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CARRIAGE DESIGN AFFECTS THE PAYLOAD OF SKYLINE LOGGING SYSTEMS

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Loggers have known for several years that carriage type affects the capability of standing and live skylines. Lysons and Mann (1) divided these carriages into two types, clamped and unclamped. Analysis for clamped carriages assumed the mainline was slack during log pickup. Logs were raised to the carriage by an auxiliary line powered by a separate source entirely contained in the carriage. Analysis for unclamped carriages assumed the mainline did not assist in log pickup but did assist in supporting part of the log payload during inhaul of the carriage to the landing. The common flyer (2) is one such unclamped system. Carriages that do not clamp the skyline but use a haulback to maintain carriage position during log pickup can also be analyzed as unclamped carriages to yield a conservative estimate for payload capability.

The load-carrying capability of the skyline for the clamped carriage is less than for the unclamped, and the difference increases with the chord slope of the skyline. At very steep chord slopes, the allowable payload for the unclamped carriage can exceed the allowable payload of the clamped carriage by 30 percent or more because of assistance from the mainline.

With the rash of new carriages in recent years, the logging engineer often does not know in which category a particular carriage belongs. Many carriages, if not the majority, both clamp to the skyline and use the mainline to raise the load to the carriage. Arbitrarily labeling them as clamped carriages could substantially underestimate their allowable payloads.

The traditional clamped carriage is shown in Figure 1, unclamped carriage in Figure 2, and the carriage with both clamp and active mainline in Figure 3.

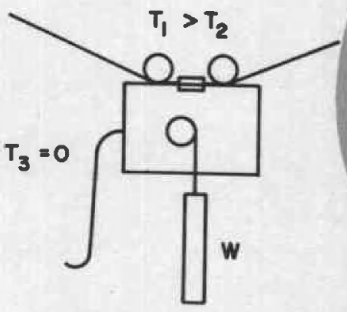

Figure 1. Clamped carriage. Line tension in the left skyline segment is T^1, in the right segment is T^2, and in the mainline is T^3. W is the log load.

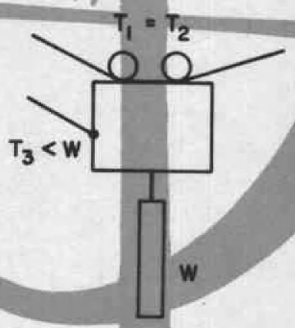

Figure 2. Unclamped carriage.

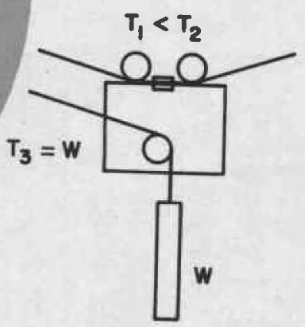

Figure 3. Clamped carriage with active mainline.

Analysis of the three carriages, assuming weightless lines and negligible carriage weight, supports the work by Lysons and Mann (1) that traditional clamped carriages have lower allowable payloads than unclamped carriages. More important, however, is the fact that analysis shows the carriage with clamp and active mainline has the same allowable payload as the unclamped carriage, if the yarder is at the upper end of the skyline, and the same allowable payload as the clamped carriage, if the yarder is at the lower end of the skyline. Of course, after the logs are locked in place and the carriage begins inhaul, all three carriages can be classified as unclamped, but the log pickup activity is what limits allowable payload.

Table 1 shows the gross payload as a fraction of allowable skyline tension for various chord slopes and midspan deflections. Negative chord slopes indicate the yarder is at the lower end of the skyline and positive slopes indicate the yarder is at the upper end of the skyline. Note that these results are uncorrected for line weights and are for illustration only.

In conclusion, this general rule can be stated: any carriage that uses the mainline to raise the logs directly to the carriage can be classified as an unclamped carriage in the skyline payload analysis if the yarder is at the upper end of the skyline and as a clamped carriage if the yarder is at the lower end of the skyline. I hope this note will simplify carriage identification and permit more realistic estimates of skyline capability.

LITERATURE CITED

1. LYSONS, H. H. and C. N. MANN. Skyline Tension and Deflection Handbook. U.S. Dep. Agric., For. Serv., Pac. N.W. For. and Range Exp. Stn., Res. Pap. PNW-39. 41 p. 1967.

2. STUDIER, D. D. and V. W. BINKLEY. Cable Logging Systems. U.S. Dep. Agric., For. Serv., Div. of Timber Management. Reprinted by O.S.U. Book Stores, Inc. 204 p. 1974.

Table 1. Gross Payload for Three Carriage Designs at Various Skyline Chord Slopes and Midspan Deflections (lines are considered to be weightless).

Chord slope	Midspan deflection	Payload/skyline tension		
		Clamped carriage	Unclamped carriage	Clamped carriage with active mainline
%	%			
-80	5	0.1487	0.1638	0.1487
-80	10	.2828	.3430	.2828
-80	15	.4036	.5367	.4036
-60	5	.1638	.1789	.1638
-60	10	.3123	.3714	.3123
-60	15	.4460	.5747	.4460
-40	5	.1789	.1916	.1789
-40	10	.3430	.3922	.3430
-40	15	.4915	.5970	.4915
-20	5	.1916	.1990	.1916
-20	10	.3714	.4000	.3714
-20	15	.5367	.5970	.5367
0	5	.1990	.1990	.1990
0	10	.3922	.3922	.3922
0	15	.5747	.5747	.5747
20	5	.1916	.1990	.1990
20	10	.3714	.4000	.4000
20	15	.5367	.5970	.5970
40	5	.1789	.1916	.1916
40	10	.3430	.3922	.3922
40	15	.4915	.5970	.5970
60	5	.1638	.1789	.1789
60	10	.3123	.3714	.3714
60	15	.4460	.5747	.5747
80	5	.1487	.1638	.1638
80	10	.2828	.3430	.3430
80	15	.4036	.5367	.5367