1375
	L. STANDISH HALL .....	1378
	HUNTER ROUSE .....	1383
	WALTER L. MOORE .....	1387
2205	<b>ENTRAINMENT OF AIR IN FLOWING WATER: A SYMPOSIUM.</b>	1393
	<b>OPEN CHANNEL FLOW AT HIGH VELOCITIES.</b>	
	By L. Standish Hall .....	1394
	<b>CLOSED CONDUIT FLOW.</b>	
	By A. A. Kalinske and James M. Robertson .....	1435

No.		Page
	Discussion:	
	By WARREN DELAPP.....	1448
	KARL R. KENNISON.....	1451
	ROBERT T. KNAPP.....	1455
	CARL E. KINDSVATER.....	1459
	J. H. DOUMA.....	1462
	JOE W. JOHNSON.....	1473
	J. C. STEVENS.....	1474
	D. C. MCCONAUGHY.....	1484
	T. J. CORWIN, JR.....	1493
	L. STANDISH HALL.....	1494
	A. A. KALINSKE AND J. M. ROBERTSON.....	1513
2206	THE SOCIETY TODAY AND TOMORROW: ADDRESS AT THE ANNUAL CONVENTION, LOS ANGELES, CALIFORNIA, JULY 28, 1943.....	1517