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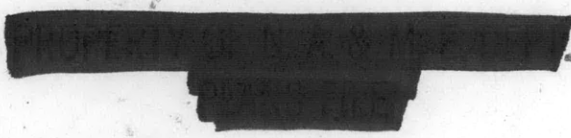
NAVY DEPARTMENT
DAVID TAYLOR MODEL BASIN
WASHINGTON, D. C.

FORCES MEASURED IN A TOWLINE DURING TOWING TESTS OF
A SERIES G-40 HIGH-SPEED SLED TARGET

by



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FORCES MEASURED IN A TOWLINE DURING TOWING TESTS OF
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INTRODUCTION

The Bureau of Ships requested (1)* that the David Taylor Model Basin measure the forces in a towline during towing tests of a high-speed sled target at sea. These tests were conducted on 15 and 16 July 1947 off Norfolk, Virginia.

TEST PROCEDURE

The high-speed target, a Series G-40 sled (No. 1012), was towed at various speeds by the USS HOBSON (DMS-26) in a straight-ahead run and in a series of right and left turns. The sled was connected to the HOBSON by 2300 yards of 6 by 37, high-strength galvanized-steel cable, 1 inch in diameter.

A 100,000-pound TMB tension dynamometer was placed in the towline between the chafing chain and the towpad on the fantail of the HOBSON. The forces in the towline were obtained by multiplying the strains in the dynamometer by a strain-load conversion factor previously determined in a laboratory calibration of the instrument. The strains from which the towline forces were derived were measured by means of SR-4 strain gages and an SR-4 portable strain indicator.

In the straight-ahead test, which took place on 15 July 1947, the speed of the propeller shaft was increased in thirteen steps from 50 RPM to 263 RPM. At each speed, the

* Numbers in parentheses indicate references on page 2 of this report.

maximum force measured in the towline during a one-minute observation period and the average force measured during the following minute were recorded. The observations were begun when the progress of the towing vessel was considered to have become constant, following each change in speed.

On 16 July, right and left turns were made at various speeds. The average forces in the towline during one-minute periods of observation at the beginning and end of each turn were measured, as were the maximum forces in the towline during successive one-minute periods throughout the turns.

TEST RESULTS

The towline forces and the times at which they were measured are given in Table 1. The times will serve as a reference by which towing-vessel speeds, rudder angles, and target positions, recorded by Bureau of Ships representatives, can be correlated with the forces in the towline. No analysis of the test results is included in this report, since the Bureau of Ships merely requested the Model Basin to obtain the data given herein for subsequent analysis by the Bureau.

REFERENCES

- (1) BuShips letter QT-3(645B) of 8 July 1947 to TMB.

TABLE 1

Tensile Forces Measured in Towline

Run	Shaft Speed RPM	Time (Eastern Daylight Saving Time)	Tension in Towline pounds		Remarks	
			Maximum	Average		
Straight Ahead Run, 15 July 1947						
1	50	1546	8,800	7,700	Photo run by PBY Target on step	
1	60	1552	11,400	8,800		
1	80	1557	12,500	11,100		
1	100	1604	17,800	15,100		
1	110	1612	19,100	16,600		
1	120	1619	23,200	18,600		
1	130	1625	24,100	21,000		
1	140	1633	26,900	24,400		
1	150	1641	31,200	27,400		
1	160	1650	34,800	30,000		
1	182	1704	39,600	35,500		
1	204	1713	45,400	40,100		
1	250	1723	56,300	50,700		
1	263	1733	60,200	54,500		
Speed (knots, by shaft RPM) Right and Left Turns, 16 July 1947						
4	15	1036	30,600	28,400		Straight ahead Straight ahead Starting turn to right
4	15	1037				
4	15	1045	29,600			
4	15	1046	28,500			
4	15	1047	29,600			
4	15	1048	28,400			
4	15	1049	28,400			
4	15	1050	26,900			
4	15	1051	27,000			
4	15	1052	26,200			
4	15	1053	26,500			
4	15	1054	27,000			
4	15	1055	26,600			
4	15	1056	26,100			
4	15	1057	26,500			
4	15	1058	25,600			
4	15	1059	27,100			
4	15	1100	26,600			
4	15	1101	25,600			
4	15	1102	26,100			

Run	Speed (knots, by shaft RPM)	Time (Eastern Daylight Saving Time)	Tension in Towline pounds		Remarks	
			Maximum	Average		
4	15	1103	26,400	25,000	Straight ahead * Starting turn to left	
4	15	1104				
4	15	1110	29,200			
4	15					
4	15	1111	30,400			
4	15	1112	30,400			
4	15	1113	30,000			
4	15	1114	30,400			
4	15	1115	29,300			
4	15	1116	28,800			
4	15	1117	28,900			
4	15	1118	29,300			
4	15	1119	31,700			
4	15	1120	29,600			
4	15	1121	29,700			
4	15	1122	30,400			
4	15	1123	28,800			
4	15	1124	31,200			
4	15	1125	30,800			
4	15	1126	32,500			
4	15	1127		29,200		
5	20	1141	47,600	43,100		Straight ahead Straight ahead Starting turn to right
5	20	1142				
5	20	1145	46,400			
5	20	1146	43,400			
5	20	1147	43,900			
5	20	1148	41,300			
5	20	1149	38,200			
5	20	1150	38,100			
5	20	1151	37,100			
5	20	1152	36,500			
5	20	1153	35,300			
5	20	1154	35,300			
5	20	1155	36,200			
5	20	1156	36,400			
5	20	1157	35,000			
5	20	1158	36,400			
5	20	1159		34,100		
5	20	1203	41,500	38,200	Straight ahead Straight ahead Starting turn to left	
5	20	1204				
5	20	1206	39,900			

* The turn was begun before the average force could be measured.

Run	Speed (knots, by shaft RPM)	Time (Eastern Daylight Saving Time)	Tension in Towline pounds		Remarks
			Maximum	Average	
5	20	1207	41,800		
5	20	1208	41,500		
5	20	1209	40,100		
5	20	1210	40,500		
5	20	1211	40,400		
5	20	1212	41,400		
5	20	1213	42,200		
5	20	1214	44,600		
5	20	1215	46,800		
5	20	1216	46,200		
5	20	1217	47,000		
5	20	1218	46,100		Speed increasing
5	20	1219	47,200		Until 1232
5		1220	49,700		
5		1221	54,400		
5	Speed	1222	49,300		
5	gradually	1223	52,500		
5	increasing	1224	53,500		
5	up to 25	1225	54,500		
5	knots	1226	54,700		
5		1227	56,100		
5		1228	57,100		
5		1229	56,900		
5		1230	58,600		
5		1231	60,000		
5	25	1232	59,100		Speed 25 knots by
5		1233	60,200		RPM
5	25	1234	60,500		
5	25	1235	56,400		
5	25	1236	54,200		
5	25	1237	47,800		
5	25	1238	48,500		
5	25	1239	44,200		
5	25	1240	44,400		
5	25	1241	44,100		
5	25	1242	46,800		
5	25	1243	50,600		
5	25	1244	46,900		
5	25	1245	52,100		
5	25	1246		46,700	
5	25	1250	52,700		
5	25	1251		50,000	
5	25	1252	60,700		
5	25	1253	59,400		
5	25	1254	54,400		
5	25	1255	56,200		



Run	Speed (knots, by shaft RPM)	Time (Eastern Daylight Saving Time)	Tension in Towline pounds		Remarks
			Maximum	Average	
5	25	1256	57,400		
5	25	1257	52,100		
5	25	1258	53,900		
5	25	1259	53,200		
5	25	1300	55,900		
5	25	1301	55,600		
5	25	1302	57,000		
5	25	1303	58,700		
5	25	1304	59,100		
5	25	1305	59,100		
5	24.5	1306	57,800		90 degree turn com- pleted, changing speed
5	24	1307	64,500		
5	24	1308	61,300		
5	24	1309	63,900		
5	23.6	1310	62,500		
5	23.6	1311	59,500		
5	23	1312	61,300		
5	23	1313	59,500		
5	23	1314	59,400		
5	23	1315	57,600		
5	23	1316	51,600		
5	23	1317		49,000	
5	23	1318	55,900		
5	22.6	1319	52,200		
5	22.2	1320	54,400		
5	22.2	1321	52,100		
5	21.6	1322	51,600		
5	21.6	1323		45,400	
5	21.6	1324		44,300	

