NAVY DEPARTMENT
DAVID TAYLOR MODEL BASIN
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A TIME-SAVING METHOD OF COMPILING, TABULATING, AND INDEXING LARGE GROUPS OF DATA

by

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DAVID TAYLOR MODEL BASIN

PERSONNEL

The idea for the method described in this report originated with Captain H.E. Saunders, USN, Technical Director. The mechanical details were developed by R. Sanberg and F.B. Kaye. The report was written by M.C. Roemer.

A TIME-SAVING METHOD OF COMPILING, TABULATING,
AND INDEXING LARGE GROUPS OF DATA

ABSTRACT

Equipment is described which was developed at the David Taylor Model Basin to facilitate the tabulation and indexing of large groups of data and the preparation of the indexes in form for publication. Sufficient details are given to permit other organizations to copy the method.

INTRODUCTION

After more than forty years of continuous operation, the David W. Taylor Model Basin, formerly the United States Experimental Model Basin, found itself in possession of an immense accumulation of model data whose usefulness was greatly circumscribed by the complete lack of any convenient index. Records of the tests of some 3800 towing models and 2600 propeller models were filed in the order of the serial numbers assigned to the models when requests to build and test them were first received. Consequently the locating of any particular item required a tedious and time-consuming search, even by the few senior members of the staff who remembered the model numbers or the approximate time when they were built and tested.

To make these records more readily available to the Taylor Model Basin staff and to extend their usefulness among other activities engaged in similar research, it was decided to tabulate and index them for publication, so that if a model having a particular group of characteristics had ever been tested, the serial number and the model data could readily be found.

For each of the thousands of models tested, there were recorded not only the test results but a number of principal characteristics, so that the classification was not too difficult if the data could be set down properly. Records of towing models, for example, comprised several or all of the following: longitudinal coefficient, displacement-length ratio, beam-draft ratio, waterline coefficient, midship section coefficient, vertical coefficient, maximum speed-length ratio, type of vessel, designer, test number, and model serial number.

It was proposed, as the first part of the task, to index these characteristics at least by model serial number, by longitudinal coefficient, and by type of vessel, but the system had to be sufficiently flexible to permit subsequent indexing by any other selected characteristic. Moreover, since similar data gathered in other towing basins and water tunnels required similar treatment, the magnitude of the task necessitated using as many labor-saving devices as possible.

Compilation of all the variously indexed lists by ordinary methods, i.e., by setting each list up individually in typescript, would have required preparation first of a rough draft, then of a smooth draft, and then of a final or format copy. This would also have required one whole list for each characteristic indexed.

Since certain mathematical symbols were involved that are not included in the standard typewriter keyboard, these would have had to be inserted by hand.

To avoid this tedious and time-consuming labor, so great that it had never been and probably never would have been undertaken, and to obviate the possibility of error in each copying process, a method was devised in which the data on characteristics were printed on prepared cards, *once only* for each model. These cards were then sorted by the characteristic to be indexed, set up in a rack designed for the purpose, and photographed, 30 cards at a time, preparatory to manifolding by a photographic process. Each photograph formed the basis for a page of manuscript, with the data for 30 models listed on it.

For the convenience of other agencies confronted by similar problems, the details of the solution evolved at the Taylor Model Basin are described in this report, chiefly by the use of photographs and sketches. While this description pertains to model basin data, the method is sufficiently flexible to cover data of many kinds.

DESIGN AND PREPARATION OF THE CARDS

It was planned to prepare each index for publication in tabular and loose-leaf form. The model characteristics or coefficients and other items of information were to be designated in column captions at the top and the bottom of each page and—were to be uniform throughout all the indexes.

In the indexing for the characteristic in the left-hand column, the values would increase progressively down the left-hand edge of the page; the same for the right-hand column. For any intermediate column, the indexing would not be so readily evident, but would still be quite convenient.

To facilitate filling out the cards, the column captions were put on every card, but when the cards were set up for photographing as described subsequently, only the column captions on the lowest cards were in evidence. The caption row at the top of a page was indicated by a separate card, and another card was used for a classification title and edition date with report number at the bottom of the page.

A master card containing 12 captions was designed, as shown in Figure 1, and several thousand were printed, sufficient to cover the models to be listed. The coefficients and other data were then entered on these cards in India ink, above the captions; see Figure 2. As the lower portion of the card was not to appear on the final page, it could be used for any rough or smooth notes which might be desired.

$\mathcal{I}$	$\triangle/(\tfrac{L}{100})^3$	B/H	P	m	$\mathcal{X}$	MAX $\sqrt[V]{L}$ TYPE	DES'GR	TEST	REMARKS	MODEL NO

Figure 1 – Blank Data Card for Towing-Model Indexes

This card was printed as shown on white bristol board, 4 inches wide by 13 inches long, cut neatly to shape before printing to permit accurate registration. The dots at the left are decimal points for certain of the coefficients. A light blue grid, which does not register when the card is photographed, is printed on it to facilitate spacing and aligning the entries.

$\mathcal{I}$	$\triangle/(\tfrac{L}{100})^3$	B/H	P	m	$\mathcal{X}$	MAX $\sqrt[V]{L}$ TYPE	DES'GR	TEST	REMARKS	MODEL NO
0.65	49	3.33	0.72	0.92	0.82	2.1 BB	EMB	E	SERIES 13	444

Figure 2 – Completed Data Card for Towing-Model Indexes

The data are entered in India ink with a lettering pen. The line at the top serves as the spacing line when the group of cards is photographed.

DESIGN OF THE MOUNTING RACK AND COPY BOARD

Racks of various designs were built to hold the cards in alignment for photographing. Most of these were found unsatisfactory because the various means employed to hold the cards, such as spring clips, studs fitting into holes punched in the cards, or both, frayed or tore the cards beyond repair after a few shifts. The design detailed in Figure 3 was finally adopted. In this rack the cards fit easily in slanting grooves, and are aligned against a sheet-aluminum side piece at the left. When the cards are placed in the rack only the entries along the top are in evidence, as indicated in Figure 4, and all the columns line up accurately. Two racks are available, so that cards can be set up in one while the other is being photographed.
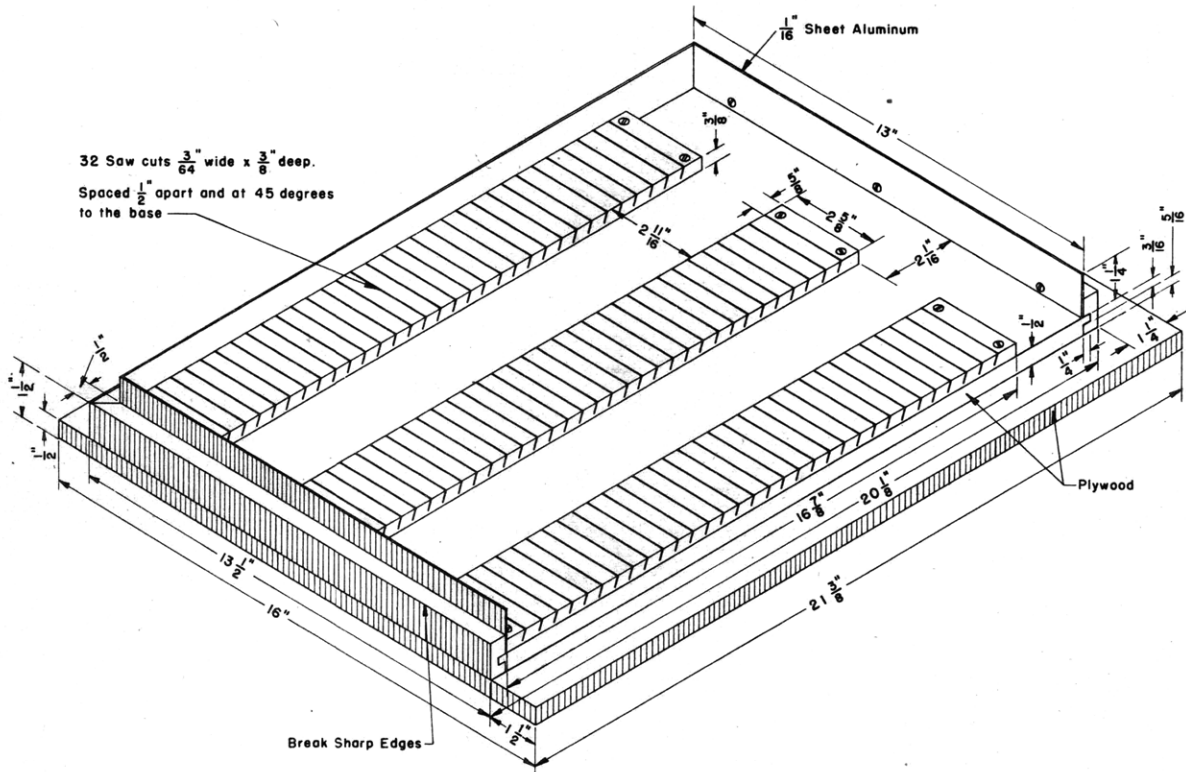
32 Saw cuts $\frac{3}{64}"$ wide x $\frac{3}{8}"$ deep. Spaced $\frac{1}{2}"$ apart and at 45 degrees to the base

$\frac{1}{16}"$ Sheet Aluminum

Plywood

Break Sharp Edges

Figure 3a – Dimensioned Working Drawing of Rack
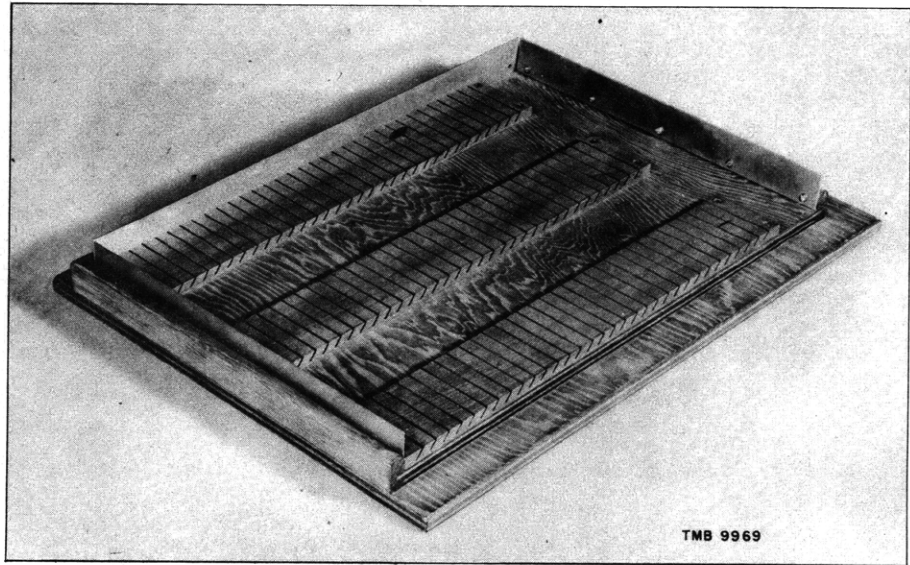

TMB 9969

Figure 3b – Photograph of Empty Rack

Figure 3 – Mounting Rack for Data Cards

It is quite necessary, to obtain accurate registration and alignment on the final page of copy, that the cards be all of uniform size, and that the bottoms of the saw cuts in the rack be clean and correctly positioned.
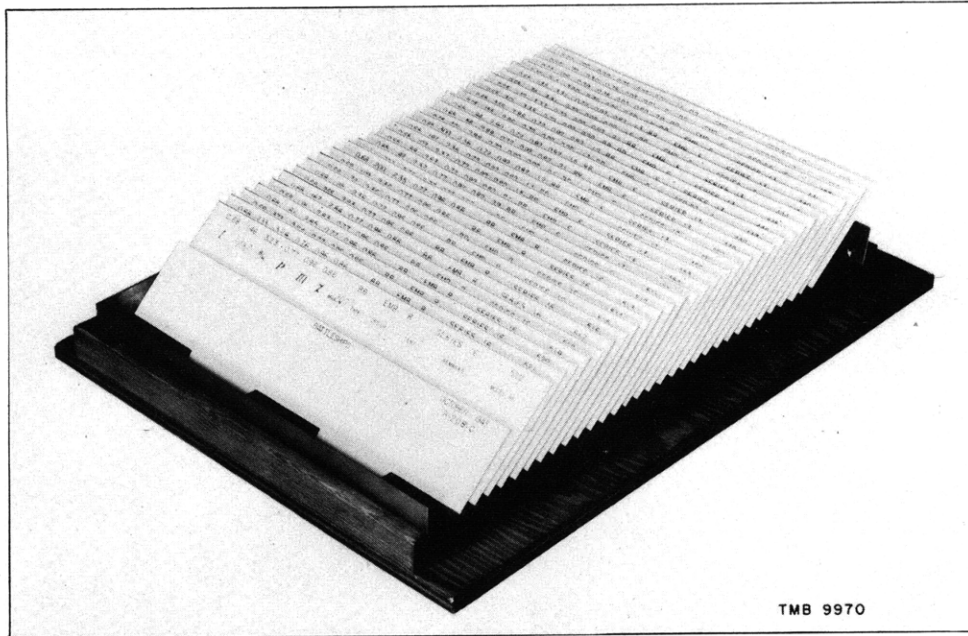
TMB 9970

Figure 4 - Mounting Rack with Data Cards in Place

The cards are a loose fit in the grooves and are easily placed. The numerical and other data on each card are clearly visible at all times. Although the cards appear uneven in this photograph, this is an illusion caused by the difference in angles of the various cards.

The aluminum strip was omitted from the right side of the rack so that the cards could be jogged into accurate alignment when the rack was mounted on the copy board.

PHOTOGRAPHIC PROCEDURE

To hold the rack in a vertical position in front of the copying camera, and to depress or fold back the top edges of the cards until they are lying smoothly in place, one over the other, a special copy board was designed and built, as depicted in Figure 5.

When ready for final photographing, the whole assembly appears as shown in Figure 6. The portion outlined by the mask, which includes the visible portions of the group of 32 cards, appears about twice its final size.

COMPILATION OF THE INDEX

When the negative is made and printed, there emerges a page as shown in Figure 7, which can be multilithed or printed in blue line, and which can be bound or punched for loose-leaf folders, as desired.

Figures 8 and 9 are parts of the same index; in the former, the entries are indexed by longitudinal coefficient, and in the latter by type vessel. Any other indexes can be made up with the same cards.
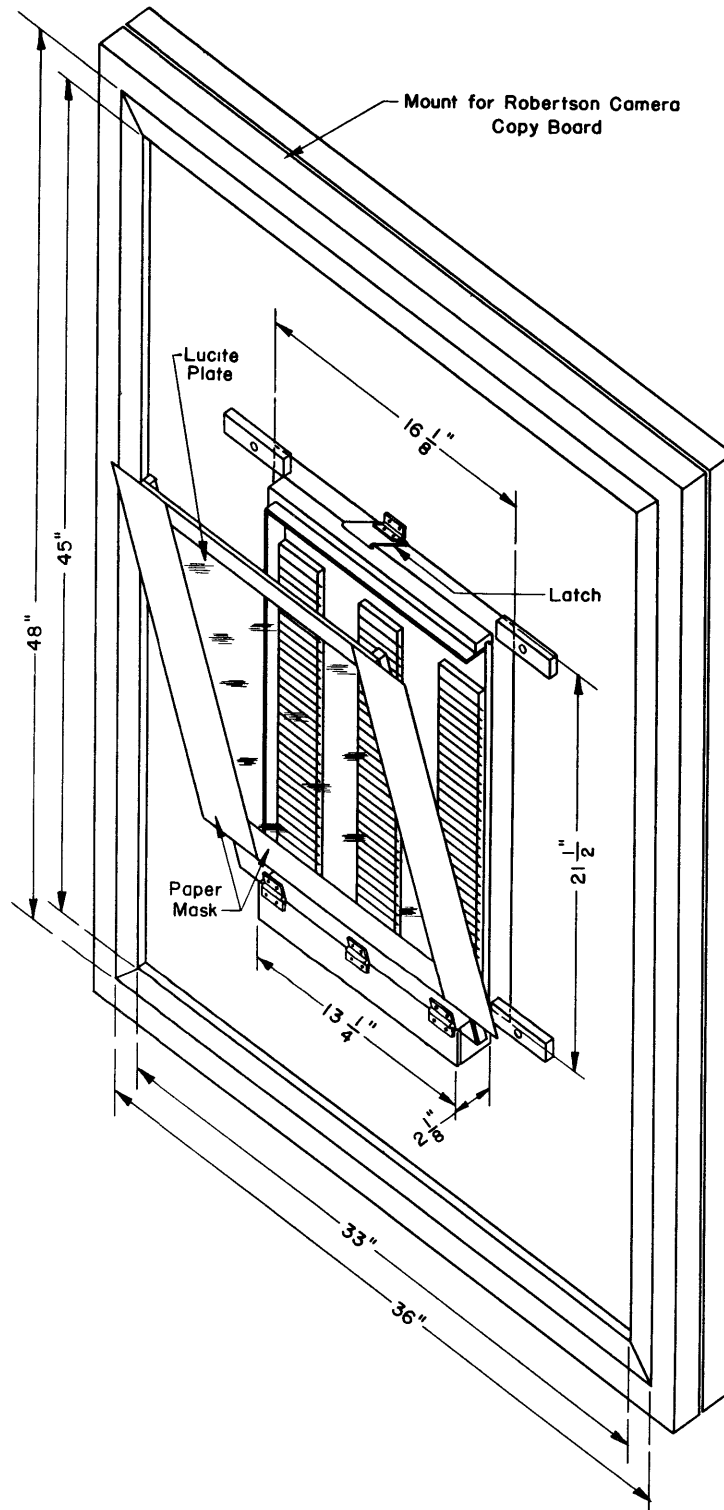
Mount for Robertson Camera
Copy Board

Lucite
Plate

$16\frac{1}{8}$"

Latch

45"

48"

$21\frac{1}{2}$"

Paper
Mask

$13\frac{1}{4}$"

$2\frac{1}{8}$"

33"

36"

Figure 5 – Working Drawing of Copy Board

A sheet of lucite, with a paper mask attached for framing the page, is
swung up in front of the rack and latched in place. The back surface
of the lucite bears against the projecting edges of the cards, and
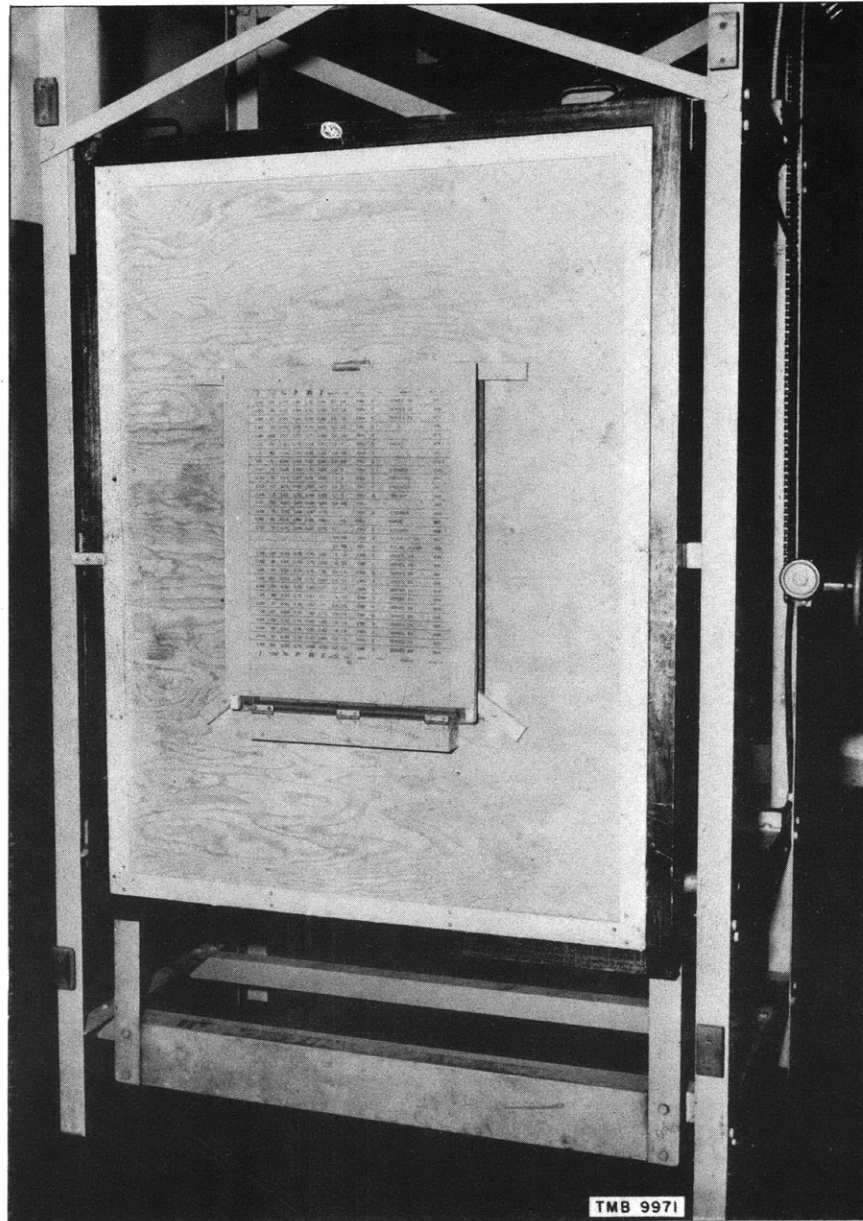presses them all back until they are in contact and in one plane.

Figure 6 - Filled Rack Mounted on Copy Board Ready to Photograph

The hinged plate of lucite fits closely over the edges of the metal strips on the top, bottom, and left side of the rack, which are of just sufficient height to permit the plate to bend the cards so that only the upper line of lettering on each card is visible and to hold the cards in position without breaking them. The cards are jogged into precise alignment by a wooden block tapped lightly against the exposed right ends of the cards. A mask of white paper is attached to the lucite plate to outline the racked cards and to maintain uniform margins.

Figure 7 – Facsimile of a Page of an Index Prepared in the
TMB Sorting and Holding Rack

On this page the towing data are indexed by model numbers.

l	$\Delta/(\frac{L}{100})^3$	B/H	P	m	χ	MAX $\frac{V}{\sqrt{L}}$	TYPE	DES'GR	TEST	REMARKS	MODEL NO
0.79	129	2.25	0.85	0.92	0.86	2.0	CA	EMB	E	SERIES 22	871
0.80	86	2.25	0.86	0.92	0.86	2.0	CA	EMB	E	SERIES 22	872
0.80	57	2.25	0.86	0.92	0.86	2.0	CA	EMB	E	SERIES 22	873
0.65	38	3.53	0.75	0.72	0.62	2.0	DD	PRV	E	SERIES 22	874
0.65	294	3.57	0.73	0.71	0.63	2.0	DD	PRV	E		875
0.61	157	2.42	0.72	0.78	0.67	1.3		PRV	E	YACHT	876
0.61	143	3.34	0.69	0.98	0.86	0.9	BB	PRV	E		877
0.61	131	3.34	0.69	0.98	0.86	0.9	BB	PRV	E		878
0.57	76	3.66	0.69	0.75	0.62	1.3		PRV	E	STEAMER	879
0.58	70	3.53	0.67	0.75	0.66	1.3		PRV	E	FREIGHTER	880
0.55	77	3.72	0.69	0.83	0.67	1.2		PRV	E	FREIGHTER	881
0.64	113	3.62	0.73	0.94	0.82	1.1		PRV	E	FREIGHT	882
0.61	143	3.34	0.69	0.98	0.86	0.9	BB	PRV			883
0.59	75	3.90	0.68	0.87	0.75	1.1		PRV	E	STEAMER	884
0.90	55	4.14	0.89	0.86	0.86	.		PRV		BARGE	885
0.55	75	3.73	0.64	0.87	0.75	1.1		PRV	E	STEAMER	886
.		.	.	.	.	0.4		USN	E	RACING CUTTER	887
.		.	.	.	.	0.5		PRV	E	RACING LAUNCH	888
0.68	129	2.92	0.76	0.70	0.62	1.5	CA	EMB	E	SERIES 24	889
0.68	86	2.92	0.76	0.70	0.62	1.6	CA	EMB	E	SERIES 24	890
0.68	57	2.92	0.78	0.70	0.62	2.4	CA	EMB	E	SERIES 24	891
0.68	287	2.92	0.76	0.70	0.62	2.9	CA	EMB	E	SERIES 24	892
0.68	129	2.92	0.76	0.80	0.71	1.5	CA	EMB	E	SERIES 24	893
0.68	86	2.92	0.76	0.80	0.71	1.6	CA	EMB	E	SERIES 24	894
0.68	57	2.92	0.76	0.80	0.71	2.4	CA	EMB	E	SERIES 24	895
0.68	287	2.92	0.75	0.80	0.72	2.9	CA	EMB	E	SERIES 24	896
0.68	129	2.92	0.76	0.90	0.80	1.5	CA	EMB	E	SERIES 24	897
0.68	86	2.92	0.76	0.90	0.80	1.6	CA	EMB	E	SERIES 24	898
0.68	57	2.92	0.76	0.90	0.80	2.4	CA	EMB	E	SERIES 24	899
0.68	264	2.92	0.76	0.89	0.79	2.0	CA	EMB	E	SERIES 24	900
l	$\Delta/(\frac{L}{100})^3$	B/H	P	m	χ	MAX $\frac{V}{\sqrt{L}}$	TYPE	DES'GR	TEST	REMARKS	MODEL NO.

l	$\Delta/(\frac{L}{100})^3$	B/H	P	m	χ	MAX$\frac{V}{\sqrt{L}}$	TYPE	DES'GR	TEST	REMARKS	MODEL NO.
0.55	66	3.51	0.67	0.88	0.72	1.3	P	PRV	E		2531
0.55	69	3.88	C.62	0.98	0.87	1.2		USN	E		3635
0.55	69	5.08	0.68	0.78	0.62	.	PG	EMB	R	SERIES 7	269
0.55	71	4.36	0.68	0.69	0.55	2.9	MB	USN	E	BARGE	2398
0.55	73	2.01	0.68	0.86	0.73	1.8	CL	EMB	E	SERIES 6	255
0.55	75	.	.	.	.	.	SS	USN	R	SERIES 44	1889
0.55	75	3.73	0.64	0.87	0.75	1.1		PRV	E	STEAMER	886
0.55	77	3.72	0.69	0.83	0.67	1.2	C	PRV	E	FREIGHTER	881
0.55	80	2.45	0.71	0.60	0.47	3.1	MB	PRV	E	LAUNCH	399
0.55	83	2.72	0.68	0.78	0.62	.	PG	EMB	R	SERIES 7	272
0.55	83	6.13	0.68	0.78	0.62	.	PG	EMB	R	SERIES 7	265
0.55	86	2.00	0.55	0.70	0.70	.		EMB	R	SERIES 5	224
0.55	86	2.00	0.55	0.70	0.70	.		EMB	R	SERIES 5	226
0.55	86	2.00	0.55	0.70	0.70	1.5		EMB	R	SERIES 5	225
0.55	86	2.92	0.66	0.92	0.80	1.7	CA	EMB	E	SERIES 20	729
0.55	86	3.13	0.55	0.70	0.70	.		EMB	R	SERIES 5	215
0.55	86	3.13	0.55	0.70	0.70	.		EMB	R	SERIES 5	216
0.55	86	3.13	0.55	0.70	0.70	.		EMB	R	SERIES 5	217
0.55	86	3.75	0.56	0.92	1.02	.	CA	EMB	E	SERIES 21	772
0.55	87	3.46	0.68	0.75	0.61	1.5	PY	PRV	E	YACHT	2804
0.55	89	3.59	0.64	0.90	0.78	1.1	P	PRV	E		2488
0.55	90	.	.	.	.	1.6	SS	EMB	E	SERIES 38	1361
0.55	90	.	.	.	.	1.6	SS	EMB	E	SERIES 39	1377
0.55	90	.	.	.	.	1.6	SS	EMB	E	SERIES 40	1393
0.55	90	2.53	0.71	0.98	0.77	1.2	PY	PRV	ES		2988
0.55	96	3.00	0.66	0.66	0.66	1.2	CG	CG	ES	CUTTER	3298
0.55	98	1.49	0.69	0.86	0.73	1.8	CL	EMB	E	SERIES 6	254
0.55	98	2.65	0.66	0.86	0.74	1.8	CL	EMB	E	SERIES 6	251
0.55	100	.	.	.	.	.	SS	USN	R	SERIES 44	1893
0.55	100	2.92	0.69	0.98	0.78	0.9		PRV	E		2282

l	$\Delta/(\frac{L}{100})^3$	B/H	P	m	χ	MAX$\frac{V}{\sqrt{L}}$	TYPE	DES'GR	TEST	REMARKS	MODEL NO

<div align="center">0.55</div>

OCTOBER 1943
R-208-B

Figure 8 – Towing Data Indexed by Longitudinal Coefficient

l	$\Delta/(\frac{L}{100})^3$	B/H	P	m	χ	MAX $V/\sqrt{L}$	TYPE	DES'GR	TEST	REMARKS	MODEL NO.
0.68	231	2.62	0.75	0.95	0.85	1.3	BB	USN	E	SERIES 3	51
0.68	231	2.15	0.75	0.95	0.85	1.3	BB	USN	E	SERIES 3	53
0.68	231	1.73	0.75	0.95	0.85	1.3	BB	USN	E	SERIES 3	55
0.68	231	1.35	0.76	0.95	0.85	1.3	BB	USN	E	SERIES 3	57
0.68	253	2.82	0.75	0.94	0.85	.	BB	USN	R	SERIES 3	89
0.68	212	2.85	0.75	0.95	0.86	.	BB	USN	R	SERIES 3	91
0.68	253	2.36	0.75	0.95	0.85	.	BB	USN	R	SERIES 3	93
0.68	192	2.59	0.75	0.94	0.86	.	BB	USN	R	SERIES 3	95
0.68	210	2.34	0.75	0.94	0.85	.	BB	USN	R	SERIES 3	97
0.68	258	1.89	0.75	0.94	0.85	.	BB	USN	R	SERIES 3	99
0.68	172	2.29	0.75	0.95	0.86	.	BB	USN		SERIES 3	104
0.68	188	2.08	0.75	0.94	0.86	.	BB	USN		SERIES 3	112
0.68	207	1.88	0.75	0.94	0.85	1.0	BB	USN	E	SERIES 3	118
0.68	261	1.50	0.75	0.95	0.85	.	BB	EMB	R	SERIES 3	120
0.68	147	2.05	0.75	0.95	0.85	.	BB	EMB	R	SERIES 3	121
0.68	120	1.86	0.75	0.95	0.85	.	BB	EMB	R	SERIES 3	122
0.68	184	1.68	0.75	0.95	0.85	.	BB	EMB	R	SERIES 3	123
0.68	205	1.52	0.75	0.95	0.85	.	BB	EMB	R	SERIES 3	124
0.64	227	3.18	0.75	0.93	0.81	1.2	BB	EMB	E	SERIES 12	423
0.64	142	3.19	0.74	0.93	0.81	1.3	BB	EMB	E	SERIES 12	424
0.64	77	3.22	0.75	0.93	0.80	1.5	BB	EMB	E	SERIES 12	425
0.64	52	3.19	0.75	0.93	0.81	2.1	BB	EMB	E	·SERIES 12	426
0.64	320	3.23	0.75	0.93	0.80	2.9	BB	EMB	E	SERIES 12	427
0.64	261	2.76	0.75	0.93	0.80	1.2	BB	EMB	E	SERIES 12	428
0.64	163	2.77	0.75	0.93	0.81	1.3	BB	EMB	E	SERIES 12	429
0.64	146	2.77	0.75	0.93	0.80	1.5	BB	EMB	E	SERIES 12	430
0.64	88	2.77	0.75	0.93	0.81	2.1	BB	EMB	E	SERIES 12	431
0.64	60	2.80	0.75	0.93	0.80	2.9	BB	EMB	E	SERIES 12	432
0.64	365	2.29	0.75	0.93	0.81	1.2	BB	EMB	E	SERIES 12	433
0.64	315	2.28	0.75	0.93	0.80	1.3	BB	EMB	E	SERIES 12	434
l	$\Delta/(\frac{L}{100})^3$	B/H	P	m	χ	MAX $V/\sqrt{L}$	TYPE	DES'GR	TEST	REMARKS	MODEL NO.

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R-208-C

Figure 9 - Towing Data Indexed by Type Vessel