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UNITED NATIONS
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ENGLISH

WOODEN BRIDGE CONSTRUCTION

UC/DMI/83/095

THE COMMONWEALTH OF DOMINICA

Dominica

Technical report: Launching of UNIDO Bridge*

Prepared for the Commonwealth of Dominica

by the United Nations Industrial Development Organization

Based on the work of C. R. Francis
Timber Engineer

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C O N T E N T S

Page

LAUNCHING THE UNIDO BRIDGE

A. INTRODUCTION

This Technical Report was prepared for the Government of Dominica as part of the project UC/DMI/83/059 "Wooden Bridges". Because of its general applicability to other countries and with the kind approval of the Minister of Communications and Works it is published separately from the Country Report for general distribution.

Specific reference is made to Carapit, the timber used in the Project and Tables 2, 3 and 4 are calculated for that species at a density of 1040 kg/m^3. These tables may be used with safety for all timbers up to that density, but economy of equipment may suffer if they are used for species less dense than, say, 850 kg/m^3.

In that case the expert recommends that the tables should be recalculated for the density of the species in question, or if a HP11C calculator is not available, by adjusting the forces shown in the tables by the ratio:

$$\frac{73 + 0.164\, d_1}{243.56}$$

where d_1 is the density of the local timber.

Reference is made in this report to the "TRADA Drawings". These Drawings comprise Part 5 of the report "Prefabricated Modular Wooden Bridges" prepared for UNIDO by the Timber Research and Development Association, Hughenden Valley, High Wycombe, Bucks., United Kingdom.

B. BRIDGE LAUNCHING

1. General

The UNIDO Bridge is launched from the **NEAR** side of the gap to the **FAR** side. Pairs are assembled with horizontal and vertical bracing to form a stable **"GIRDER"**. The **NOSE** of this girder is supported from a travelling block which runs on a **MAIN LINE**. The main line is anchored at each end to a **DEADMAN** and is supported at each end by either a four legged **DERRICK** or a two legged **SHEAR LEGS**. (In the details which follow the use of shear legs is described.)*

2. Rigging calculations

The general arrangement of the rigging is shown in Figure 1. It is possible to calculate by elementary statics the forces in every component of the rigging, once the dimensions of shear legs, slings, etc., are known. The expert attaches considerable importance to these calculations. In longer spans and with denser timbers, the working load limits of the various components are easily exceeded. The girders weigh several tons and an accident could easily be fatal, either by a man being cut in half by a broken wire rope or being crushed by a falling girder. Such accidents will continue to happen unless the officer-in-charge knows exactly what is happening at every stage of the launch.

The most important launching forces are the tension in the main line. (T), and horizontal pull required from the far bank (h) to pull the bridge across.

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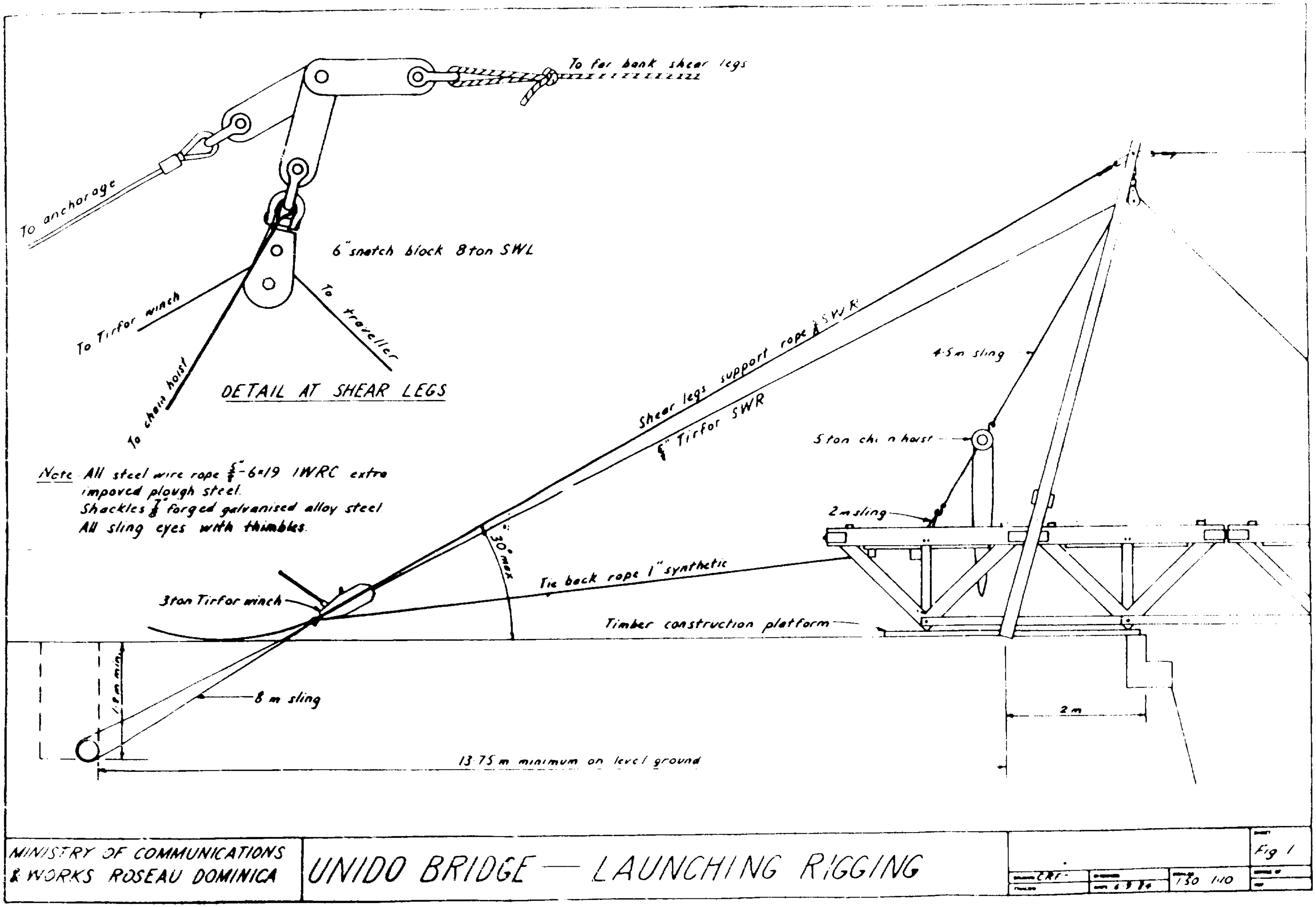
*The words in **HIGHLIGHTED CAPITAL LETTERS** are used in the sense defined in the introductory paragraph and are hereafter used only in this sense.



To far bank shear legs
To anchorage
6" snatch block 8ton SWL
To Tirfor winch
To traveller
To chain hoist
DETAIL AT SHEAR LEGS
Note: All steel wire rope 5/8"-6×19 IWRC extra improved plough steel.
Shackles 7/8" forged galvanised alloy steel
All sling eyes with thimbles.
Shear legs support rope 5/8" SWR
5/8" Tirfor SWR
4·5m sling
5ton chain hoist
2m sling
30° max
Tie back rope 1" synthetic
3ton Tirfor winch
Timber construction platform
8 m sling
13·75 m minimum on level ground
2 m
MINISTRY OF COMMUNICATIONS & WORKS ROSEAU DOMINICA
UNIDO BRIDGE — LAUNCHING RIGGING
CRF
Fig 1
730 110

The programme in Table 1, written for a HP11C calculator calculates in Kg. Force first T then h. This is done for span L from 3 m to 30 m at launching distances d in 3 m increments, and for sags of 1 m to 7 m. At the start of each cycle the display momentarily shows in turn L, d and S. Thus 12, 6, 4 indicates that the following figures will refer to T then h in a 12 m span, launched 6 m across the gap with a 4 m sag. Note that when h is negative it indicates that the bridge will launch itself across the gap, a potentially dangerous situation requiring a tie back line. The notation used is shown in Figure 2. w, the weight per lineal metre of girder complete with horizontal and vertical bracing, may be calculated as shown at the end of the programme but it is safer to weigh several pairs of panels with their associated bracing and bolts on a **weighbridge** and determine w from the weighbridge figure.

The forces as determined for Carapit (1040 kg/m^3) for shear legs set back of 0 m, 1 m and 2 m are given in Tables 2, 3 and 4.

From these tables a safe launching sequence may be determined.

At the final stage of the launch, the resultant forces on the far shear legs may lie behind it, causing its head to kick backwards. The heads of the two sets of shear legs should, therefore, be tightly tied together. Whether this will happen or not may be determined by summing the vectors of T for the final stage of the launch.

Also the far shear legs may be inclined less steeply than the 4 to 1 slope recommended, although this increases the forces in the legs slightly. Force diagrams for this situation are shown in Figure 3.

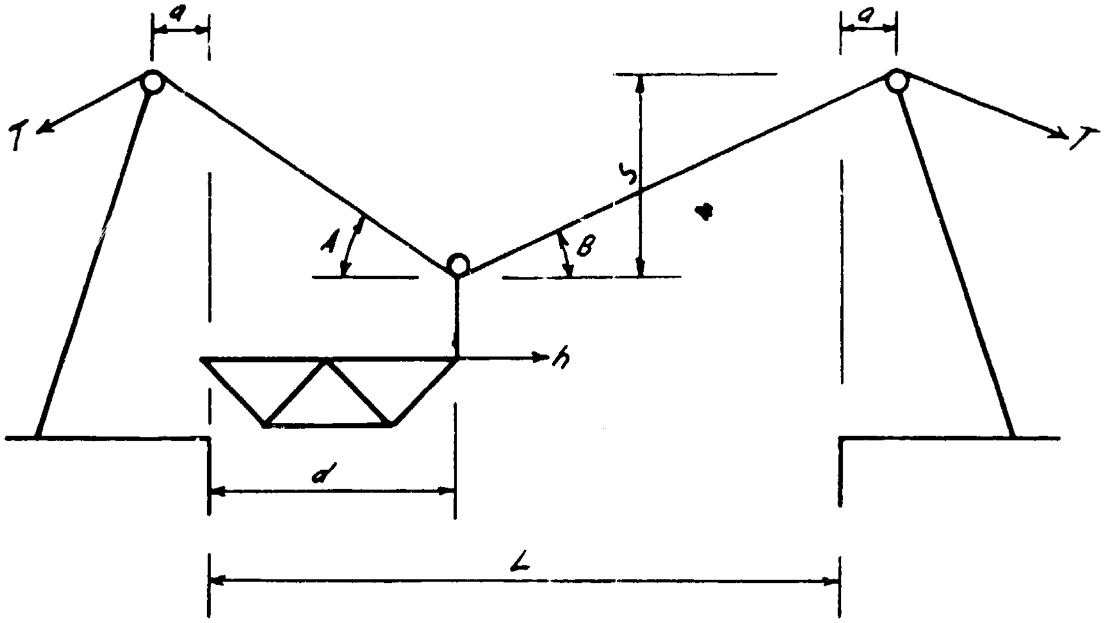
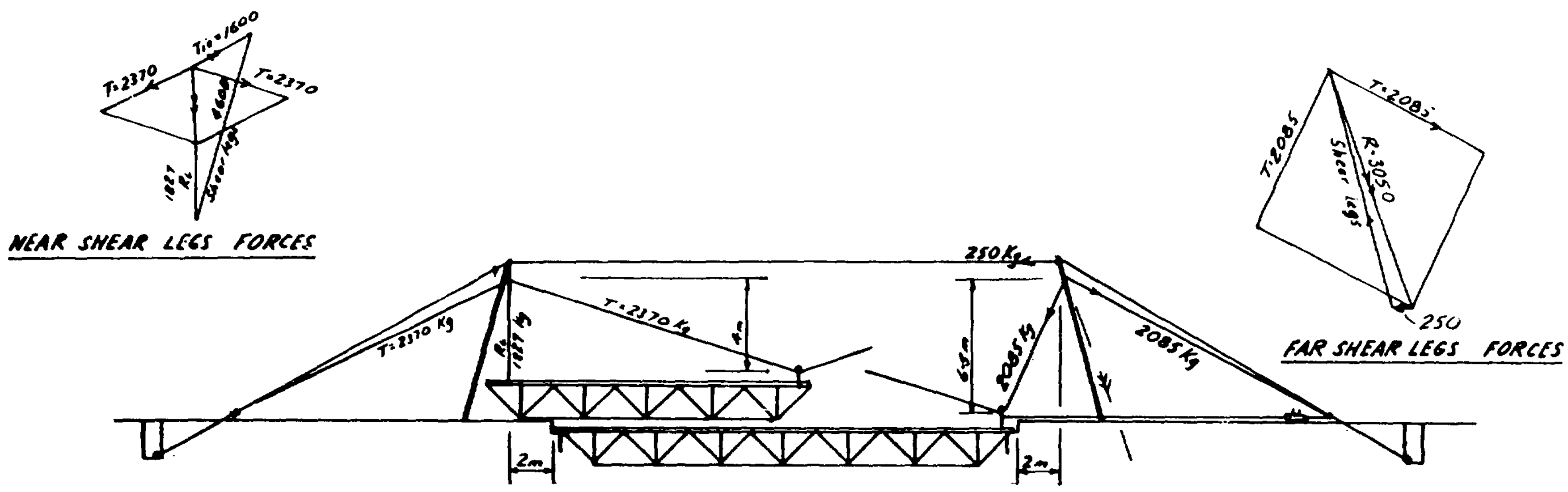


Figure 2. Programme notation



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UNIDO BRIDGE FAR SHEAR LEGS STABILITY

C.R.F. | 21.1.85 | 1:200 | Fig 3

TABLE 1 HP11C PROGRAMME

Step No	PRGM	Notes	Step No	PRGM	Notes
1	f LBL A			÷	cot B
	0			$\frac{1}{x}$	tan B
	STO 1	clear d	35	g $\tan^{-1}$	B
	3			STO 4	
5	STO + 0			SIN	sin B
	f LBL B			+	sin A + sin B
	0			RCL 5	ω
	STO 2	clear s	40	RCL 1	d
	3			×	
10	STO + 1	d		2	
	f LBL C			÷	$\frac{\omega d}{2}$
	1			x ≷ y	
	STO+2	S	45	÷	
	RCL 0	L		R/S	T
15	f PSE	display L		RCL 3	
	RCL 1	d		COS	cos A
	f PSE	display d		RCL 4	
	RCL 2	S	50	COS	cos B
	f PSE	display S		−	cos A − cos B
20	x ≷ y			×	
	RCL 6	a		R/S	h
	+	d+a		RCL 2	
	÷	tan A	55	7	
	g $\tan^{-1}$	A		f x ≠ y	? s = 7
25	STO 3			GTO C	
	SIN	sin A		RCL 1	
	RCL 0	L		RCL 0	
	RCL 1	d	60	f x ≠ y	? d = L
	−	L-d		GTO B	
30	RCL 6	a		RCL 0	
	+	L-d+a		3	
	RCL 2	S		0	

Step No	PRGM	Notes
65	f x ≠ y GTO A R/S	? L = 30

Notes:

Calculate w = weight per lineal metre of girder from

$w = 73 + 0.164d$

where d = density of timber in Kg/m^3. Store in R 5

Then store constants

a STO 6 (set back)

(L-3) STO 0

Do f PRGM

R/S

Table 2

Main line tension and horizontal force - kg

Carapit 1040 kg/m^3 - setback a = o

Sag =	2m		3m		4m		5m		6m		7m	
L = 9m	T	h	T	h	T	h	T	h	T	h	T	h
d = 3m	420	-49	317	-59	270	-63	244	-62	229	-59	218	-56
d = 6m	840	98	634	119	540	125	489	124	457	119	436	112
d = 9m	902	881	834	791	781	714	739	646	706	588	680	537
L = 12m												
d = 3m	474	-68	358	-86	303	-95	272	-98	253	-97	239	-94
d = 6m	1157	0	818	0	660	0	572	0	518	0	482	0
d = 9m	1423	205	1073	259	910	286	817	294	758	292	716	283
d = 12m	1257	1240	1178	1143	1112	1055	1057	976	1012	905	973	841
L = 15m												
d = 3m	509	-79	385	-101	328	-114	295	-120	273	-122	257	-121
d = 6m	1373	-38	959	-52	762	-62	650	-69	580	-72	533	-74
d = 9m	2059	57	1438	78	1143	93	975	103	870	109	800	111
d = 12m	2036	314	1542	406	1312	457	1179	482	1091	488	1029	483
d = 15m	1616	1602	1530	1500	1455	1406	1390	1319	1334	1239	1286	1165
L = 18m												
d = 3 m	533	-85	405	-111	346	-127	312	-135	289	-139	273	-140
d = 6 m	1523	-57	1061	-80	840	-98	714	-111	634	-199	580	-123
d = 9m	2531	0	1736	0	1352	0	1130	0	990	0	894	0
d = 12 m	3046	115	2123	161	1681	196	1429	221	1268	238	1159	247
d = 15m	2664	424	2026	554	1730	634	1559	677	1446	696	1364	699
d = 18m	1978	1966	1886	1860	1805	1762	1732	1669	1668	1583	1612	1502
L = 21m												
d = 3m	550	-89	420	-117	360	-135	325	-146	302	-152	286	-154
d = 6m	1633	-69	1138	-98	901	-121	765	-138	679	-150	612	-158
d = 9m	2879	-29	1965	-42	1520	-53	1262	-62	1096	-68	982	-73
d = 12m	3839	39	2620	56	2027	71	1682	82	1461	91	1310	97
d = 15m	4081	174	2845	245	2253	302	1913	345	1697	376	1548	395
d = 18m	3302	534	2520	704	2159	812	1952	876	1814	910	1713	922
d = 21m	2340	2330	2245	2222	2158	2120	2080	2024	2010	1933	1946	1857

../..

Table 2 (continued)

Main line tension and horizontal force - kg

Carapit 1040 kg/m^3 - setback a = o

Sag =	2m		3m		4m		5m		6m		7m	
L = 24m	T	h	T	h	T	h	T	h	T	h	T	h
d = 3m	564	-92	431	-122	371	-142	336	-154	313	-161	296	-164
d = 6 m	1716	-78	1197	-110	949	-137	806	-157	715	-173	653	-184
d = 9m	3145	-47	2143	-68	1654	-87	1369	-102	1186	-114	1059	-124
d = 12m	4453	0	3018	0	2315	0	1903	0	1637	0	1453	0
d = 15m	5242	79	3572	114	2757	145	2282	170	1976	191	1765	206
d = 18m	5147	233	3591	330	2846	410	2419	472	2146	518	1958	551
d = 21m	3945	645	3019	854	2595	992	2352	1078	2191	1127	2074	1151
d = 24m	2703	2694	2605	2585	2515	2480	2432	2381	2356	2286	2288	2196
L = 27m												
d = 3m	574	-94	440	-126	380	-147	345	-160	322	-168	305	-173
d = 6m	1781	-83	1244	-119	987	-148	840	-172	746	-190	681	-203
d = 9m	3394	-59	2285	-86	1762	-110	1458	-130	1261	-147	1125	-160
d = 12m	4937	-24	3337	-35	2551	-45	2089	-53	1788	-61	1580	-67
d = 15m	6171	30	4172	44	3189	56	2611	67	2236	76	1975	84
d = 18m	6708	119	4569	172	3524	220	2915	261	2521	294	2249	321
d = 21m	6233	292	4352	416	3454	519	2939	601	2609	664	2382	710
d = 24m	4591	755	3523	1005	3036	1173	2758	1281	2575	1347	2442	1382
d = 27m	3067	3059	2966	2948	2873	2842	2787	2740	2707	2642	2633	2549
L = 30m												
d = 3m	582	-96	448	-128	387	-150	352	-165	329	-174	313	-180
d = 6m	1833	-88	1281	-125	1018	-157	867	-183	771	-203	704	-218
d = 9m	3522	-68	2399	-99	1851	-127	1531	-151	1324	-171	1180	-188
d = 12m	5327	-40	3598	-58	2746	-76	2245	-91	1918	-104	1690	-115
d = 15m	6923	0	4666	0	3551	0	2893	0	2464	0	2164	0
d = 18m	7990	60	5396	88	4119	113	3367	136	2876	156	2535	173
d = 21m	8218	159	5598	231	4319	296	3572	352	3089	400	2754	439
d = 24m	7333	351	5126	502	4072	628	3469	731	3083	811	2817	871
d = 27m	5240	866	4029	1155	3480	1354	3169	1485	2964	1568	2815	1616
d = 30m	3432	3423	3329	3312	3233	3204	3143	3100	3060	3000	2982	2904

Table 3

Main line tension and horizontal force - kg

Carapit 1040 kg/m^3 - setback a = 1 m

Sag = 3m	2m		3m		4m		5m		6m		7m	
L = 9m	T	h	T	h	T	h	T	h	T	h	T	h
d = 3m	506	-34	368	-44	304	-49	268	-51	246	-50	232	-49
d = 6m	1012	68	735	88	607	98	536	101	493	101	464	98
d = 9m	1005	536	887	569	817	560	768	536	730	506	701	475
L = 12m												
d = 3m	568	-49	412	-65	339	-75	297	-80	271	-82	253	-82
d = 6m	1330	0	927	0	736	0	629	0	561	0	517	0
d = 9m	1704	147	1235	195	1016	225	892	241	814	246	760	246
d = 12m	1396	756	1245	820	1156	824	1091	804	1040	773	998	738
L = 15m												
d = 3m	610	-57	443	-77	365	-91	321	-99	292	-103	272	-105
d = 6m	1552	-30	1073	-41	842	-51	710	-57	627	-62	571	-64
d = 9m	2328	44	1609	62	1263	76	1066	86	941	92	856	96
d = 12m	2439	229	1772	309	1460	363	1282	396	1168	413	1089	418
d = 15m	1794	978	1612	1075	1506	1096	1428	1083	1366	1054	1313	1018
L = 18m												
d = 3m	640	-63	466	-85	385	-101	339	-112	309	-118	288	-121
d = 6m	1712	-46	1181	-65	925	-81	777	-93	683	-102	619	-107
d = 9m	2794	0	1907	0	1476	0	1225	0	1065	0	956	0
d = 12m	3424	92	2362	130	1849	162	1554	186	1366	203	1237	214
d = 15m	3198	313	2329	426	1924	506	1693	558	1544	589	1439	605
d = 18m	2194	1201	1984	1333	1864	1372	1775	1368	1703	1344	1641	1308
L = 21m												
d = 3m	662	-66	483	-91	400	-109	353	-121	322	-129	301	-133
d = 6m	1832	-56	1263	-81	989	-101	831	-117	729	-129	659	-138
d = 9m	3147	-25	2139	-35	1647	-45	1359	-53	1174	-59	1046	-64
d = 12m	4196	33	2852	47	2195	60	1812	71	1565	79	1395	85
d = 15m	4580	141	3158	201	2472	252	2076	292	1823	323	1648	345
d = 18m	3971	397	2899	544	2400	651	2117	725	1934	771	1805	798
d = 21m	2596	1424	2359	1591	2225	1650	2127	1657	2046	1638	1977	1604

Table 3 (continued)

Main line tension and horizontal force - kg

Carapit 1040 kg/m^3 - setback a = 1 m

Sag = 3m	2m		3m		4m		5m		6m		7m	
L = 25m	T	h	T	h	T	h	T	h	T	h	T	h
d = 3m	679	-69	497	-95	412	-114	364	-128	334	-137	312	-142
d = 6m	1926	-64	1329	-91	1041	-115	874	-134	768	-149	694	-160
d = 9m	3423	-40	2324	-58	1785	-74	1470	-88	1266	-100	1125	-109
d = 12m	4805	0	3249	0	2485	0	2035	0	1744	0	1541	0
d = 15m	5706	67	3873	97	2975	124	2450	147	2110	166	1875	182
d = 18m	5778	191	3986	274	3122	44	2623	402	2303	447	2082	481
d = 21m	4756	483	3479	664	2886	799	2551	894	2335	958	2183	997
d = 24m	3000	1649	2737	1852	2591	1930	2484	1948	2396	1936	2320	1906
L = 27m												
d = 3m	693	-71	508	-98	422	-118	374	-133	343	-143	321	150
d = 6m	2000	-69	1381	-99	1082	-125	910	-147	800	-164	723	-178
d = 9m	3644	-51	2472	-74	1898	-95	1562	-113	1344	-129	1192	-142
d = 12m	5293	-21	3572	-30	2723	-39	2223	-47	1897	-54	1670	-60
d = 15m	6616	26	4465	38	3404	49	2779	59	2372	6[illegible]	2088	75
d = 18m	7287	101	4945	148	3796	190	3124	227	2688	258	2385	284
d = 21m	7002	241	4834	347	3789	438	3185	514	2798	575	2531	622
d = 24m	5546	568	4064	784	3378	947	2992	1065	2743	1146	2569	1199
d = 27m	3405	1874	3116	2113	2958	2211	2843	2242	2749	2236	2668	2211
L = 30m												
d = 3m	705	-73	517	-100	431	-122	382	-137	351	-148	329	-156
d = 6m	2061	-73	1424	-105	1117	-133	940	-157	826	-176	748	-191
d = 9m	3874	-59	2594	-86	1992	-110	1639	-132	1409	-151	1250	-167
d = 12m	5692	-35	3837	-51	2922	-67	2382	-80	2029	-93	1783	-103
d = 15m	7364	0	4956	0	3766	0	3062	0	2601	0	2279	0
d = 18m	8538	52	5756	77	4383	100	3573	121	3044	139	2674	155
d = 21m	8922	137	6054	200	4647	257	3824	309	3289	353	2917	390
d = 24m	8245	291	5697	420	4468	533	3760	627	3306	705	2992	766
d = 27m	6342	653	4654	904	3875	1096	3437	1236	3157	1336	2960	1403
d = 30m	3810	2098	3496	2374	3327	2493	3205	2536	3106	2538	3019	2518

Table 4

Main line tension and horizontal force - kg

Carapit 1040 kg/m^3 - setback a = 2 m

Sag =	2m		3m		4m		5m		6m		7m	
L = 9m	T	h	T	h	T	h	T	h	T	h	T	h
d = 3m	595	-25	422	-33	341	-39	295	-42	267	-43	248	-43
d = 6m	1190	50	844	67	682	77	591	83	534	85	496	85
d = 9m	1237	342	1001	410	887	437	817	440	768	431	731	416
L = 12m												
d = 3m	664	-37	470	-50	378	-60	326	-66	293	-70	271	-71
d = 6m	1506	0	1040	0	817	0	689	0	609	0	555	0
d = 9m	1992	110	1409	151	1134	180	978	199	879	209	812	213
d = 12m	1722	487	1403	594	1250	643	1155	659	1088	656	1037	643
L = 15m												
d = 3m	712	-44	505	-61	406	-73	350	-82	314	-88	290	-91
d = 6m	1734	-24	1190	-34	926	-42	774	-48	677	-53	611	-56
d = 9m	2601	36	1784	51	1389	63	1161	72	1016	79	917	84
d = 12m	2850	175	2018	243	1625	294	1401	329	1257	351	1159	363
d = 15m	2217	634	1816	781	1626	856	1509	887	1425	893	1361	885
L = 18m												
d = 3m	748	-48	531	-68	428	-82	369	-93	332	-100	306	-105
d = 6m	1903	-38	1303	-54	1012	-68	843	-79	735	-88	661	-94
d = 9m	3063	0	2083	0	1604	0	1324	0	1144	0	1021	0
d = 12m	3806	75	2607	108	2024	136	1687	158	1470	175	1322	187
d = 15m	3741	242	2654	338	2140	412	1847	466	1659	502	1529	525
d = 18m	2718	782	2236	971	2010	1072	1872	1121	1773	1138	1697	1135
L =21m												
d = 3m	776	-52	551	-72	445	-89	385	-101	346	-110	319	-116
d = 6m	2033	-47	1392	-67	1080	-85	899	-100	783	-112	703	-121
d = 9m	3421	-21	2318	-30	1777	-39	1461	-46	1255	-52	1113	-57
d = 12m	4561	28	3091	40	2370	52	1948	61	1674	69	1485	75
d = 15m	5082	117	3479	169	2701	213	2249	250	1958	280	1757	302
d = 18m	4654	310	3306	435	2670	533	2308	607	2076	659	1916	695
d = 21m	3221	931	2659	1162	2399	1291	2241	1358	2129	1387	2041	1392

Table 4 (continued)

Main line tension and horizontal force - kg

Carapit 1040 kg/m^3 - setback a = 2 m

Sag =	2m		3m		4m		5m		6m		7m	
L = 24m	T	h	T	h	T	h	T	h	T	h	T	h
d = 3m	798	-54	567	-76	459	-94	397	-107	358	-117	331	-124
d = 6m	2136	-53	1463	-77	1136	-98	946	-116	823	-130	739	-141
d = 9m	3706	-34	2509	-50	1920	-65	1575	-77	1350	-88	1194	-97
d = 12m	5167	0	3487	0	2660	0	2172	0	1855	0	1634	0
d = 15m	6177	57	4181	84	3200	108	2625	129	2251	146	1991	161
d = 18m	6409	160	4389	231	3407	294	2837	347	2470	390	2217	424
d = 21m	5584	378	3972	533	3213	656	2781	751	2506	820	2315	869
d = 24m	3729	1081	3087	1354	2793	1511	2616	1597	2491	1639	2393	1653
L = 27m												
d = 3m	815	-56	581	-79	470	-98	408	-112	368	-123	340	-131
d = 6m	2220	-58	1521	-84	1181	-107	984	-127	857	-144	769	-157
d = 9m	3937	-44	2664	-64	2038	-83	1670	-100	1430	-114	1264	-127
d = 12m	5658	-18	3812	-27	2901	-35	2363	-42	2011	-48	1765	-53
d = 15m	7073	23	4766	33	3626	43	2953	52	2514	60	2206	67
d = 18m	7874	88	5327	129	4075	166	3340	200	2861	229	2528	253
d = 21m	7769	203	5323	294	4134	375	3445	445	3000	503	2693	550
d = 24m	6523	447	4646	631	3763	781	3262	897	2943	984	2722	1046
d = 27m	4238	1231	3517	1547	3189	1733	2994	1838	2856	1894	2749	1917
L = 30m												
d = 3m	830	-57	592	-81	480	-101	417	-116	376	-128	348	-136
d = 6m	2289	-62	1569	-90	1219	-115	1016	-136	886	-154	796	-169
d = 9m	4128	-51	2793	-75	2136	-97	1750	-117	1499	-134	1324	-150
d = 12m	6066	-31	4083	-45	3104	-59	2524	-72	2145	-83	1879	-93
d = 15m	7817	0	5256	0	3988	0	3237	0	2744	0	2399	0
d = 18m	9098	46	6125	68	4656	89	3787	108	3218	124	2819	139
d = 21m	9632	119	6516	175	4984	226	4084	273	3497	314	3088	349
d = 24m	9155	246	6275	358	4877	458	4066	545	3543	618	3182	678
d = 27m	7470	517	5326	731	4319	906	3749	1044	3387	1148	3136	1226
d = 30m	4748	1381	3948	1741	3587	1955	3374	2080	3225	2150	3109	2183

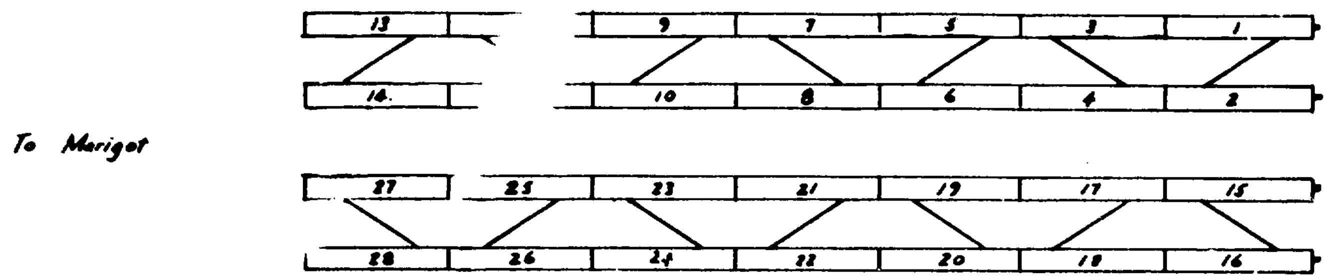
3. Setting out

On any but a site with flat and level approaches the expert recommends that a longitudinal profile should be surveyed for about 25 m beyond each abutment and plotted to a scale of 1:50. The example for the Cuffey River bridge is shown in Figure 4. With the shear legs drawn in position and the lengths of blocks, shackles, etc., drawn, the position of the deadman anchorages may be determined. The expert recommends that the positions of the shear legs and anchorages should be taped out, not merely placed as shown in the film "Short Cut", and located on an accurately set out centre line.

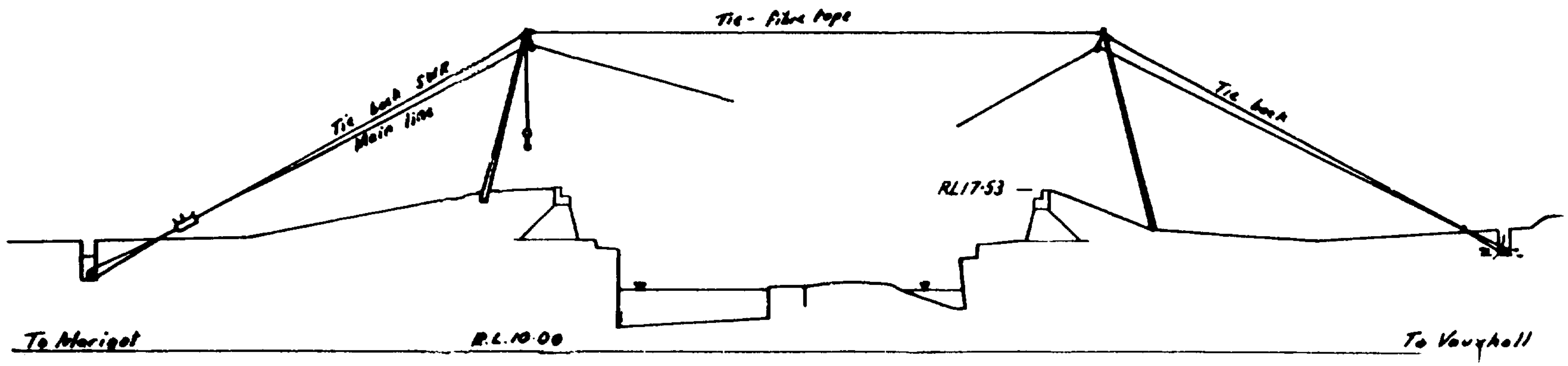
4. Anchorages

The anchoranges used are of the "deadman" type. A trench is dug at the anchorage position 1.8 m deep by 2 m long by 600 mm wide, perpendicular to the centre line. A narrow trench is dug on the centre line rising at 30 degrees from the bottom of the main trench. A sound hardwood log 300 mm diameter by 1.8 m long is placed in the trench and the anchorage sling is passed behind this and led up the sloping trench. It is disadvantageous to wrap the sling right round the log. The trench is backfilled and rammed in layers. The two eyes of the sling should be evened up before the trench is back filled above the level of the log. The trench for the sling need not be back filled unless it is very wide.

If the soil is soft silt or clay of low shear strength the size of the anchor should be increased by using a longer log. The force to be taken, particularly at the far deadman is approximately the sum of T and h for the sag at the final stage of seating the girder and can be determined from the Tables.



TRUSS LAYOUT



RIGGING AS ERECTED

MINISTRY OF COMMUNICATIONS & WORKS ROSEAU DOMINICA	UNIDO BRIDGE SETTING OUT DETAILS	C.R.P. 1:100 1:200	4

5. Shear legs - construction and erection

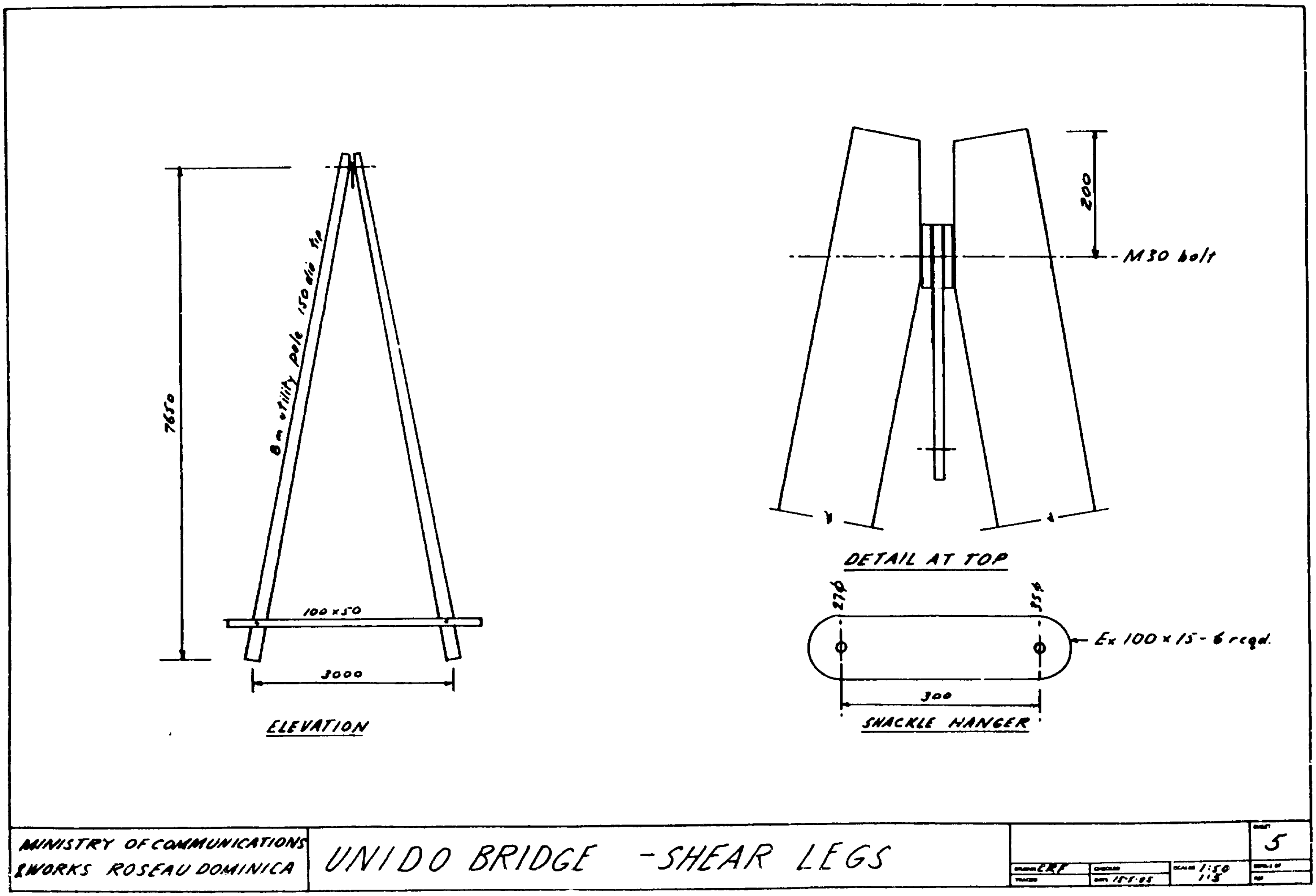
The shear legs are constructed to the details shown in Figure 5. Sound utility poles are suitable.

The foot positions are set out, excavated about 150 mm and a footing of 200 x 50 timber placed. Restraining posts of 100 x 50 timber are driven behind the foot positions.

From the dimensions of the shear legs as built and the positions of their feet and the anchorage the length of the tie back wire is determined either by calculation or by drawing to a scale of 1:50. Shackle lengths should be taken into account. The shear legs is laid down with its head towards the gap. The tie back is shackled to its hanger, and the snatch block (and the chain block sling at the near end) to the centre hanger. A light pilot rope should be reeved through the snatch blocks for later reeving of the main line. Planks are laid down for the feet to slide on.

A light shear legs at least 4 m high is made from 100 x 50 decking timber and the chain block is attached to this. The head of the main shear legs is hoisted up at least 3 m high. Using the large Tirfor attached to the anchorage on the opposite bank, and a long sling made from the top line, the foot of the shear legs is winched forward. The restraint of the tie back will cause the head to rise.

Provided that the head of the shear legs is raised at least 3 m, force developed in this operation will not exceed about 1 ton.


7650
8m utility pole 150 dia tip
100 x 50
3000
ELEVATION
200
M30 bolt
DETAIL AT TOP
27φ
35φ
Ex 100 x 15 - 6 reqd.
300
SHACKLE HANGER
MINISTRY OF COMMUNICATIONS
& WORKS ROSEAU DOMINICA
UNIDO BRIDGE -SHEAR LEGS
1:50
1:5
5

Finally the main line is reeved and the top line is fixed taut between the heads of the two shear legs.

Details of the anchorages and of raising the shear legs are shown in the photographs Figures 6 and 7.

6. Girder construction and launching

Two pairs of trusses are stood up on the platform and braced together as shown in Figures 22 and 24 of the TRADA Drawings to make a 6 m length girder. The trusses are spaced apart by temporary spacers 700 mm long with 1,100 mm nailing pieces on top. Male ends shoud lead. It is recommended that two 150 x 12 mm coach screws should be used in each end of the horizontal diagonal braces rather than the nails shown in the TRADA Drawings, especially in hard timbers. Drilling upwards is easier than nailing. The trusses must be carefully checked for line and squareness. The nose is supported by a 150 x 150 mm timber slung from the traveller. The wire from the light Tirfor is also fixed to the traveller. A tie back rope is attached to the rear of the trusses and to the rear anchorage or to a post dug at least 1.2 m into the ground on the bridge centre line.

By tightening up on the main line and hoisting with the chain block, the 6 m length of girder is swayed 3 m across the gap. The girder _must_ be under the control of the holdback rope since at this stage it has a strong tendency to go to the middle of the gap. The wire from the small Tirfor is merely kept from being too slack at this stage.

The assembly is lowered at the rear when the points of the two near trusses are just behind the abutment. Two more trusses are added and the operation is repeated. After the halfway mark is reached the girder will have to be pulled across by the small Tirfor and the holdback rope is required only when the chain block is lifting behind the vertical.

Figure 6. Deadman anchorage and sling 1.8 m deep and 1.8 m long.

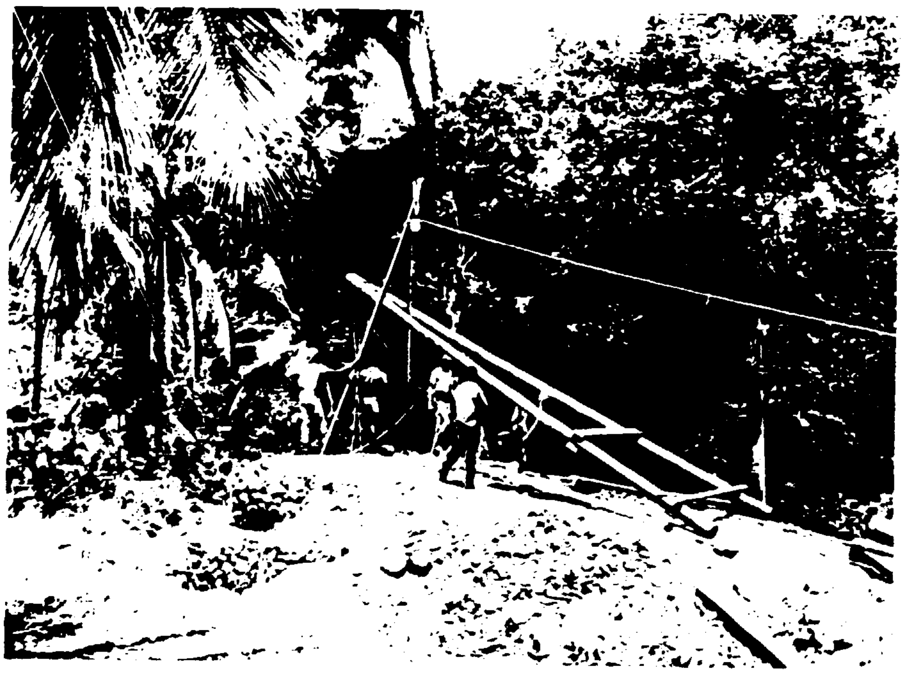


Figure 7. Raising shear legs. Note tie back rope and boards under feet of shear legs.

The main line must be kept as slack as is consistent with girder assembly. There is a strong tendency for the man in control of the main Tirfor to want to trice up the nose as much as possible. This tendency must be resisted and the sag must be kept as large as possible to minimise the main line tension.

Photographs of early and later stages of the launching are shown in Figures 8 and 9.

7. Landing

When the final pair of trusses is assembled the nose of the girder should be at about its final level. The chain block must be suspended from a sling sufficiently long so that it is almost chock-a-block when lifting the rear of the girder clear of the construction platform since it will be fully extended when finally lowering the girder. Note that the standard 10 ft (3.65 m) is barely adequate. If a 12 ft extension block is not available then temporary slings will be required to support the girder while the chain block is re-hung from a longer sling. If this situation occurs then provision for hanging two additional slings plus additional shackles will be required.

Under the control of the small Tirfor and the main line, the nose of the girder is landed on the far abutment. It is convenient if the ends of the girder are landed on 1200 mm long pieces of board which in turn rest on short pieces of pipe or reinforcing steel. These small rollers aid considerably in skidding the girder sideways over to its final position.

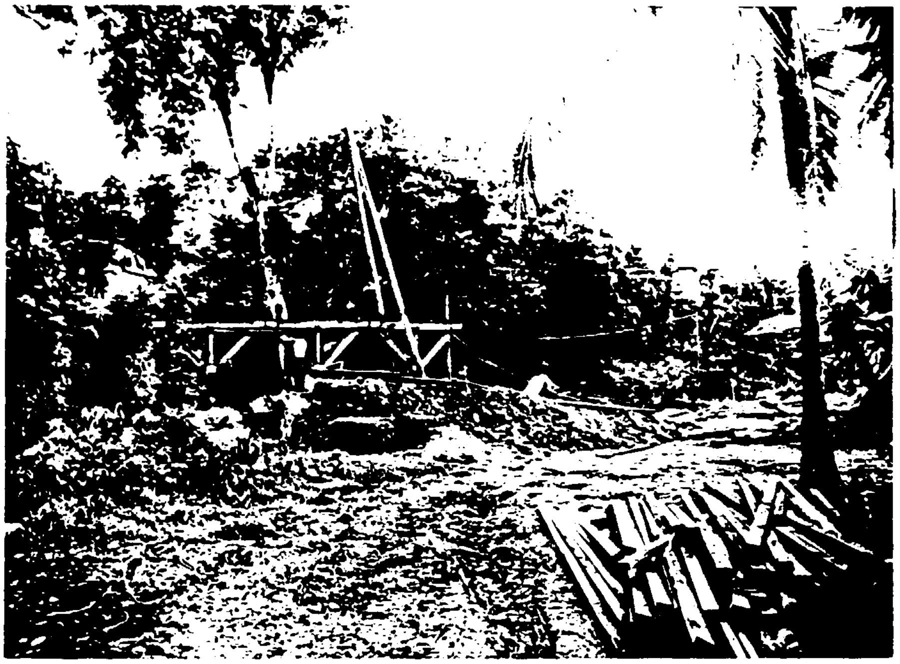


Figure 8. Commencement of launch.

Figure 9. Ready to add sixth pair of panels. Note increase in sag from Figure 8.

Should the girder bow sideways more than 200 mm at any stage of launching a potentially dangerous situation is developing and the girder must be de-launched and the bowing rectified. The reason will probably be found to be out-of-square end plates Mk 10. Shimming may be required.

After the second girder is launched and positioned the two girders should be connected together at the correct centre distance (1,400 mm c-c of inner trusses - see Figure 24 of TRADA Drawings). Any overall bow can be corrected by pulling sideways with a Tirfor anchored to a suitable tree on the river bank. Note that in this case the sling should not go round the top chord as this would interfere with nailing on the decking.

8. Decking

Nailing the decking may start from one end and proceed across the bridge or if there is sufficient labour and hammers, at both ends working towards the centre.

Structurally the most important decking is at the ends of the bridge. As the decking approaches the end(s), and the dead load reaches its maximum, careful watch for lateral movement must be maintained and the slightest movement corrected by pulling with the Tirfor winches and the chain block. At this stage the shear legs and anchorages should have been dismantled and there will be plenty of slings and steel wire rope available.

9. Dismantling shear legs

After both girders are in position any any additional trusses for a six- or eight-truss bridge have been positioned, the shear legs may be dismantled. This process is basically the reverse of their erection. A long sling is attached to the feet of the rear shear legs and pulled back by the Trifor. As the legs approach horizontal they will skid back and fall to the ground.

As this operation is NOT under control all personnel should stand well clear and the Tirfor operator should have an escape route planned. The far legs may then be dropped in the same position. The top tie back rope should be re-positioned to a separate anchorage to avoid the shear legs tipping backwards.

10. Rigging hardware

The following pages are copied from their catalogue by kind permission of the McMaster-Carr Supply Company, P.O. Box 4355, Chicago, Ill. 60880, U.S.A. They contain information on hardware items which the expert has found suitable for launching the UNIDO bridge. Sizes recommended are underlined. Note that the prices are in US dollars, early 1985, and are subject to change.

The correct method of application of wire rope clips is also shown.

Twisted Fiber Rope

Synthetic Fiber Rope

High Strength Shock Resistant Nylon Rope

Made of nylon, this rope is roughly 2 ½ times stronger than manila. Nylon's high elasticity, combined with strength, assures capacity to absorb shock loads. Loses 10-15% of its strength when wet, but initial strength superiority compensates. Full strength regained on drying. Nylon affords good resistance to abrasion and weathering. Has a high melting point and retains its physical properties until almost reaching that point. Resists alkalies and has fair acid resistance, except to concentrated hydrochloric and sulphuric acids.

For use where high strength and elasticity are required. Used in shipping, oil drilling, public service and industrial work.

Working load limits are based on approximately 8-11% of new rope breaking strength. White color. Larger sizes up to 6" dia. or 18" circumference are available. Specify 3827T900 . . . Prices on request.

Rope Dia.	Breaking Strength, Lbs.	Working Load Limit, Lbs.	Std. Pkg., Ft.	No.	NET PER 100 FEET Less Than 100'	NET PER 100 FEET 100' To 599	NET PER 100 FEET 600' & Up
3/16"	900	75	600	3827T31	$5.83	$4.77	$4.38
1/4"	1,490	124	600	3827T32	7.90	6.46	5.92
5/16"	2,300	192	600	3827T33	14.22	11.63	10.66
3/8"	3,350	278	600	3827T34	19.44	15.91	14.58
1/2"	5,750	525	600	3827T35	35.48	29.03	26.61
5/8"	9,350	935	600	3827T36	55.41	45.34	41.56
3/4"	12,800	1,420	600	3827T21	79.36	64.93	58.52
1"	22,500	2,500	600	3827T22	137.81	112.75	103.35
1 1/4"	33,750	3,760	600	3827T23	212.67	174.00	159.50
1 1/2"	47,700	5,320	600	3827T24	293.48	240.12	220.11
2"	82,800	9,200	600	3827T25	[illegible]	416.20	381.52
2 1/4"	113,000	12,600	600	3827T26	658.29	538.80	493.72
2 5/8"	146,000	16,200	600	3827T27	857.30	701.43	642.98
3"	180,000	20,000	600	3827T29	1071.63	873.79	803.72

General Purpose Synthetic Rope

Polypropylene rope is the lightest of all ropes. Nearly twice as strong as manila and has better shock absorbing qualities, though not as good as nylon. Buoyant and unaffected by water. Softens progressively with temperature rise. Resists acids and alkalies.

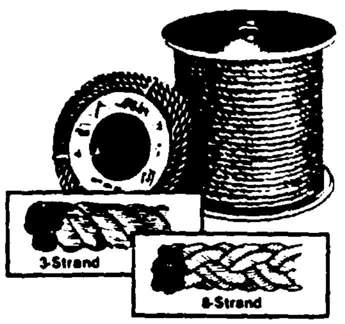
Uses include anchor lines, barrier rope and general use in construction, commercial fishing, farming and petroleum. Working load limits based on approximately 10-14% of new rope breaking strength.

Rope Dia	Breaking Strength, Lbs	Working Load Limit, Lbs	No.	NET PER 100 FEET Less Than Std Pkg	NET PER 100 FEET Std Pkg. & Up
3-Strand Construction. Yellow. 600-ft. Std. Pkg.					
1/4"	1,130	113	3837T35	$3.41	$3.01
3/8"	2,430	244	3837T36	7.12	6.29
1/2"	3,780	420	3837T37	11.66	10.30
5/8"	5,580	700	3837T38	19.09	16.86
3/4"	7,650	1,090	3837T39	28.44	24.73
1"	12,600	1,800	3837T41	47.78	41.54
3-Strand Construction. 2 yellow, 1 black strand. 300-ft. Std. Pkg.					
1 1/4"	18,900	2,700	3837T42	69.74	60.64
1 1/2"	26,700	3,820	3837T43	148.84	129.42
1 3/4"	38,700	5,550	3837T44	175.20	152.35
2"	46,800	6,700	3837T45		
8-Strand Plaited Construction. Yellow. 540-ft. Std. Pkg.					
2 1/4"	62,100	8,850	3837T61	222.67	193.62
2 5/8"	81,000	11,600	3837T62	290.43	252.55
3"	103,000	14,700	3837T63	370.30	322.00

Dacron Rope

Polyester rope is m[illegible] n twice as strong as manila. Low stretch rope is unaffected by [illegible] hility to absorb shock is ⅔ that of nylon. Excellent abrasion, [illegible] e and chemical resistance. Used in marine industry as [illegible] ng and stringing line; also for tree rope, truck rope and [illegible] s. White color. Working load limits based on approximatel[illegible] new rope breaking strength.

Rope Dia	Breaking Strength, Lbs	Working Load Limit, Lbs	Std Pkg Ft	No.	NET PER 100 FEET Less Than 100'	NET PER 100 FEET 100' To 599	NET PER 100 FEET 600' & Up
3/16"	900	90	600	3828T14	$8.26	$7.06	$6.16
1/4"	1,490	149	600	3828T35	11.96	9.57	8.32
3/8"	3,350	334	600	3828T36	25.91	20.73	18.03
1/2"	5,750	640	600	3828T17	47.34	37.87	32.93
5/8"	9,000	1130	600	3828T18	68.07	58.14	[illegible]
3/4"	11,300	1610	600	3828T19	88.97	76.00	66.32



Mylar Rope

A polyester film rope with much less stretch than any other synthetic rope. Mylar's strength approaches that of dacron and is more than twice that of manila. Highly resistant to abrasion, chemicals and atmospheric conditions. Unaffected by water, including salt water. Has dielectric strength greater than almost every known insulator. Rather stiff, not a good knotting rope. Conforms to MIL-R-24335.

For marine, public utility and industrial use where strength with lack of stretch is important. White color. Working load limits are based on approximately 30% of new rope breaking strength.

Rope Dia	Break Strgth. Lbs	Work Load Limit, Lbs	Std Pkg., Ft	No.	NET/100 FEET Less Than Std Pkg	NET/100 FEET Std. Pkg & Up
1/8"	350	105	5000	3842T33	$20.40	$17.00
3/16"	750	[illegible]	2500	3842T34	33.60	28.00
1/4"	1200	360	1200	3842T36	48.00	40.00
3/8"	2450	735	1200	3842T38	92.40	77.00
1/2"	4500	1350	600	3842T41	174.00	145.00

Polyester-Cover Polypropylene-Core Rope

Polyester cover provides high strength, low strength, abrasion resistance, good rendering qualities and a high melting point. Polypropylene core keeps rope light, provides supporting strength and assures easy handling. Sizes over 1" float.

Used for mooring lines and other marine applications, towing hawsers, car pullers and industrial purposes. White color. Working load limits are based on approximately 11-14% of new rope breaking strength.

Rope Dia	Break. Strgth, Lbs	Work Load Limit, Lbs	Std Pkg., Ft	No.	NET PER 100 FEET Less Than Std Pkg	NET PER 100 FEET Std Pkg. & Up
3/8"	3,000	333	600	3821T11	$20.20	$14.43
1/2"	5,400	600	600	3821T12	35.78	25.46
5/8"	7,200	900	600	3821T13	48.39	34.50
3/4"	9,800	1400	600	3821T14	65.00	46.04
7/8"	13,500	1928	600	3821T15	91.52	64.83
1"	17,000	2428	600	3821T16	114.40	81.03
1 1/4"	25,000	3571	600	3821T17	171.80	121.55
1 1/2"	34,000	4857	600	3821T18	239.20	169.43
2"	62,000	8857	600	3821T19	431.60	305.72

Dielectric Polypropylene Rope

Consistently meets electric utility high dielectric requirements. Special hot stretch process compresses the fibers to give them strength. Penetration treatment provides a moisture barrier for high dielectric strength. This rope is as much as 30% stronger than standard polypropylene rope and has the lowest level of elongation of any polypropylene rope available.

Used for line stringing, transformer hoisting, insulated tool work and hand lines. Yellow color.

Rope Dia.	Breaking Strength, Lbs	Working Load Limit, Lbs ◆	Std Pkg., Ft	No.	NET PER 100 FEET Less Than Std Pkg	NET PER 100 FEET Std Pkg. & Up
3/8"	3,300	366	600	3820T11	$27.59	$20.00
1/2"	5,400	600	600	3820T12	36.08	27.50
5/8"	8,200	1025	600	3820T13	60.00	46.05
3/4"	10,600	1514	600	3820T14	78.00	61.84

◆Working load limits are based on approximately 11-14% of new rope breaking strength.

Natural Fiber Rope

Premium Grade Manila Rope

Special Features: Manila is the strongest natural fiber. It continues to be a viable rope choice, even in the face of competition from synthetic cordage, because it is easy handling and economical. Has limited elongation. Runs smoothly through blocks and on catheads because of its excellent ability to render or ease out smoothly over metal while under load. Treated to repel moisture but still susceptible to rot and chemical attack. Meets Fed. Spec. TR605b. Working load limits based on approximately 20% of new rope breaking strength. **Uses:** As an economical rope for general purposes. **Color:** Natural.

Rope Dia.	Breaking Strength Lbs.	Working Load Limit Lbs.	Std. Pkg.	No.	NET PER 100 FEET: Less Than 100'	100' & Up; Less Than Std. Pkg.	Std. Pkg. & Up
1/4"	540	108	1200'	3825T12	$ 7.93	$ 6.16	$ 5.10
3/8"	1,215	242	600'	3825T14	15.95	12.37	10.25
1/2"	2,385	476	600'	3825T15	28.35	22.00	18.23
5/8"	3,960	792	600'	3825T16	48.92	37.96	31.45
3/4"	4,860	972	600'	3825T17	58.82	45.64	37.81
1"	8,100	1620	600'	3825T19	92.56	72.43	59.50
1 1/4"	12,150	2430	600'	3825T21	142.47	111.50	91.59
1 1/2"	16,650	3330	600'	3825T22	204.28	159.87	131.33
2"	27,900	5580	600'	3825T24	367.58	287.67	236.30

Manila Car-Puller Rope

Special Features: A hard-laid manila rope. Strands are laid very tightly to make a stiffer, but more abrasion resistant rope than the manila rope listed above. Working load limits based on approximately 20% of new rope breaking strength. **Uses:** Widely used on capstans for pulling, for spotting freight cars in railroad yards and on sidings. **Color:** Natural.

Rope Dia.	Breaking Strength Lbs.	Working Load Limit Lbs.	Std. Pkg.	No.	NET PER 100 FEET: Less Than 100'	100' And Up
1 1/4"	12,150	2430	600'	3835T12	$213.18	$177.65
1 1/2"	16,650	3330	600'	3835T13	286.88	241.58
1 3/4"	23,850	4770	600'	3835T14	407.54	342.34
2"	27,900	5580	600'	3835T15	491.79	413.10

Sisal Rope

Special Features: A coarser fiber rope than manila, with approximately 80% of the strength at a lower cost.

Though less resistant to surface abrasion than manila, sisal is slightly more resistant to internal wear from flexing.

Working load limits based on approximately 20% of new rope breaking strength.

Uses: More economical than manila rope. For applications that do not demand a stronger rope. **Color:** Natural.

Rope Dia.	Breaking Strength Lbs.	Working Load Limit Lbs.	Std. Pkg.	No.	NET PER 100 FEET: Less Than 100'	100' & Up; Less Than Std. Pkg.	Std. Pkg. & Up
3/16"	324	65	2000'	3819T11	$3.64	$3.07	$2.79
1/4"	432	86	1500'	3819T12	4.80	3.84	3.49
5/16"	720	144	1000'	3819T13	7.05	5.64	5.13
3/8"	972	194	500'	3819T14	10.19	8.15	7.41
7/16"	1260	252	500'	3819T15	12.73	10.19	9.26
1/2"	1908	382	500'	3819T16	17.85	14.28	12.98
3/4"	3888	778	500'	3819T17	38.82	31.06	28.24

340 # Wire Rope

Ropes on this Page Available in These Grades

Improved Plow Steel with Fiber Core
Made from high strength steel with fiber core center. For use at lighter loads and lower temperatures where additional support of an independent wire rope core is not required. Should not be used where maximum strength or resistance to crushing is required. For light or standard duty.

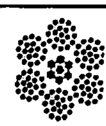
Improved Plow Steel with Independent Wire Rope Core
Independent wire rope core provides additional support and strength. Can handle heavy loads and shock loads. Resists crushing better than fiber core ropes. A rope with independent wire rope core can be used where temperatures above 212°F are encountered. For heavy duty service.

Extra Improved Plow Steel with Independent Wire Rope Core
This is the highest standard wire rope grade and is used for the most demanding services. Has the greatest strength—it is approximately 15% stronger than improved plow steel rope with IWRC. Resists abrasion, crushing and high temperatures. Has highest fatigue resistance.

Abbreviation: IWRC—Independent Wire Rope Core

Standard Flexible Hoisting Rope

6 x 19 Classification
Fiber Core or IWRC



Breaking strength conforms to latest revision of applicable Federal Specification RR-W-410. Moderate flexibility, high strength. This class has 8 to 26 wires per strand. Preformed. Right regular lay.

Improved Plow Steel with Polypropylene Core. For derricks, hoists, scrapers, etc.

Improved Plow Steel with IWRC. For shovels, crawler drag lines, clamshells, etc.

Extra Improved Plow Steel with IWRC. Stronger than Improved Plow Steel with IWRC and for similar uses.

Right long lay available in 1/2" diameter and up—Prices on Request.

Dia.	Improved Plow Steel Fiber Core: Breaking Strength Lbs.	No.	NET PER FOOT	Improved Plow Steel IWRC: Breaking Strength Lbs.	No.	NET PER FOOT	Ex. Improved Plow Steel IWRC: Breaking Strength Lbs.	No.	NET PER FOOT
3/16"	3,110	3440T15	$0.32	3,200	3440T35	$0.36	—	—	—
1/4"	5,480	3440T16	.41	5,880	3440T36	.50	6,800	3440T56	$0.63
5/16"	8,520	3440T17	.61	9,160	3440T37	.60	10,540	3440T57	.74
3/8"	12,200	3440T18	.64	13,120	3440T38	.65	15,100	3440T58	.79
7/16"	16,540	3440T19	.66	17,780	3440T39	.82	20,400	3440T59	.97
1/2"	21,400	3440T21	.73	23,000	3440T41	.90	26,600	3440T61	1.08
9/16"	27,000	3440T22	.83	29,000	3440T42	1.03	33,600	3440T62	1.24
5/8"	33,400	3440T23	1.00	35,800	3440T43	1.17	41,200	3440T63	1.39
3/4"	47,600	3440T24	1.40	51,200	3440T44	1.68	58,800	3440T64	1.99
7/8"	64,400	3440T25	1.81	69,200	3440T45	2.16	79,600	3440T65	2.58
1"	83,600	3440T26	2.29	89,800	3440T46	2.75	103,400	3440T66	3.16
1 1/8"	105,200	3440T27	2.80	113,000	3440T47	3.36	130,000	3440T67	3.84
1 1/4"	129,200	3440T28	3.30	138,800	3440T48	3.91	159,800	3440T68	4.48

Wire Rope Cutters 349

Impact Type Wire Rope Cutters

Portable unit cuts wire rope cleanly and safely. Actuated by striking with a hammer. Rope is ready for splicing or socketing as the roundness of the wire rope is maintained after cutting. There are no frayed or flame hardened ends. **For best results when cutting, use seizing bands listed below.**

For cutting plow or improved plow steel ropes having fiber, strand or independent wire rope core.

3500T11. Light duty. For occasional cutting of rope or electrical cable up to 1" dia. Not for continuous cutting of rope over 5/8".

3500T12. Medium duty. For regular cutting of rope from 5/8" to 1 1/16". Mounting holes in base.

3500T13. Heavy duty. For regular cutting of rope up to 1 1/2". Mounting holes in base.

WIRE ROPE CUTTERS, COMPLETE

Rope Capacity	O'all Ht.	Base Dia.	Wt. Lbs.	No.	NET EACH
1"	6"	3 1/2"	7	3500T11	$37.84
1 1/16"	7"	6 1/4"	15	3500T12	63.36
1 1/2"	9"	7 3/4"	28	3500T13	106.64

CUTTER REPLACEMENT PARTS

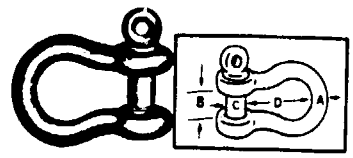
Rope Cap.	Base Casting No.	NET EACH	Plunger No.	NET EACH	Die Set No.	NET EACH	Blade with Pin No.	NET EACH	Plunger Guide Pin No.	NET EACH
1"	3500T21	$17.63	3500T22	$11.85	3500T23	$10.20	3500T24	$7.13	3500T26	$0.24
1 1/16"	3500T31	37.28	3500T32	13.88	3500T33	19.06	3500T34	7.13	3500T36	.24
1 1/2"	3500T41	65.03	3500T42	24.45	3500T43	25.80	3500T44	10.88	3500T46	.29

Simply lay the rope in cutter groove and apply a few quick blows with a hammer. Makes a clean, smooth cut.

Anchor & Chain Shackles

Material: Forged steel shackles with forged alloy steel pins. Shackles and pins are heat treated and tempered for added strength and to maintain the ductility standards required by Federal Specification RR-C-271b.
Finish: Galvanized.
Types: Shackles are available in two types: anchor (bow type) and chain ("D" type). Both are available with screw pins, loose pins or bolt type pins.
Special Features:
Anchor shackles feature an open throat design that permits free line movement without undue wear. Wide bow allows ample clearance for thimbles and turnbuckles.
Chain shackles with their flat throat design, restrict movement of rigid chain lines. Reduce chain wear and prevent kinking or fouling.
Alloy pins are used on all shackles for added strength. **Shackles with screw pins** require no special tools to assemble. Simply slip screwdriver blade or hand punch through pin eye and tighten.
Shackles with loose pins are locked with cotter pins. Especially suitable where a tamper-proof shackle is desired. Also used in corrosive atmospheres where a threaded pin might rust or freeze tight.

Bolt type shackles have a bolt pin with a threaded end to accommodate a nut as well as a locking cotter pin. The cotter pin eliminates the possibility of the nut working loose and the bolt pin slipping out. Bolts have thread-protected ends for maximum strength and safety. In most cases, rough handling won't damage the end of the bolt; so the nut can be easily removed when necessary.
All shackles are marked with size and working load limit.
Uses: Shackles are used on rope or chain lifting and rigging lines to attach fittings or to suspend a line.
Approvals: All shackles listed on this page meet the requirements of **Federal Specification RR-C-271b.**
Caution: Screw pin shackles should not be used in applications where load shifting might unscrew the shackle pin.
Only the proper fitting pin should be used. Other substitutes are not intended to take the bending that is normally applied to the pin.
Shackles should never be pulled at an angle; the capacity would be tremendously reduced. Instead, fittings and hoist lines should be centralized on the pin with suitable washers or spacers.


Anchor Shackle With Screw Pin


Chain Shackle With Screw Pin

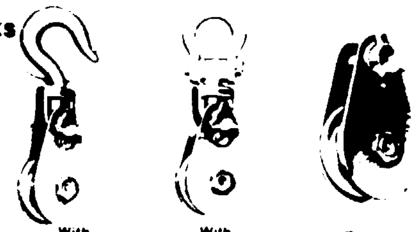
Anchor & Chain Shackles With Screw Pins

Shackle Size A	Approx. Working Load Limit-Lbs.	Inside Wdth. at Pin B	Pin Dia. C	Anchor Shackles: Inside Lgth. D	Anchor Shackles: No.	Anchor Shackles: NET EACH	Chain Shackles: Inside Lgth. D	Chain Shackles: No.	Chain Shackles: NET EACH
3/16"	667	3/8"	1/4"	7/8"	3558T44	$1.25	—	—	—
1/4"	1000	15/32"	5/16"	1 1/8"	3558T45	1.28	7/8"	3560T44	$1.34
5/16"	1500	17/32"	3/8"	1 1/4"	3558T46	1.37	1"	3560T45	1.57
3/8"	2000	21/32"	7/16"	1 7/16"	3558T47	1.71	1 1/4"	3560T46	1.69
7/16"	3000	23/32"	1/2"	1 11/16"	3558T48	2.02	1 1/2"	3560T47	2.06
1/2"	4000	13/16"	5/8"	1 15/16"	3558T49	2.48	1 11/16"	3560T48	2.48
5/8"	6500	1 1/16"	3/4"	2 1/2"	3558T51	4.47	2"	3560T49	4.40
3/4"	10000	1 1/4"	7/8"	3"	3558T52	6.56	2 5/16"	3560T51	6.53
~~7/8"~~	~~13000~~	~~1 7/16"~~	~~1"~~	~~3 1/4"~~	~~3558T53~~	~~8.77~~	2 7/8"	3560T52	8.79
1"	17000	1 11/16"	1 1/8"	3 3/4"	3558T54	11.98	3 1/4"	3560T53	11.49
1 1/8"	19000	1 13/16"	1 1/4"	4 1/4"	3558T55	17.70	3 1/2"	3560T54	15.72
1 1/4"	24000	2"	1 3/8"	4 1/2"	3558T56	25.26	3 11/16"	3560T55	23.09
~~1 3/8"~~	~~28000~~	~~2 1/4"~~	~~1 1/2"~~	~~5 1/4"~~	~~3558T57~~	~~31.37~~	4 1/2"	3560T56	28.65
1 1/2"	34000	2 3/8"	1 5/8"	5 3/4"	3558T58	36.95	5"	3560T57	35.89
1 3/4"	50000	2 7/8"	2"	7"	3558T59	62.26	5 7/8"	3560T58	61.18
2"	70000	3 1/4"	2 1/4"	7 3/4"	3558T61	79.79	6 3/4"	3560T59	77.47

Wire Rope Bolt Opening Snatch Blocks

Application: These snatch blocks are primarily used in the oil industries, but they have many uses in plants and warehouses as well, for lifting and hoisting applications. Hook and shackle assemblies are quickly interchangeable on 6, 8, 10 and 12 diameter sheave sizes.
Features: Bolt opening feature permits insertion of wire rope while blocks are suspended. Bolt has a retaining spring to prevent it from falling off.

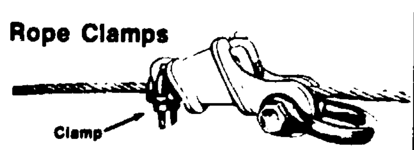
Equipped with pressure lube fittings. Side plates are designed to eliminate the possibility of rope jamming. Forged steel swivel hooks, yokes, sheaves and shackles. Light and medium duty snatch blocks have bronzed bushed sheaves. Heavy duty block has roller bearing sheaves.
These snatch blocks are available with hook or shackle mounted at top. The toggle block (tail board) is used to guide wire rope in different directions.

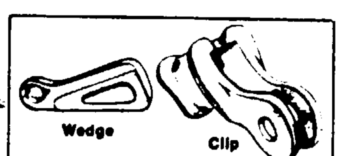

With Hook — With Shackle — Tail Board

Sheave Dia. In.	Wire Rope Size In.	Work Load Limit Tons	Snatch Block With Hook: Wt. Lbs.	No.	NET EACH	Snatch Block With Shackle: Wt. Lbs.	No.	NET EACH	Tail Board Block: Wt. Lbs.	No.	NET EACH
LIGHT DUTY BRONZED BUSHED WIRE ROPE SNATCH BLOCKS											
3	3/8	2	3	3197T11	$ 54.36	3	3197T21 ♦	$ 54.36	3	3197T31	$ 38.62
4 1/2	1/2	4	11	3197T12	102.91	12	3197T22	116.00	6	3197T32	62.36
6	3/4	8	26	3197T13	174.55	27	3197T23	199.82	15	3197T33	107.46
~~8~~	~~1/2~~	~~8~~	33	3197T14	208.00	~~34~~	~~3197T24~~	~~233.27~~	21	3197T34	143.09
10	3/4	8	41	3197T15	247.09	42	3197T25	275.09	29	3197T35	166.36
MEDIUM DUTY BRONZED BUSHED WIRE ROPE SNATCH BLOCKS											
6	3/4	12	40	3208T11	$268.97	48	3208T21	$310.34	24	3208T31	$172.76
8	3/4	15	51	3208T12	310.69	57	3208T22	350.00	30	3208T32	212.41
10	7/8	15	63	3208T13	377.59	69	3208T23	420.69	42	3208T33	276.38
HEAVY DUTY ROLLER BEARING WIRE ROPE SNATCH BLOCKS											
8	1 1/8	20	75	3215T11	$610.00	87	3215T21	$726.00	42	3215T31	$384.60
10	1 1/8	20	89	3215T12	724.00	101	3215T22	772.00	55	3215T32	460.00
12	1 1/8	20	103	3215T13	679.31	115	3215T23	888.00	70	3215T33	554.00

♦ Furnished with 1 1/4 ID swivel eye

Mid-Line Wire Rope Clamps





Material: Heat treated cast steel. **Special Feature:** Permits attaching a continuous cable without cutting the cable. Can be attached anywhere along a span of cable—anchor securely, yet can be removed easily, leaving the cable intact. **Uses:** Used for all types of cable pulling operations and rigging of cable operated machines. **Contents:** Consists of three parts—open top clamp body, locking wedge with eye end and wire rope clip. **How It Works:** To attach simply (1) Slip clamp body onto cable. (2) Insert wedge. (3) Lock wedge to cable by using the wire rope clip. (4) Tighten clip to torque values listed in specification table. Clamp remains locked until you choose to remove it. **Caution:** Wire Rope Clamp is designed for use with 6x19 right regular lay wire rope, either fiber core or IWRC. **Prices do not include shackle and pin.**

Wire Rope Dia.	Working Load Lbs.	Torque Ft. Lbs.	Pin Hole Dia.	Basket Throat Width	No.	NET EACH
3/8"	4,000	45	1 1/16"	9/16"	3487T14	$35.00
1/2"	7,000	65	1 1/16"	9/16"	3487T15	35.25
~~5/8"~~	~~11,000~~	~~95~~	~~1 1/4"~~	~~1 1/8"~~	~~3487T16~~	~~56.38~~
3/4"	15,000	130	1 1/4"	1 1/8"	3487T17	[illegible]
7/8"	21,000	225	1 5/8"	1 1/2"	3487T18	119.80
1"	27,000	225	1 5/8"	1 1/2"	3487T19	120.41
1 1/8"	35,000	225	1 5/8"	1 1/2"	3487T21	152.45
1 1/4"	43,000	360	2 5/8"	1 3/4"	3487T22	171.36

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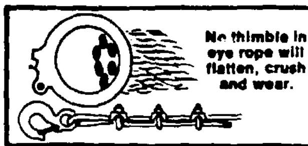
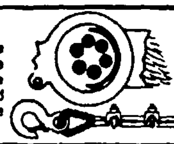
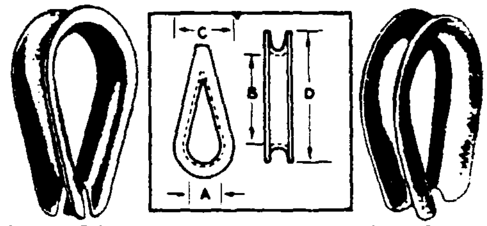
Wire Rope Thimbles



Thimble Use In A Wire Rope Eye

Important: With the exception of some slings all spliced eyes must incorporate rope thimbles to maintain rope strength and reduce wear. Connection efficiency can be reduced 10% if thimble is not used because rope flattens under load as shown in illustrations.





Standard Pattern **Heavy Pattern**

Material: Stamped carbon steel or stainless steel. **Finish:** Carbon steel is hot dipped galvanized. Stainless steel is polished. **Special Features:** Standard Pattern for light duty service. Heavy Pattern for heavy duty service. Stainless Steel used where corrosive atmosphere exist. Conforms to latest applicable Federal Specification No. FF-T-276.

Standard Pattern—Light Duty

Wire Rope Dia.	Eye Opening Width A	Eye Opening Lgth. B	Overall Width C	Overall Lgth. D	No.	NET EACH
1/8"	11/16"	1 3/16"	1 1/8"	1 13/16"	3494T11	$0.23
3/16"	11/16"	1 3/16"	1 1/8"	1 13/16"	3494T12	.23
1/4"	11/16"	1 3/16"	1 1/8"	1 13/16"	3494T13	.23
5/16"	13/16"	1 1/2"	1 1/4"	2 1/8"	3494T14	.28
3/8"	15/16"	1 5/8"	1 15/32"	2 3/8"	3494T15	.28
1/2"	1 1/8"	1 7/8"	1 3/4"	2 3/4"	3494T16	.31
5/8"	1 3/8"	2 1/4"	2 3/8"	3 1/2"	3494T17	.83
3/4"	1 5/8"	2 1/2"	2 11/16"	3 3/4"	3494T18	.96
7/8"	1 7/8"	3 1/2"	3 3/16"	5"	3494T19	1.49
1"	2 1/2"	4 1/4"	3 3/4"	5 11/16"	3494T21	1.69
1 1/8"-1 1/4"	2 3/4"	4 1/2"	4 3/16"	6 1/4"	3494T22	4.46
1 1/2"	3 1/4"	5"	5 3/8"	7 1/2"	3494T23	7.12
1 3/4"	4 1/4"	7 1/4"	7 1/4"	10 3/4"	3494T24	17.29
2"	4 1/4"	7 1/4"	7 1/4"	10 3/4"	3494T25	17.29

Heavy Pattern—Heavy Duty

Wire Rope Dia.	Eye Opening Width A	Eye Opening Lgth. B	Overall Width C	Overall Lgth D	No.	NET EACH
GALVANIZED CARBON STEEL						
1/4"	7/8"	1 5/8"	1 1/2"	2 3/16"	3495T14	$0.28
5/16"	1 1/16"	1 7/8"	1 13/16"	2 1/2"	3495T15	.43
3/8"	1 1/8"	2 1/8"	2 1/8"	2 7/8"	3495T16	.64
7/16"	1 1/4"	2 3/8"	2 3/8"	3 1/4"	3495T17	1.12
1/2"	1 1/2"	2 3/4"	2 3/4"	3 5/8"	3495T18	1.16
5/8"	1 3/4"	3 1/4"	3 1/2"	4 1/4"	3495T21	1.31
3/4"	2"	3 3/4"	3 3/16"	5"	3495T22	2.30
7/8"	2 1/4"	4 1/4"	4 1/4"	5 1/2"	3495T23	3.12
1"	2 1/2"	4 1/2"	4 11/16"	6 1/8"	3495T24	5.81
1 1/8"-1 1/4"	2 7/8"	5 1/8"	5 7/8"	7"	3495T25	7.59
1 1/4"-1 3/8"	3 1/2"	6 1/2"	6 15/16"	9 1/8"	3495T26	12.83
1 3/8"-1 1/2"	3 1/2"	6 1/4"	7 1/8"	9"	3495T27	22.78
1 5/8"	4"	8"	8 1/8"	11 1/4"	3495T28	26.28
1 3/4"	4 1/2"	9"	8 1/2"	12 3/16"	3495T29	32.22
1 7/8"-2"	6"	12"	10 3/8"	15 1/8"	3495T31	40.05
2 1/4"	7"	14"	11 7/8"	17 1/8"	3495T32	82.67
STAINLESS STEEL—TYPE 304						
1/4"	7/8"	1 5/8"	1 1/2"	2 3/16"	3495T44	$1.74
5/16"	1 1/16"	1 7/8"	1 13/16"	2 1/2"	3495T45	2.80
3/8"	1 1/8"	2 1/8"	2 1/8"	2 7/8"	3495T46	3.72
1/2"	1 1/2"	2 3/4"	2 3/4"	3 5/8"	3495T47	6.34
5/8"	1 3/4"	3 1/4"	3 1/8"	4 1/4"	3495T48	10.90
3/4"	2"	3 3/4"	3 3/16"	5"	3495T49	21.74

Type 316—Stainless Steel

Wire Rope Dia.	Eye Opening Width A	Eye Opening Lgth. B	Overall Width C	Overall Lgth. D	No.	NET EACH
3/32"	0.393"	0.590"	0.589"	0.866"	3868T21	$0.45
1/8"	0.393"	0.629"	0.651"	0.984"	3868T22	.58
5/32"	0.472"	0.708"	0.767"	1.062"	3868T23	.63
3/16"	0.511"	0.826"	0.845"	1.259"	3868T24	.73
1/4"	0.590"	1.023"	0.983"	1.496"	3868T25	.83
9/32"	0.748"	1.220"	1.181"	1.771"	3868T26	1.28
5/16"	0.866"	1.456"	1.377"	1.968"	3868T27	1.43
3/8"	0.944"	1.614"	1.495"	2.283"	3868T28	2.00
1/2"	1.141"	2.047"	1.810"	2.755"	3868T29	4.73

Wedge & Spelter Wire Rope Fittings

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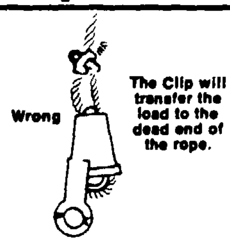
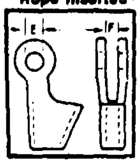
Wedge Sockets are among the simplest devices for anchoring a wire rope. They are intended for On-the-job attachment and for quick rope replacement. However, the efficiency of wedge sockets is only 70% of the strength of the rope if properly installed. Care must be taken that moving loads do not force the wedges out and accidental slackening of cable does not release the socket. Wedge socket should not be used on spin resistance ropes. When using a wedge socket it is good practice to start out with a longer rope than is required so that the socket can be renewed periodically without splicing the rope.

Zinc Spelter Sockets are efficient and permanent terminal attachments for wire rope. They are the most reliable of all terminal fittings and when properly applied are capable of developing 100% efficiency.



Open Wedge Sockets

Socket & Wedge With Rope Inserted



Material: Heat treated cast steel. **Special Feature:** Design permits quick means of securing and holding wire rope lines. Ideal for use where attachments must be changed frequently. **Uses:** Attaches to beams, shackles, rigging, etc. **How It Works:** Simply form wire rope end around the wedge, insert socket and pull tight. As line tension increases wedge is drawn tighter in its socket. May be adjusted or removed by tapping wedge out with a driftpin and hammer.

Note: 3/8" to 1" sizes available in extra heavy duty construction . . . **Prices On Request.**

Wire Rope Dia.	Inside Throat Opening F	Pin Hole Dia. E	Socket & Wedge No.	Socket & Wedge NET EACH	Wedge Only No.	Wedge Only NET EACH	Pin Only No.	Pin Only NET EACH
3/8"	5/8"	1 1/16"	3484T14	$21.55	3484T34	$ 2.05	3484T55	$ 2.32
1/2"	5/8"	1 1/16"	3484T15	21.55	3484T35	2.05	3484T55	2.32
5/8"	1 1/4"	1 5/16"	3484T16	25.93	3484T36	2.39	3484T57	4.77
3/4"	1 1/4"	1 5/16"	3484T17	35.00	3484T37	3.82	3484T57	4.77
7/8"	1 3/4"	1 5/8"	3484T18	48.68	3484T38	5.52	3484T61	6.14
1"	1 1/2"	1 5/8"	3484T19	61.16	3484T39	5.80	3484T61	6.14
1 1/8"	1 1/2"	1 5/8"	3484T21	89.93	3484T41	7.77	3484T61	6.14
1 1/4"	1 3/4"	2 1/8"	3484T22	138.27	3484T42	15.55	3484T63	15.68
1 3/8"	1 3/4"	2 1/8"	3484T23	141.14	3484T43	18.41	3484T63	15.68
1 1/2"	2 1/2"	3 1/8"	3484T24	188.18	3484T44	30.00	3484T67	40.23
1 5/8"	2 1/2"	3 1/8"	3484T25	188.18	3484T45	30.00	3484T67	40.23
1 3/4"	2 1/2"	3 1/8"	3484T26	502.43	3484T46	63.20	3484T67	40.23
2"	2 1/2"	3 1/8"	3484T27	502.43	3484T47	63.20	3484T67	40.23

Socket

Wedge

Pin

RECOMMENDED METHOD OF APPLYING **CROSBY CLIPS** TO GET MAXIMUM HOLDING POWER

1 Turn back the specified amount of rope from the thimble. Apply the first clip one base width from the dead end of the wire rope (U-bolt over dead end — live end rests in clip saddle). Tighten nuts evenly to recommended torque.

2 Apply the next clip as near the loop as possible. Turn on nuts firm, but do not tighten.

3 Space additional clips, if required, equally between the first two. Turn on nuts — take up rope slack — tighten all nuts evenly on all clips to recommended torque.

4 **NOTICE!**

Apply the initial load and retighten nuts to the recommended torque. Rope will stretch and shrink in diameter when loads are applied. Inspect periodically and retighten. The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.

Clip Size Inches	Minimum No. of Clips	Amount of Rope to Turn Back in Inches	Torque in Ft. Lbs
1/8	2	3 1/4	4.5
3/16	2	3 3/4	7.5
1/4	2	4 3/4	15
5/16	2	5 1/4	30
3/8	2	6 1/2	45
7/16	2	7	65
1/2	3	11 1/2	65
9/16	3	12	95
5/8	3	12	95
3/4	4	18	130
7/8	4	19	225
1	5	26	225
1 1/8	6	34	225
1 1/4	7	44	360
1 3/8	7	44	360
1 1/2	8	54	360
1 5/8	8	58	430
1 3/4	8	61	590
2	8	71	750
2 1/4	8	73	750
2 1/2	9	84	750
2 3/4	10	100	750
3	10	106	1200
3 1/2	12	149	1200

If a greater number of clips are used than shown in the table, the amount of rope turn-back should be increased proportionately.

ABOVE BASED ON USE OF GENUINE CROSBY CLIPS ON NEW ROPE.

The efficiency rating of a properly prepared termination for clip sizes 1/8" through 7/8" is 80% and for sizes 1" through 3" is 90%. This rating is based upon the catalog breaking strength of wire rope. If a pulley is used in place of a thimble for turning back the rope, add one additional clip.

The number of clips shown is based upon using right regular or Lang lay wire rope, 6 x 19 class or 6 x 37 class, fibre core or IWRC, IPS or EIPS. If Seale construction or similar large outer wire type construction in the 6 x 19 class is to be used for sizes 1 inch and larger, add one additional clip.

The number of clips shown also applies to right regular lay wire rope, 8 x 19 class, fibre core, IPS, sizes 1 1/2 inch and smaller; and right regular lay wire rope, 18 x 7 class, fibre core, IPS or XIPS, sizes 1 3/4 inch and smaller.

For other classes of wire rope not mentioned above, it may be necessary to add additional clips to the number shown.

IMPORTANT — FAILURE TO MAKE A TERMINATION IN ACCORDANCE WITH INSTRUCTIONS, OR FAILURE TO PERIODICALLY CHECK AND RETIGHTEN TO THE RECOMMENDED TORQUE, WILL CAUSE A REDUCTION IN THE EFFICIENCY RATINGS.