JUNE 2004

225

MPOB TT No. 218

CABLEWAY SYSTEM FOR OIL PALM FFB EVACUATION

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MPOB INFORMATION SERIES ISSN 1511-7871

Malaysia is facing an acute shortage of agricultural land. One of the alternatives is to go for marginal areas such as hilly land and peat. Through R&D, these areas can be cultivated with oil palm with good returns in spite of high development cost.

In the hilly areas, oil palm planted on terraces is much easier to reach by machine than those without terrace. Small machines with a capacity of 500 kg to 600 kg have been found suitable. As terraces are generally narrow, thus bigger machines are unable to move on the terraces. In sandy and young soils as in Sabah terracing is not possible, thus the use of cableway system as an alternative.

While for peat area, it was reported that the total area under peat in Malaysia stands close to 2.8 million hectares. The biggest peat area is in Sarawak comprising over 1.6 million hectares. The balance is found in peninsular, over 800 000 ha and Sabah 86 000 ha. The inherent physical and chemical properties of peat make its development for agricultural use difficult. Apart from that, peat has a low ground bearing pressure. For such area, it needs a vehicle that exerts a low ground pressure. Machines using high flotation tyres or tracks have a good potential to be used in peat soil area.

Most plantations in the inland areas have palm on steep hills. Some of the areas have hill locks isolated in the estate, which are difficult to access especially during wet weather. The use of cableway is one way of accessing to these areas as the load is not on the ground but above the ground.

THE SYSTEM

A cableway system was developed by MPOB in collaboration with Sime Kubota Sdn Bhd. This system had several major components such as mainline cable, hauling cable, FFB bin, pylons and chain block (*Figures 1* and *2*).

The distance between pylons was 150 m to prevent excessive sagging of the mainline and hauling cables. The hauling cable was attached to a pulley system that carried a chain block which was attached with the FFB bin. The movement of the FFB bin was by hauling cable that was wound to a drum attached to the prime mover. The prime mover can either be placed at the top or base of the hill slope. This FFB container stopped at the terrace where FFB from

Figure 1. The cableway system: pylon, power unit, chain block and bucket.

ISSN 1511-7871
9 771511 787001
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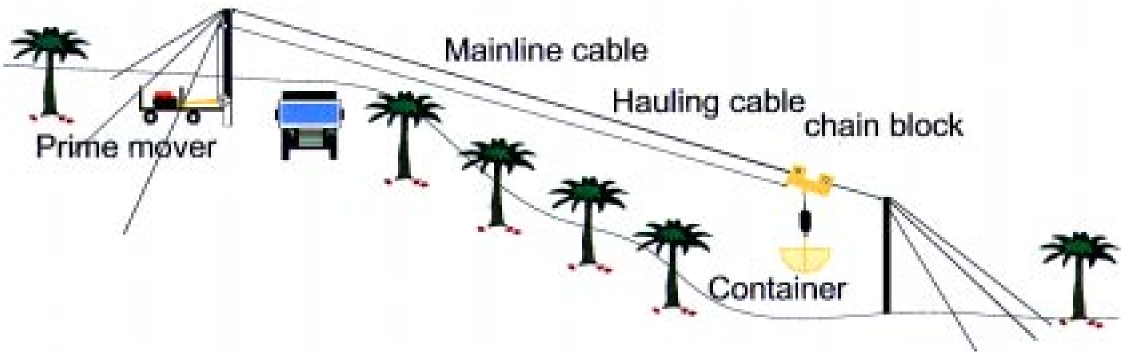

Figure 2. Cableway system in slope area.

TABLE 1. GENERAL SPECIFICATION OF THE CABLEWAY SYSTEM

Prime mover	Diesel engine (5 hp)
Mainline cable	12 mm (diameter)
Hauling cable	6 mm (diameter)
Loading capacity	500 kg
Gradient	60°
Max. distance between two pylon	150 m

that terrace were collected. The chain block was used to adjust the bin height for easy loading of FFB. When the FFB bin reaches the unloading area (which can either be at the top or bottom of the slope), the bin is opened at the base so that the FFB falls into a waiting lorry that would take the FFB to the estate ramp or to the mill (*Figures 3* and *4*).

ADVANTAGES

The cableway offers the possibility of access to the whole plantation with an unmanned transport system. Besides that, the cableway transport system also offers various advantages such as:

1. The cable lines can be installed for slopes up to 60°. With a cable line, which connects the hill locks, the fruits can be brought to any sides of the cableway.
2. The drive unit has low power requirement (5 hp) as compared to the power needed by any road transports such mini-tractor (30 hp – 35 hp).
3. The system is not only for FFB transportation but can also be utilized for transporting other products such as fertilizer and other field produce and inputs.

Figure 3. Bucket moving on the cable without FFB.

Figure 4. Bucket moving on the cable with FFB.

COMPARISON ON COST EFFECTIVENESS BETWEEN A NEW ROAD BUILT AND ITS MAINTENANCE VS. CABLEWAY SYSTEM

Assumption:

Area coverage used cableway system: 100 ha
Total distance: 8 km (8000 m)
Yield palm: 4 yr (1st harvesting round)
Average yield: 21.26 t ha^{-1}
Period of seven years

Conventional road (laterite)

Road building cost	= RM 30 m^{-1}	
	= RM 30 x 8000 m	= RM 240 000
Road maintenance cost	= RM 5 m^{-1} yr^{-1}	
	= RM 5 x 8000 m	= RM 40 000 yr^{-1}
Total cost (road building and maintenance) for seven years		= RM 280 000
Average cost (road building and maintenance)/seven years		= RM 280 000/7
		= RM 34 286 yr^{-1}
Cost per tonne (year 1)	= RM 34 286/1128	= **RM 30.40 t^{-1}**
(1st year – free maintenance)		
Cost per tonne (year 2)	= RM 34 286 + RM40 000/1758	= **RM 42.26 t^{-1}**

Cableway system

Cost of the system:

- Driving-unit: RM 20 000 unit^{-1}
- Cable, pylon *etc* : RM 12 000/100 m

Cost to install cable system	= RM 120 m^{-1}	
	= RM 120 x 3000 m	= RM 360 000
Cost prime mover		= RM 20 000
Cost R&M (cable and prime mover)	= RM0.50 m^{-1} yr^{-1}	= RM 1 500
Total cost (cable and prime mover) for seven years		= RM 380 000
Average cost (cable and prime mover) for seven years		= RM 380 000/7
		= RM 54 286 yr^{-1}
Cost per tonne (year 1)	= RM 54 286/ 1128	= **RM 48.12 t^{-1}**
(1st year – free maintenance)		
Cost per tonne (year 2)	= RM 54 286 + RM 1 500/1758	= **RM 31.73 t^{-1}**

CONCLUSION

With the cableway system there is a possibility of access to difficult areas especially during the wet season where no wheeled transport could reach. As the moving path of this system is minimal, maintenance cost is minimal compared to road system. It was calculated that over seven years of usage, the total and maintenance cost for cableway system are 19% and 96% lower than conventional road, respectively (*Figure 5*). The space required for this system is minimal, as it can be between the palm rows, thus tall palm stand can be achieved. This system can be applied to flat areas for the mainline road.

TABLE 2. COMPARISON ON COST EFFECTIVENESS BETWEEN NEW ROADS BUILT AND MAINTAINED THE CONVENTIONAL WAY AND A CABLEWAY SYSTEM

No. of year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
t yr^{-1} *	1 128	1 758	2 133	2 388	2 459	2 510	2 510	14 886
Conventional road								
Road built (RM)	34 286	34 286	34 286	34 286	34 286	34 286	34 286	240 000
Road maintenance (RM)	Free R&M	40 000	40 000	40 000	40 000	40 000	40 000	240 000
Total cost (RM)	34 286	74 286	74 286	74 286	74 286	74 286	74 286	480 000
Cost t^{-1} (RM)	30.40	42.26	34.88	31.11	30.21	29.60	29.60	32.25
Cableway system								
Cable and driving-unit (RM)	54 286	54 286	54 286	54 286	54 286	54 286	54 286	380 000
Maintenance (RM)	Free R&M	1 500	1 500	1 500	1 500	1 500	1 500	9 000
Total cost (RM)	54 286	55 786	55 786	55 786	55 786	55 786	55 786	389 000
Cost t^{-1} (RM)	48.12	31.73	26.15	23.36	22.69	22.22	22.22	26.13

* Source: Lahad Datu Station.

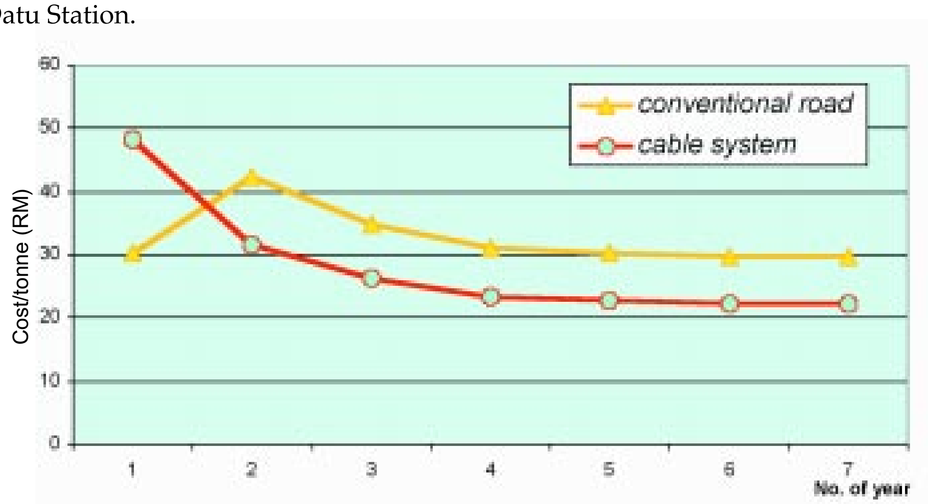

Figure 5. Comparison on cost per tonne between new road built by the conventional way and a cableway system.

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