Logging Roads in Japan

By Mitsumasa FUKUDA

Forest Mechanization Division, Forest and Forest Products Research Institute
(Kukizaki, Inashiki, Ibaraki 305 Japan)

Logging roads in forests of Japan have a great diversity ranging from the multi-purpose trunk roads constructed in the form of connecting lines along the ridgelines of, or over the mountain peaks, main or arterial roads, and feeder roads directly related to various works of forest enterprise such as forest management, afforestation, tending, felling and logging, to the extremely simple roads made by only stripping the ground surface and compacting with motor vehicles. Consequently, geometrical structures as observed in the alignments of the roads and their cross-sectional structures, including road surface, subbase, roadbed, are designed and constructed in a large variety of ways by taking into consideration the balance between the cost of construction and the anticipated economic benefits, their function and safety. In recent years, effects of road construction on the environment is also taken into account. There are various different types of roads depending on the anticipated features of traffic such as traffic volume, kinds of vehicle, weight (tons) of load on vehicle, speed (km/hr) of traffic, etc.

There are also all-weather type roads which can be used all the year round, seasonal type roads used only during the summer or winter, and temporary roads to be used for a certain purpose only for a certain short period and abandoned after the use. No matter what types of roads they are, they have to meet the following requirements: they must cost as little as possible, they must continue to function to fulfill the purposes for which they are constructed, and they must have adequate durability during the period of utilization so long as they are used appropriately as forest roads.

The forest roads are classified systematically by the forestry administration into categories each of which is given a special term or name.

Widths of forest roads by the category

Roads for the development of the large scale forest spheres are 5.0 or 7.0 m wide, and the roads for the development of specified forest region, i.e., super forest roads, are 4.6 or 5.0 m wide. The roads of these two categories are constructed and managed by the Forest Development Corporation. Wide-sphere trunk forest roads have a width of 4.0 or 5.0 m, ordinary forests roads are either 3.0, 4.0 or 5.0 m wide, forest roads built as a compensation for tax payed on volatile oil used for agriculture, forestry and fisheries are either 3.0, 4.0, or 5.0 m wide, forest roads for structural improvement of forests, forest roads for developing mountain villages, forest roads built as a relief of the unemployed, and forest roads to prevent depopulation of remote areas are all 3.0–4.0 m wide.

In contrast to the above-mentioned roads in private forests, main roads in national forests are 3.6–4.0 m wide (standard: 4.0 m), and national forest work roads are 3.0–4.0 m wide (standard: 3.6 m).

The current stipulations concerning forest roads, revised in 1973, provide that the first-class automobile roads are to be 5.0 m in width (design speed: 30–40 km/h), the second-class automobile roads should be 4.0 m wide (20–30 km/h), the third-class automobile roads, 3.0 m wide (20 km/h), light car roads, 2.0–3.0 m wide, and both horse roads and sledge roads are to be 1.8 m wide. At present, the majority of them are automobile roads, and horse roads and sledge roads are scarcely used.

These stipulations provide, moreover, that the surface of forest roads should, except for

Plate 1. Multi-purpose trunk road (simplified pavement)

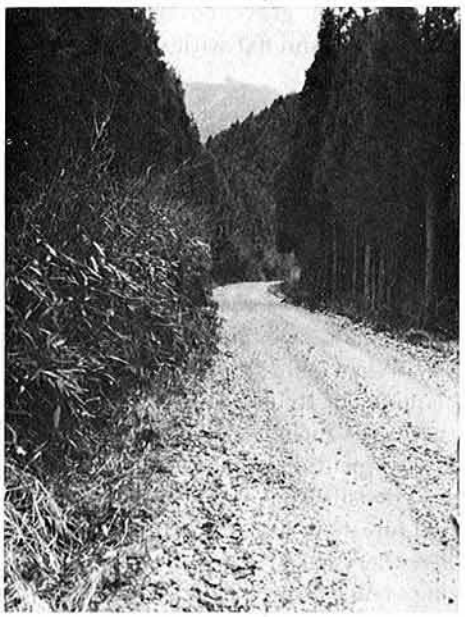

Plate 2. Main or arterial road through forest (gravel road)

Plate 3. Feeder road through forest (gravel road)

Plate 4. Spur or skidding road (soil road)

special cases, be gravel-covered and finished uniformly plane and flat with sufficient supporting strength.

Nationwide average density of forest roads

Average density of forest roads is said to be about 3 m/ha in forests owned by private enterprise and approximately 4 m/ha in national forests. When subsidiary truck-working spur road, equivalent to forest road, and high density road networks in national forests are added to the roads mentioned above, the nationwide average density covering both private and national forests is 10–11 m/ha as of 1974.

When the type of logging system is that of utilizing trucks on plane forest lands, the standard density of forest roads is 30–40 m/ha.

For the type of utilizing tractors on forest lands with natural inclination of 15° or less, it is 20–30 m/ha, whereas in the case of using intermediate-distance skyline wirings (250–500 m long) at an inclination of 15–30°, it is said to be 10–20 m/ha.

These densities of forest roads are decided on the basis of the main systems of forestry works, which are regarded as usually adoptable at present in our country. If, in forest land with a natural inclination of 15–30°, a work system by the use of tractor, such as the type of utilizing tractors on forest land with a natural inclination of 15° or less is attempted to employ instead of an intermediate-distance skyline wiring, the road density must be designed to be 20–30 m/ha, by taking into account the tractor's travelling capacity, its capability of operation, and the need of work road which can replace the role of the skyline wiring. Thus, the standard of the road density in this case must be set at 20–30 m/ha, by including the work road. In the standard density of forest roads is not included the access road connecting the forest region with the community or market.

Conceptual difference between forest roads in a narrow sense and spur roads

Trunk roads and access roads are not subject to any legal stipulations concerning the road itself like the Road Act, but are subject to regulations regarding state subsidies stipulated in the Forest Act. Their standards and structures are stipulated by rules and regulations concerning forest roads and the accompanying technical standards. They are, so to say, standard properties guaranteed semipermanently with a period of depreciation of 20–30 years. They are the object of fixed capital investments. In their functions as such they are strongly characterized as being similar to traffic roads.

On the other hand, for the spur roads, which are branched from trunk roads to form highly dense networks, and directly related to various forest works, standards and structures equivalent to those required for the trunk roads are applied. Some types of spur roads are entitled to be eligible for receiving subsidies, but others are compelled to be built and maintained at lower costs. Consequently, they are utilized at the maximum possible level of function, barely maintaining the minimum of safety. For this reason their structural makeup is expedient, liable to be non-standardized. It is said that they last for 2–3 years, or 7–8 years, but in the strict sense, their period of depreciation is not really guaranteed. They are trodden roads, requiring continuous inspection and repair for the maintenance.

They are simply temporary structures, to which circulating capital is invested, and are exclusively of character and function of a work track, so that their width and other items in designing can not be standardized by regulations.

Pavement of logging roads

Like the developmental process followed by farm roads, the time is likely to come in a very

near future when people in general take it for granted that roads through forests should be paved based on the sense that not only safety and comfort are required for the traffic on the roads but also from the stand point of maintenance and management of the roads. Difference of the pavement of forest roads from that of national highways and prefectural roads is that the former deals with mostly soil stabilization treatments with soil-cement or lime-mixtures.

Although economic aspect is not neglected, it is more desirable to construct the roads which are closer to the all weather type, and have such a cross section which can support heavier load of vehicles in traffic, and less affected by natural conditions like weather. The subsidy to pavement of forest roads was approved in 1971: two years after it was approved to farm roads. This was initiated from the need to prevent and reduce damages of houses and crops caused by flying stones, sand, and dust. Pavement is practiced in compliance with the standards provided in "the outline of cement and concrete pavements", "the outline of asphalt pavements", and "the outline of simplified pavements", all edited and issued by the Japan Road Association.

A large number of forest roads are found today paved actually either partially or totally on steep slopes, on extremely erodible soils, and along sharp curves, to ensure safety of traffic and better maintenance and management of the roads. As long as human activities are directed toward forests, the forest roads are needed as an infrastructure for our approach. The general future tendency of forest roads will be chiefly toward the maintenance of forests, while they will be used in parallel for forestry production as well. It appears to be essential in the future that all the forest lands in the country should be divided into different regions on the basis of different handling of forests, and road networks well adapted to each regions and matched with actual local circumstances should be worked out even if it requires a long period of time.

References

1) Fukuda, M.: Road and paths through forest land in Japan. Text for group training course in afforestation techniques and administration, 1–4 (1978).
2) Matthews, D. M.: Cost control in the logging industry. Mcgraw-Hill Book Company, New York & London, 374P. (1942).
3) Raynor, C. W.: Practical logging roads for efficient operational use. Proc. Fifth World Forestry Congress, 3, 1918–1921, Univ. of Washington, Seattle, Washington, U.S.A. (1960).

(Received for publication, October 25, 1980)