

Cable Logging Systems in Japan

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In Japan, the forest land covers about 25 million ha, equivalent to 68% of the total land area. According to a spot-sampling survey on a nation-wide scale, flat and gentle slope forest land occupies about 30% of the total forested area, and the remainder is more than 15° in gradient. And major timber stands are largely distributed in the mountainous regions. Consequently, the cable logging systems are more frequently and successfully used for hauling logs out of the forest than any other logging methods in the country.

A steam skidder was introduced for the first time into Kiso Forest in Nagano from the United States in 1920. In 1921, the first Japanese-made skidders were manufactured in Tokyo. From that time, the use of the cable logging methods was extended gradually to large-scale logging sites in the national forest. After the war, as steady progress in the forest mechanization was made, the cable logging techniques also took a new step forward. The Wyssen skyline crane was introduced in 1951, and the new cable logging systems such as the Kumamoto system and the Japanese mono-cable system were developed successively. In the late 1950's, the tree-length yarding and full-tree yarding were performed, and the long-distance skylines and the curved skylines were enthusiastically carried out.

Such remarkable progress in the cable logging techniques resulted in enlarging the unit area of clear-cutting, and public denunciation of clear-cutting became stronger eventually. In order to cope with such a serious situation, several promising alternatives for the selective cutting, the partial

cutting or the small-area clear-cutting have been developed since the late 1960's.

Classification of cable logging systems

There are many types of cable logging systems in Japan, numbering over 120 systems. Those developed in recent years, however, are too varied and complicated to be classified according to the traditional basis. For the convenience of identification and dissemination of techniques, ten basic systems are chosen as follows according to the configuration and rigging used: the Tyler system, the North Bend system, the Kumamoto system, the hoist yarding system, the slack-line system, the aerial snubbing system, the Dunham system, the running skyline system, the mono-cable system and the high-lead system. In accordance with the new classification criteria, almost all of more than 120 systems can be classified into ten groups systematically.

Cable logging operation

Japanese cable logging systems are distinguished by that the continuous or endless operating lines driven by the spool-type drum of the yarder are very often used, as well as that, when a cable logging system is set up, a "guide" tree is almost always selected in front of the yarder and rigged up in the same way as the head tree except the skyline block. A cable logging system is commonly operated by a crew of three to five men; one operator, one or two chocker setters,

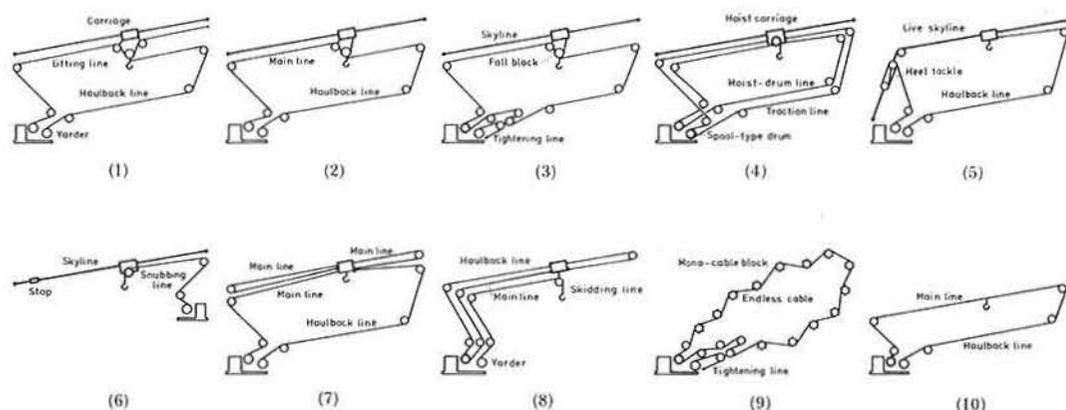


Fig. 1. Basic cable logging systems

(1) Tyler system. (2) North Bend system (downhill type). (3) Kumamoto system. (4) Hoist yarding system. (5) Slack-line system. (6) Aerial snubbing system. (7) Dunham system (Japanese form). (8) Running skyline system. (9) Mono-cable system. (10) High-lead system.

Table 1. Average daily output and turn volume (m^3)

		Clear-cutting	Selective cutting	Thinning
Skyline system	Daily output	32.3 (6.6)	21.9 (5.0)	*
	Turn volume	1.14 (0.62)	0.90 (0.35)	*
Non-skyline system	Daily output	19.7 (4.0)	19.1 (2.8)	—
	Turn volume	—	—	—
Mono-cable system	Daily output	*	20.2 (2.6)	8.9 (2.6)
	Turn volume	*	0.44 (0.11)	0.13 (0.04)

1) Figure in brackets indicates standard deviation.

2) Skyline system includes Tyler system, North Bend system, Hoist yarding system, and Kumamoto system.

3) Non-skyline system represents only running skyline system in this table.

and one or two unhookers. In the case of tree length yarding, one or two chain-saw men are added for bucking the yarded trees at the landing. Setting-up and dismantling the cable system are managed by the same crew members.

The operating efficiency of the cable logging system depends to a great extent upon the cutting systems, the timber volume per hectare and single tree volume. Table 1 approximately shows the average daily outputs and the average turn volumes by cutting systems and cable logging systems. The daily output of a modified skyline system for the

selective logging generally decreases by about 20% as compared with that of the ordinary one.

New cable logging systems

Many unique cable logging systems suitable for the selective cutting or partial cutting in mountainous regions have been developed in Japan.

For the traditional skyline systems having a haulback line such as the Tyler system and the downhill North Bend system, the effective methods of restricting the passage of the

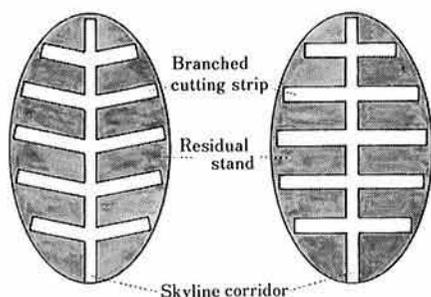


Fig. 2. Branched cutting strips

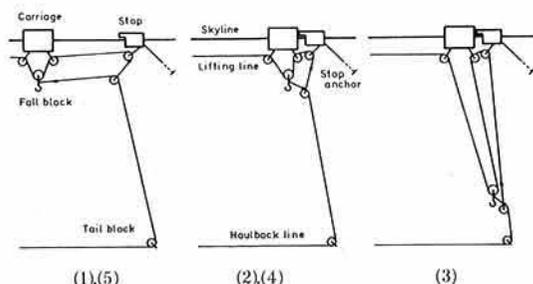


Fig. 3. Modified Tyler system for branched strip yarding

- (1) Carriage outhaul;
- (2) Pull fall block laterally;
- (3) Hooking logs to fall block;
- (4) Lateral skidding to carriage;
- (5) Carriage inhaul.

haulback line have been developed to prevent damage to the residual stand or young growth; the one in which the movement of the haulback line is restrained by the tension of the lifting line, the one by an additional control line, the one by special equipment, the one by an additional pullout line, and so on. These contrivances have made it possible to yard the branched cutting-strips crossing a skyline corridor as shown in Fig. 2.

For example, the modified Tyler system shown in Fig. 3 is the most popular skyline system for yarding the branched strips. In the system, the lifting line runs from the carriage back through the lifting-line block attached to a stop riding on the skyline and hung down. A guide block is attached to the end of the lifting line. The stop can be moved to any point desired on the skyline by man power and anchored backward to a stump. The haulback line runs from the fall block back through the guide block attached

to the end of the lifting line, down through the tail block, then forward through several blocks to the haulback drum of the yarder. A traction line is added to the system so as to hold on the carriage steadily when lateral yarding is conducted.

The comparatively modern cable logging system which has a skidding line or a hoist line, such as the hoist yarding system, the aerial snubbing system, the running system or the simplified North Bend system, is technically applicable to the selective cutting or thinning. Among them, the running skyline system and the simplified North Bend system are more frequently employed on the selective logging locales.

The mono-cable system is the developing but promising cable logging system for selective cutting in mountainous regions. Generally, it consists of an 8–14 mm endless cable, more than twenty open-side blocks, and a yarder equipped with one spool-type drum and one ordinary drum. The endless cable is suspended on many mono-cable blocks attached to standing trees at intervals of 10–50 m along the yarding path. The weight of the turn is 100–400 kg, and two or more turns are transported at regular intervals. The total length of the endless cable sometimes reaches over 1,500 m. The Japanese mono-cable system differs from the European ones in that the open-side blocks are hung on the standing trees with flexible wire ropes instead of rigid equipment, and that the hanging ropes are used for attaching choked logs to the endless cable. Recently, the lateral yarding has been successfully carried out with the mono-cable system additionally equipped with a pull-out line.

Detailed explanations of the thirty-nine typical cable logging methods, including the ones applicable for the selective logging, are given with the aid of illustrations.

Reference

- 1) Konuma, J. & Shibata, J.: Cable logging systems in Japan. *Bull. Gov. Forest Exp. Sta.*, No. 283, 117–174 (1976).