

CHAPTER 6

FIELD MACHINE

SECTION 9

CALCULATION FOR AERIAL ROPEWAY

0901. **Introduction.** Aerial ropeways provide a quick and simple means of transporting light loads across gaps. They are useful particularly in rocky or mountainous country for crossing dry gaps, as a means of communication before a bridge is built or as an aid to the actual bridge building. Another use is as an alternate to porter or pack transport on rocky slopes. The simple aerial ropeway across a nearly level gap consists of a single cable, support and anchored at both ends, on which runs a snatch block or traveller which carry the load and which is hauled across the gap with ropes. The difference in level of the cable support should not generally exceed one twenty-fifth of the span.

0902. **Detail Calculation.**

- a. The data given are as follows:
 - (1) Weight of Heavy store item..... 12 cwt.
 - (2) Height of bulkiest store item..... 6 feet.
 - (3) Weight of traveller including sling 0.25 cwt.
 - (4) Height of traveller including sling 5 feet.
 - (5) Height of both the banks from mean sea level is same.
 - (6) Unload dip is 1/50 and load dip is 1/20 at the center.
 - (7) Use 2.5 inch Steel Wire Rope.
- b. We need to find out,
 - (1) Total Distance of support.
 - (2) Concentrate load.
 - (3) Detail of gyn.
 - (4) Tension cable.
 - (5) Anchorage.
 - (6) Actual pull require.

d. **Sequence of Design.**(1) **Determination of Size of Sp.**

(a) Effective height of support = Height of the traveler include sling /lifting tackle (Allowance for choc-a-bloc)+ Height of the load+ Load dip (Normally span/20)+ Bank Heights at both ends (If there is any difference in bank Height at both ends)+ work clearance (2' to 3').

(b) From Table 9 of FE pamphlet No. 1 part II find out maximum stresses on one leg of sheer and gyn.

(c) Allowance 3' at the top and 1' at the bottom to be added with the effective height of support. From 10 of FE pamphlet Number.1 part II find-out suitable size of the spar.

(2) **Determination of Distribution Between Support.**

Distribution between support = Actual gap+ 2x25' (For work clearance at both sides).

(3) **Slope Between Support.** Nil.(4) **Determination of Size of Main/Tension Cable.**

(a) Length of the Cable. The total length of the cable =Actual gap + 2x 4.13 x Effective height of support + 2x spar (Each 20').

(b) Concentrated load on suspended cable to be found out considering the following factors:

- i. Weight of the load to be carried.
- ii. Weight of traveler including sling.
- iii. 10% for wind and other impacts.

(3) **Size of the Cable.** From Table 11 of FE pamphlet number 1 part II.

Table: Safe Concentrated load on Suspended Cables

Circumference of Steel Wire Rope (ins)	Tension of Steel Wire Rope (tons)	Safe Conc Load (CWT)			
		Span			
		200'	300'	400'	500'
1	.5	2	1.9	1.8	1.6
1.5	1	4	3.8	3.6	3.2
2	2.8	10	9.5	9	8
2.5	4.2	16	15.2	14.4	12.8
3	6.4	22	20.9	19.8	17.6

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(4) **Anchorage for Main/Tension Cable.** Find out the tension of main cable from Table 11 of FE pamphlet number. 1 part II. Basing on tension of main cable select suitable size of anchorage.

(5) **Pull Require in Tension Tackle.** The pull require in tension tackle
 $P = W/G(1+fn).$

Where,

P = The pull require on the running end of the fall.

W = The weight to be moved.

G= The theoretical gain.

n= The total number of sheaves, include the leading block.

f =A co-efficient of friction varying between 1/5 and 1/10 according to the state of the tackle.

(6) **Determination of Size Hauling Cable.**

(a) From para 12d (2) find out concentrated load on suspended cable. From Table 2 given below find out the suitable size of hauling cable.

Weight in CWT	Size of cordage in inches	Size of Steel Wire Rope in inches
Up to 3	1	-
3-7	1.5	-
7-12	2	-
12-20	2.5	-
20-30	3	-
30-40	-	1
40-50	-	1.5

(b) **Length.** The length of hauling cable 1.5 x Length of main cables (Each side).

(c) **Pull Required in Hauling Tackle.** As per para 2d(5).

(d) **Anchorage for Hauling Tackle.** Basing on concentrate load on suspended cable and pull required in hauling tackle.

(7) **Determination of size for support.**

(a) Maximum tension in sling $=T/2$ (From table 11 of FE pamphlet Number. 1 part II).

(b) Select suitable size of Steel Wire Rope for sling including number of turns.

e. **Solution to the Problem.**(1) **Determination of Size of Support.**

- (a) Effective height of support
 = Height of the traveler include sling /lifting tackle
 (Allowance for choc-a-bloc)+ Height of the load+ Load
 dip (Normally span/20)+ work clearance (2' to 3').
- $$= 5' + 6' + \frac{350'}{20} + 3'$$
- $$= 5' + 6' + 17.5' + 3'$$
- $$= 31.5' + 3' + 1' \text{ [Allowance 3' at the top and 1' at the bottom}$$
- $$\text{to be added with the effective height of support]}$$
- $$= 35.5' = 36'$$
- (b) From Table 9 and 11 of Field pamphlet number's part II,
 maximum stresses on one leg $= T/5 = 4.2/5 = 0.84$ tons.
- (3) Size of spar will be 9" in dia and 36' in length.

(2) **Determination of Distribution Between Support.** Here
 distribution between support $= 300' + 2 \times 25' = 350'$.

- (3) **Slope Between Support.** Since height of both the banks
 from mean sea level is same, both the support will remain at same level.

(4) **Determination of size of Main/Tension cable.**

- (a) Length of the cable $= 300' + 2 \times 4.13 \times 36' + 2 \times 20' = 538'$.
- (b) Concentrate loads on suspended cable $= (12 + 0.25 + 1.2)$ cwt.
 $= 13.45$ cwt
- (c) From Table 11 of FE pamphlet number. 1 part II size of
 the main cable is 2.5" circumference Steel Wire Rope.
- (d) **Anchorage for Main/Tension Cable.** OPH at both
 ends.
- (e) **Pull Require in Tension Tackle.** Using 2/2 tackle
 pull required in tension tackle is 130 lbs.

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(5) **Determination of size of Hauling Cable.**

- (a) Size of hauling cable = 2.5" circumference cordage.
- (b) Length = $1.5 \times 638' = 957'$ (Each side).
- (c) **Pull Required in Hauling Tackle.** Here it will be 4.4 cwt.
- (d) **Anchorage for Hauling Tackle.** I type OPH at both ends.

(6) **Determination of Size Sling for Support.** 2.5" circumference Steel Wire Rope with 2 to 4 turns.