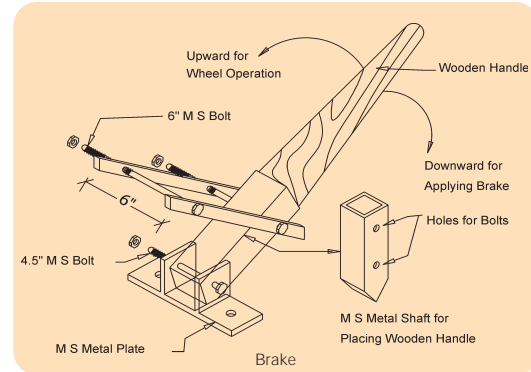
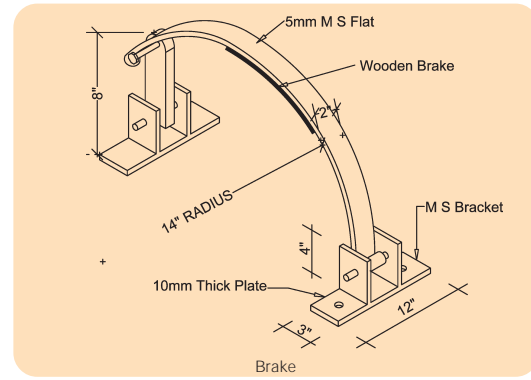


Brake System

FUNCTION The brake system is used to control the speed of the trolley during landing at the down platform by applying force to the handle. It consists of brake strips connected with the fixed support at one end and connected to the brake handle at the other end.

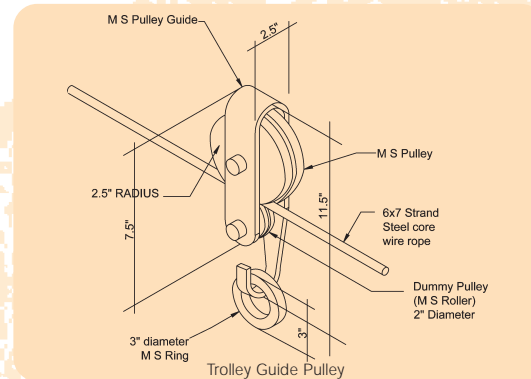
Diagram with components & specifications >>



Trolley Guide Pulley System

FUNCTION The trolley guide pulley system guides and provides cushioning effect to the support wire rope and converts gravitational force into kinetic energy. The system consists of pulley guide and dummy pulley attached to the supporting channel. Between these two pulleys the wire rope slides. The ring connected to the trolley hanger is also attached to these pulleys.

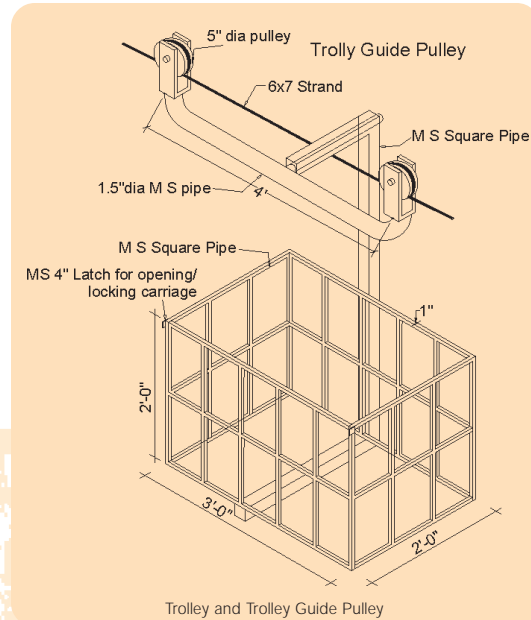
Diagram with components & specifications >>



Trolley

FUNCTION Trolley is made from the mild steel (MS) pipes with a hanging trolley box for loads. The flexible supporting hanger is connected to the guide pulley system. Its weight should be as light as possible with approximate value of around 30 kg. The center of gravity of the trolley should be balanced during operating condition.

Diagram with components & specifications >>



Support and Control Wire Rope

SPECIFICATIONS

- 6x7 strand steel core F 10-12mm wire rope for support cable
- 6x7 strand jute core F 8-10mm wire rope for control cable
- The factor of safety should be at least 3 or more

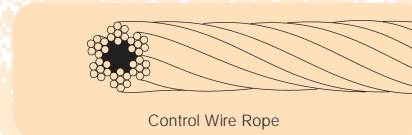
$$T = \frac{((2 \cdot W + w \cdot L + Ww \cdot L) \cdot l) / (8 \cdot b)}{\cos \beta}$$

where,

T = Total load on the cable
W = Weight of loaded trolley (kg)
Ww = Wind load factor (kg/m²)
w = specific weight of wire rope (kg/m²)
β = cable inclination with saddle point
L = $l [1 + 0.5 \cdot \{ (h / l)^2 \} + 8/3 \cdot \{ (b / l)^2 \}] + L_b$
h = Vertical distance
b = $l \cdot h / (8 \cdot e \cdot 4^1)$

where,

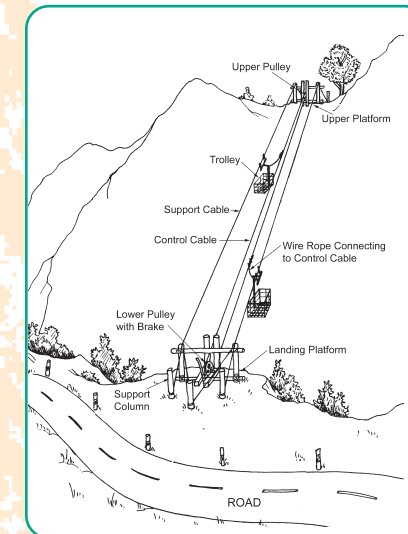
L = Total length of the wire rope
b = Sagging at mid-way from highest point
e = Lowest point horizontal distance from highest point
l = Horizontal distance
h = Vertical distance
L_b = Backstay length at up station and down station



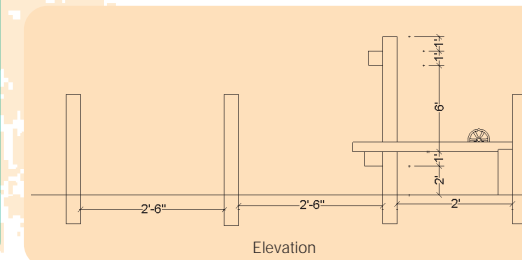
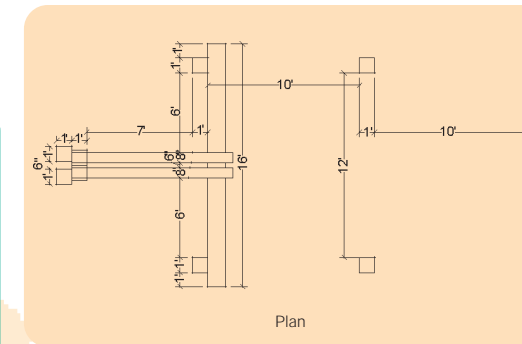
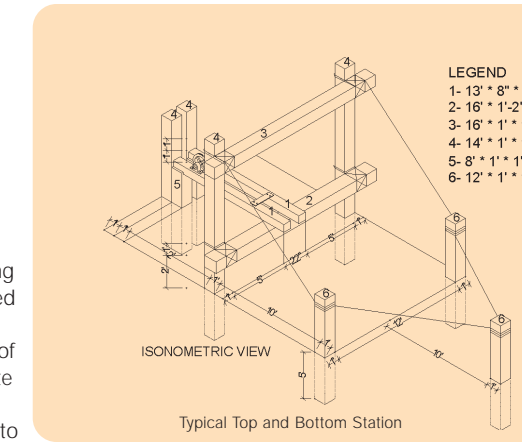
Top and Down-station Platform

FUNCTION The top-station and the down-station platforms are civil foundations which include housing control pulley, supporting cable, brake system and other functioning structures. Both the stations are used as loading and unloading platforms. The civil structure and foundation should be stable enough to bear all the impact and operating load of the system. This can be constructed of dry timber, iron beams and concrete structures depending upon the availability of raw materials and technology. The concrete construction makes the structure more stable which allow the ropeway alignment to be stable.

Diagram with components & specifications >>



▲ LAYOUT DRAWING OF GRAVITY ROPEWAY



TECHNICAL BRIEF gravity ropeways



SERVICE PROVIDERS

1. For wire ropes of ISI standard
Usha Martin Industries Limited
14 Princep Street, Calcutta 700 072, India
Tel: 27-2203

Navin Steel Industries
Dhangu Road, Pathankot - 145001, India
Tel: 01893-244690, Fax: 01893-24408

2. For wire rope accessories
Navin Steel Industries
Dhangu Road, Pathankot - 145001, India
Tel: 01893-244690, Fax: 01893-24408

3. Design
Practical Action Nepal
PO Box 15135, Pandole Marg, Lazimpat, Kathmandu
Phone: 977-1-4446015/4434482, Fax: 977-1-4445995
Email: info@practicalaction.org.np

4. Installation Support
Ambika Fabrication and Repairing Pvt. Ltd.
Bhaktapur, Katunje, Ward No. 9, Sallaghari, Tinkune
Ph: 977-1-6610353
Contact Person: Doordam Thapa
Cell Ph: 9851052853

Structo Nepal Pvt. Ltd.
P.O. Box: 228, Block No. 27,
Patan Industrial Estate, Patan
Ph: 977-1-5521192, Fax: 977-1-5542118
Contact Person: Rajendra Pradhan

Appropriate Technology Development
and Goods Manufacturing Industries (ATDGM)
Balaju Industrial Estate,
Balaju, Kathmandu
Ph: 977-1-4356191
Contact Person: Shankar Man Shrestha
E-mail: shankar@manjee.wlink.com.np

FOR FURTHER INFORMATION

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www.practicalaction.org



Nepal possesses extreme geographical conditions ranging from high hills and mountains to the flat land areas called the *terai*. Rugged terrains, unfavourable weather conditions and scattered settlements in the hilly and mountainous regions obstruct the mobility of people, transport of goods and services and hinder development efforts. Although these extreme conditions create challenges, interestingly, they provide opportunities to experiment with context appropriate transportation systems.

Construction of roads is capital-intensive, tedious and time consuming in a topography that is harsh and the cost for transporting construction materials by air is high. Therefore, the gravity ropeway is a viable alternative mode of transport. This system improves accessibility of poor people living in the remote areas and enhances their living standards.

In the 1920s the first major long distance ropeway was constructed in Nepal and it was 22 km long. In 1964 it was improved and extended to 42 km. By 2000 the government and the private sector had constructed several ropeways for hydropower stations. The first commercially successful cable car was established in 1998 by the private sector, with approximate span of 3 km, connecting Prithivi Highway at Kurintar with Manakamana Temple.

Practical Action Nepal Transport Programme

Practical Action Nepal commenced its transport programme in 1998. It improved and promoted innovative transportation systems such as cable river crossing bridges known as *tulin*, gravity ropeway for hilly and mountainous regions and bicycle ambulance/trailer for the *terai* regions. The transport programme seeks to develop, adapt and replicate affordable, accessible and appropriate modes of transport, which directly contributes to the improvement of livelihoods of marginal villagers.

Gravity ropeway technology was transferred from Northern India to Nepal by Practical Action Nepal in collaboration with International Center for Integrated Mountain Development (ICIMOD). In partnership with ICIMOD and private manufacturer/supplier, Practical Action Nepal installed a couple of demonstration ropeways in Marpha and Tukche VDCs of Mustang district to facilitate the transportation of apples from orchards to the road-heads.

After a successful intervention in Mustang Practical Action Nepal installed Janagaon-



Bishaltar Ropeway in Benighat VDC, Hadikhola-Chiraudi Ropeway in Kalleri VDC of Dhading district, and Torisawara-Bishaltar Ropeway in Torisawara VDC of Gorkha district with financial support from The European Union, and UK Trusts and Foundations.

The initial study showed that the transportation cost of agro based products decreased by at least 50% after being served by gravity ropeway system. Such encouraging statistics

provided confidence to the villagers to supply their products in larger amounts and to enter the competitive market of the cities. Access to transportation system and market linkages improved their socio-economic status in terms of income, health, education and community awareness. Promotion of this technology also helped local economy by creating employment opportunities and supporting the business of the local manufacturers and service providers.

Working Principle and Design of Gravity Ropeway

Gravity ropeway is an inexpensive and simple means of transportation. It operates basically by gravitational force without the use of external power. The gravity ropeway consists of two trolleys rolling over support tracks attached to a control cable in the middle which moves in a traditional flywheel system. When the loaded trolley at the up-station is pulled downward by the force of gravity, the other trolley at the bottom-station is pulled up automatically by means of control cable.

Principally, the goods coming downward from top station has to be thrice as heavy as the load going up from the down station. The sliding down of the trolley and its speed depends upon the angle of elevation made by the cables installed with the horizontal ground.

A flywheel with bearing and bracket is used as a brake to control the landing speed of the trolley at the bottom-station. Communication between top and bottom stations is done by tapping the wire rope. The operator at the top-station strikes the wire rope with a stick to send a wave signal through the wire rope to the operator at the down-station. The operator at the down-station then applies the hand brake to control the flywheel.

Cost

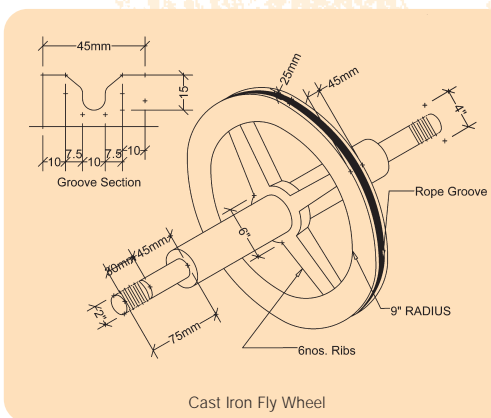
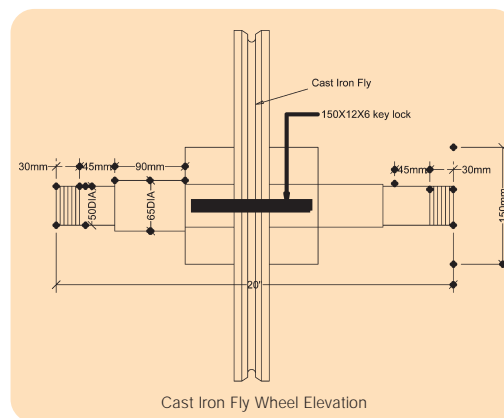
The tentative cost of the gravity ropeway system for the inclined span of 1000m to 1500m ranges from NRs. 7,00,000 to 8,00,000. The cost primarily depends upon the local topography, angle of inclination, the ropeway span at inclination between the two stations, and use of local raw materials and construction technology.

functions and components of the gravity ropeway

Top Station Control Pulley

FUNCTION Top station control pulley is used to control and guide the control wire rope at the top-station. It is supported at the end with two bearings and the housing is fixed rigidly on the base frame of the platform.

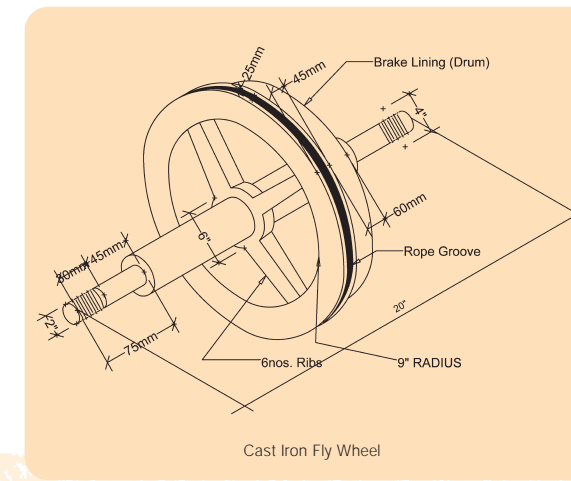
Diagram with components & specifications >>



Down Station Control Pulley with Fly Wheel

FUNCTION Down-station control pulley with fly wheel is used to control and guide the control wire rope at the down-station. It is supported at the end with two bearings and the housing is fixed rigidly on the base frame of the platform. The fly wheel is used for the smooth motion on the wire rope.

Diagram with components & specifications >>



Bearing and Housing

FUNCTION Bearing and housing are used to support and provide free movement to the shaft containing control pulley. For this purpose SKF Roller bearing No. 6212 with corresponding bearing housing are used.

Diagram with components & specifications >>

