

# **A Chute System Integrated with Mobile Winch and Synthetic Rope to Extract Logs in Mountainous Regions**

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## **Abstract**

In current log chute extraction applications in Turkey, the system has been generally tested in down-slope transportation of wood products by gravity. These applications indicated that the system needs to be improved in various points. In this study, a chute system integrated with mobile winch was evaluated for controlled sliding of the wood-based products into downhill direction and for pulling them to uphill direction. Besides, synthetic ropes were used in pulling the products which is to lower the weight of the system, comparing with steel cables used in current applications. The system was tested on a sample wood extraction operation in Kahramanmaraş Forest Enterprise Directorate to evaluate its performance. In the concept of this study, work organization and work safety issues were also addressed in terms of productivity and security of the system. The results indicated that the chute system equipped by a mobile winch and synthetic rope can be productive, practical, safe, and efficient alternative for extracting wood products.

**Keywords:** Wood extraction, chute system, mobile winch, synthetic rope

## **Introduction**

The system of extracting woods on plastic chutes has been implemented in numbers of logging applications in Turkey. Chute system is usually manufactured by polyethylene plastic materials which are consecutively connected to each other in certain lengths and half-circle shape (Acar et al., 2002; Akay et al., 2013). Based on these studies, chute system provides important advantages such as low operation cost, reduced environmental damages, and minimum value loss of the transported wood products (Gumus and Acar, 2002; Acar and Unver, 2009).

In previous chute system application, the system has been used for downhill transportation of wood products. This system is found to be more practical and efficient alternative than traditional methods used for timber extraction in Turkey (Eroglu et al., 2007). However, gravity-based system is not capable of extracting timber at uphill direction. Besides, some difficulties (value loss and stand damage) occur when transporting large size logs even at downhill slope especially in steep terrain. In this study, a chute system integrated with mobile winch was evaluated for controlled sliding of the wood-based products at downhill slope and for pulling them to uphill direction. The chute system integrated with mobile winch was implemented in Kahramanmaraş Forest Enterprise Directorate to test its performance.

## **Material and Methods**

### ***Mobile Winch***

The mobile winch used in this study was PCW5000 winch with Honda GXH-50cc engine. Pulling capacity was 1000-2000 kg depending on the rope configuration. The winch operates with 10-20 mm diameter synthetic rope. During logging operation, system requires

additional equipment such as chain choker, polyester choker, metal locks and hooks. Polyester choker is used to set the winch up on an appropriate tree stem or stump with sufficient strength. The weight of the winch is 16 kg, so that winch, synthetic rope and other system equipment can be easily carried on a backpack by a worker (Figure 1).



Figure 1. Mobile winch, synthetic rope and other system equipment

### **Pulling of the Wood-Based Products at Uphill Slope by Mobile Winch**

Extraction of the forest products can be performed by pulling them up within the chute system using mobile winch. This system provides economic and ecological solution to logging problems at steep terrain where forest products are to be transported from valleys to uphill landing areas (Figure 2). The sample applications indicated that using chute system in such areas significantly decreases residual stand damage and soil disturbances. The time spent on move-in and move-out activities for the chute system can be considerably higher in current methods. However, these activities can be completed in reasonable time in chute system integrated with mobile winch since mobile winch can be used to set up the system.



Figure 2. Pulling of the Wood-Based Products at Uphill Slope by Mobile Winch

### **Controlled Sliding of the Wood-Based Products at Downhill Slope by Mobile Winch**

Forest products with small size slide within the chute system downhill direction by gravity. However, sliding speed of the product can increase rapidly as size of the products increases and ground slope gets higher. This causes forest products to jump out from the chute system along the alignment or to leave the chute system at the end with very high speed. In both cases, residual trees along the system are subject to injuries and/or forest products loss their economic values. Besides, these uncontrolled conditions threat workers safety, damage the chute system and cause extra maintenance time and cost. In order to avoid such problems, controlled sliding of the forest products with large diameter can be implemented on steep terrain by using mobile winch and synthetic rope, integrated with chute system (Figure 3). By using mobile winch, forest products slide into plastic pipes without causing damages on the residual trees, losses on economic value of the products, and risks on workers safety.



Figure 3. Controlled Sliding of the Wood-Based Products at Downhill Slope by Mobile Winch

### Conclusions and Suggestions

In recent decades, chute systems have been used during extraction of forest products in Turkey, especially into downhill direction by gravity. There are only few attempts to use chute systems for uphill transportation of the products. This paper presents the first study where a chute system integrated with mobile winch and synthetic rope was implemented for controlled sliding of the wood-based products into downhill direction and for pulling them to uphill direction in Turkey. The results from the sample applications revealed that extraction of forest products to uphill direction within the chute system integrated with mobile winch can be an effective, economic, ecological, and safe method. It is highly anticipated that this new chute system will be an important alternative to current logging methods. The main advantages of this system are listed below:

- It is low-cost system due to lower fuel consumption
- It has high production rate for small scale forestry activities
- It minimizes stand damage on forest soil and residual trees
- It can be implements on steep and difficult terrain conditions
- The system components (winch, rope, and other equipment) can be carried easily
- The move-in and move-out activities do not take very long time
- This system provide safe working environment

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