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# Analysis of Aerial Ropeways by following various Indian and International Codes for Urban Mobility with some Structural Modifications in Monocable Ropeways to make it Safe, Secure, Economical and all Weather Durable

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## I. INTRODUCTION

'Cable-propelled transit' (CPT), in particular detachable aerial ropeways are widely employed as transportation systems in alpine areas. In recent years, these transport systems have also been increasingly used in urban areas and are no longer a niche public transportation technology (Hoffmann 2006, Alshalalfah, Shalaby, and Dale 2014). Cable cars systems compete with performance characteristics of other more common urban transport technologies and have the potential to enhance the existing transport provision in cities (O'Connor and Dale 2011).

While many applications can be found as transportation systems in airport facilities, and to provide access to tourist attractions, several metropolitan areas have even incorporated gondolas and aerial tramways into their public transport networks. This paper focuses on aerial ropeway systems that operate as a mass transit service (similar to buses, BRT, LRT, etc.) and are part of the public transit systems in their respective cities. Therefore, the analysis and case studies presented in the paper concern systems that are used as a public transit service.

### *A. Effect of The Long Spans/Tempertaure on Rope in Monocable Detachable Ropeways/effect of wind on Ropeway Operations*

In case of the aerial ropeway rope is the most important component which rotates and helps in transportation of passengers by the movement of the cabins also the safety of the ropeway is totally dependent on the smooth/hindrance free movement of the rope. The diameter of the rope is always designed as per the capacity of the passengers/load to be carried out. However, the elongation of the rope is normal in case of the ropeways. Also balancing the tension in the rope is critical for the ropeway operations. hence to balance the tension in case of the elongation the tension trolley is designed in the ropeway system which helps in maintain the tension/allowable sag in the line for stable operations of the ropeway. There is always a set limit for the elongation of the rope which can be maintained by tension trolley during acquisition. As the rope reached its maximum elongation limit which can be adjusted by tension trolley after that process to keep sufficient tolerance for the elongation, the rope under goes shortening in case of ropeways. The rope shortenings is done as per the requirements whenever the tension trolley reaches the maximum limit. The maximum times the shortening can be done depends on number of splices. In this paper we will be working/analysing the ropeway lift which consists of 3 splices and the maximum shortenings which can be done is three.

### *B. Shortinig Of The Rope*

Rope shortening is the process in which the rope is shortened by some length when the elongation reaches to its maximum limit .The shortening process is critical and needs a specific technician for the process. The rope shortening usually depends on the length of the tension cylinder present in the tension unit. In this paper I analyzed the rope shortening procedure and came to know that there is particular limit to the number of shortenings done on the particular rope. It is usually done on the splice and can be done by cutting of the rope as well if already done at splice junction. At Empyrean sky view projects private Limited the number of splices on the rope were 3 hence the maximum number of shortenings that could be done are 3 .Thus the life of rope also depends on the number of shortenings which could be done in the rope in case of ropeways.

## II. LITERATURE REVIEW

### A. Review Of Literature

1) *An elasticity Influence of Wire Rope on the Calculation of Freight Ropeway Bearing Cable .( Jian Qin, Jun Chen, Liang Qiao)*

The force-displacement data during loading and unloading process is obtained by wire rope stretch experiment, which includes 7 different diameters ropes. Based on the data, deformation curves of elastic extension are established. It is shown that the loading and unloading curves compose of the elastic hysteresis loop because the wire rope during unloading shows obvious elasticity. Analyzing the elastic deformation curve characteristics, the values of loading and unloading curve parameters are provided by fitting the experimental data.

The loading elastic modulus is constant independent of initial load, and the unloading elastic modulus is non-linear which is related with the maximum load. The elastic modulus is applied to the calculation of freight ropeway bearing cable. Compared the result with the actual project data, it shows that the method considering the wire rope an elasticity can improve the precision of bearing cable calculation.

The accurate algorithm of the single-span ropeway cable system is presented in reference [7]. Based on this algorithm, a case is calculated to analyze the affection of wire rope elasticity. To simplify the explanation, the algorithm without considering the wire rope elasticity is called ordinary algorithm, and the algorithm with considering is called accurate algorithm. Case 1 is the actual project, and the parameters are set.

Erection parameters of freight ropeway. The bearing cable is 6×36+FC twisted wire rope. Its diameter is 22mm, and the nominal tensile strength is 1670MPa. The length of bearing cable is 826.7 m. There is a 450kg mass in the 3rd span, 660kg mass in the 2nd span. The interval between two loads is 297m. When the 660kg mass moves forward 100m from the 40m of the 2# bracket, record the change value of the tension on the left side of the 3# bracket. The results by the ordinary and accurate algorithms are compared with the measured data, as shown in . As can be seen from the figure, the calculation tension result using accurate algorithm is smaller than that using ordinary algorithm, which is closer to the measured data. By comparison, the accuracy increases about 3%. 50 100 150 200 250

2) *Inspection of ropes for Austrian Ropeway using modern NDT Instruments A.Russold -TUEV,*

Vien, AustriaS. Belitsky - INTRON PLUS, Moscow, Russia

Steel wire ropes are most significant part of ropeways. Safe use of the ropeways depends directly on the rope condition, on the in-time and reliable rope inspection. Magnetic flaw detectors are used to determine rope wearing. They can measure the rope loss of metallic area (LMA) and detect the rope local faults (LF) like broken wires and other faults [1, 2].Rope NDT at aerial ropeways differs from rope NDT at mine hoists, cranes and elevators. The difference is specified by construction of the ropeways, by rope wearing character by NDT condition.

The carrying rope is immovable at reversible aerial ropeways, therefore magnetic head of flaw detector must move along the rope during testing. There are one or several towers supporting the rope between stations at this type of ropeways. Difficulty appears by NDT due to this. Meanwhile, the carrying rope is subjected to wear mostly on the towers by cabin passage over them. Some companies produce special magnetic heads with one-side access to the rope under test to pass over the tower. But rope NDT practice in Austria does not suggest rope testing on the towers because of low reliability of testing data due to big ferrous mass influence. Instead of this the rope is tested only between the towers where two-side access to the rope is possible. Meantime, the rope is displaced along periodically. Due to this the rope wears out more uniformly and inspection of the rope part, located on the tower earlier, is possible.

The ropes of locked or spiral types are used mostly as carrying ones. They have the maximum ratio of rope metal area to rope diameter. This requires high power of the flaw detector magnetic system for magnetic saturation of rope material. Besides, use of AC electromagnetic systems is impossible because of high shielding of electromagnetic field by the external wires of the rope.

The design with one ring haulage rope is used mostly at modern aerial ropeways. The rope in this case can be tested completely locating magnetic head at the most convenient place. The rope length can be as much as 5 km and more and there are one or several splices in the rope. The splice increases the rope diameter for (10-20)% and the metallic area for 16,6%. So flaw detector must store big value of information for next analysis.

3) *British Standard BS EN 10264:2012 - Steel wire and wire products – Steel wire for ropes Part 1, 2 & 3.*

BS EN 10264-2:2012 lays stress on the use of steel wire and wire products, steel wire for ropes cold drawn non alloy steel wire for ropes for general applications. BS EN 10264-3:2012 stresses on the use of steel wire and wire products. Steel wire for ropes round and shaped non alloyed steel wire for high duty applications. BS EN 10264-4:2012 stresses on the use of steel wire and wire products .steel wire for ropes stainless steel wire. BS EN 12385-1-2002+A1:2008 indicates on safety of ropes and general requirement of ropes.

4) *Technical Recommendations, Studies and Statistics for Aerial Ropeways. International Organisation for Transportation by Rope (O.I.T.A.F.).*

OITAF is committed to developing recommendations for manufacturers, operators and public authorities in various expert committees and working groups in those fields in which national regulations differ or do not exist; this relates in particular to the operation of ropeways and the applications of technical regulations in practical areas especially in those countries which don't have any or only insufficient regulations.
The ordinary System, the so called Detector, with Weight approx. of 17.5 kg, allows the measurement of the LF Signal (Localized Fault), which is an objective identification of broken wires (internal and/or external).

5) *Analysis of oscillations in cable in a cable way, wind load effects. By J.Gustincic and L M Garcia Raffi.*

Ropeways are widely spread in mountain resorts, not only because they are convenient and fast transportation for the maintenance of ski runs, but because they are economic and ecological transportation to hard-to-reach places. Cabin ropeways are preferred in resorts that need high transport capacity. The question of the wind influence and oscillations on a cableway in different conditions is of great importance. It strongly affects the comfort of the passengers as well as the safety engineering criteria during the initial calculation and later on during the periodical checks of the transport system. Self detachable aerial cableways. Suspended on a hauling and sustaining rope, the cabins need to face big stresses from inertial forces and additional wind loads. It is necessary to predict when the cabins need to be detached and stored in the storehouse, since huge wind loads can harm the complex cable structural system. This paper will study the basics of the phenomena. Furthermore it's interesting to study both the air induced oscillations and the consequences they can have on the cableway.
create the cabins with least wind impact hence aerofoil.

## III. NEED, SCOPE & OBJECTIVES OF STUD

### A. *Need & Scope & Objective Of The Study*

The urban transportation seems to be increasing day by day to meet the transportation needs we prefer different modes of the transport also we try to implement various updated means of the transport. In this research we have laid stress on implementing monocable detachable ropeways as a mode of urban transportation including structural modelling which will keep it safe, secure and economical for urban transportation. By conducting the studies on ropes and tower to tower span in case of monocable ropeways along with various wind conditions i have tried to implement new system in the urban transportation in India which will act as a safe secure fast and updated mean of urban transportation.
The only major factor which was affecting the operation of the monocable ropeway were the variable wind conditions. As the aerial ropeway is always subjected to the variable wind conditions hence the safety of the passengers and continuity of the transportation was necessary in case of making this sucessfull.In that regard I tried to maintain span limits along with the rope using with rope monitoring along with various safety devices with gauge, sheave width length variation which can maintain the stability of the ropeway hence ropeway operations.

### B. *Objectives*

The various aims of the above mentioned study are as under:-

1) The new means of transportation can included in the urban mobilisation which will act as fast cheap and safe mode of transportation.
2) The study will help in safe and secure transportation of the passengers under various wind conditions up to certain wind limit.
3) The rope elongation pattern can be controlled by maintaining the span within the limit which will create stability in the ropeway smooth movement and secure as well.

 

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4) The minimum replacement of the rope /rope changing can minimize the cost of installation /cost of operations as well.
5) When the cost of the installation and the operation gets minimised the transportation fare also remains in limits hence cheap mode of transport.

### *C. Research Methodology*

The methodology for completing the project titled "Analysis of aerial ropeways ropeways by following various Indian and international codes for urban mobility with some structural modifications in monocable ropeways to make it safe, secure, economical and all weather durable."

Following are the steps which are involved in the research methodology:

1) Structural analysis including span etc.
2) Rope dimension analysis /Rope properties breaking strength.
3) Rope analysis at various load conditions monitoring elongation.
4) Analysis of wind effect along the line on ropeway.
5) Results And Post Modifications Required For Stability.
6) Cost analysis and comparison.

Structural Analyis Including Spans Etc In Line

Rope Dimension Analysis /Rope Properties/Breaking Strength

Rope Analysis at Various Load Conditions Monitoring Rope Elongation

Analysis of Wind Effect Along The Line On Aerial Ropeway

Results and Post Modifications Required For Stability

Cost and Comparision

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## IV. RESULTS

In this research program we have gone through various activities like monitoring the elongation of the rope impact of the large span on the rope including the enormous impact of the wind in line. The resultant data observed after analysing all the processes and even after shortening of the rope which was followed to continue operation and to observe elongation result in future.

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*A. Results.*

The data includes the elongation data which was collected after shortening to keep an eye on the elongation and further predict the date of shortening including noticing the behavior of the rope under various load/climatic conditions.

| LORRY SCALE READING WITH RESPECT TO RUNNING HOURS AFTER SHORTENING. | | | | | |
|---|---|---|---|---|---|
| Sr.No. | DATE | LORRY SCALE POSITION BEFORE ACQUISITION IN CM | LORRY SCALE POSITION AFTER ACQUISITION IN CM | HMI READING IN MM | ROPEWAY RUNNING HOURS |
| 1 | 21-09-2019 | 67.5 | 67.5 | 616 | 596.43 |
| 2 | 22-09-2019 | 67.5 | 67.8 | 619 | 605.01 |
| 3 | 23-09-2019 | 67.8 | 67.8 | 620 | 612.17 |
| 4 | 24-09-2019 | 67.8 | 67.8 | 620 | 614.24 |
| 5 | 25-09-2019 | NO OPERATION | | | |
| 6 | 26-09-2019 | 67.8 | 67.8 | 620 | 622.23 |
| 7 | 27-09-2019 | 67.8 | 67.8 | 620 | 630.39 |
| 8 | 28-09-2019 | 67.8 | 67.9 | 621 | 640.38 |
| 9 | 29-09-2019 | 67.9 | 68.2 | 624 | 649.84 |
| 10 | 30-09-2019 | 68.2 | 68.2 | 624 | 656.22 |
| 11 | 01-10-2019 | NO OPERATION | | | |
| 12 | 02-10-2019 | 68.2 | 68.5 | 627 | 666.38 |
| 13 | 03-10-2019 | 68.5 | 68.8 | 630 | 674.37 |
| 14 | 04-10-2019 | 68.9 | 68.9 | 631 | 680.69 |
| 15 | 05-10-2019 | 69 | 69.2 | 639 | 690.16 |
| 16 | 06-10-2019 | 69.5 | 69.8 | 640 | 700.78 |
| 17 | 07-10-2019 | 69.9 | 69.9 | 641 | 709.9 |
| 18 | 08-10-2019 | 69.9 | 70 | 642 | 718.91 |
| 19 | 09-10-2019 | 70 | 70.2 | 646 | 724.21 |
| 20 | 10-10-2019 | 50.9 | 68.2 | 623 | 720.31 |
| 21 | 11-10-2019 | 68.5 | 68.6 | 628 | 739.88 |
| 22 | 12-10-2019 | 68.9 | 69.2 | 635 | 749.03 |
| 23 | 13-10-2019 | 69.8 | 70 | 643 | 759.01 |
| 24 | 14-10-2019 | 70.4 | 70.9 | 652 | 767.46 |
| 25 | 15-10-2019 | NO OPERATION | | | |
| 26 | 16-10-2019 | 71 | 71.3 | 657 | 773.63 |
| 27 | 17-10-2019 | 52.3 | 71.9 | 662 | 782.87 |
| 28 | 18-10-2019 | 72.2 | 72.3 | 666 | 793.12 |
| 29 | 19-10-2019 | 72.5 | 72.8 | 672 | 799.95 |
| 30 | 20-10-2019 | 73 | 73.5 | 680 | 808.37 |
| 31 | 21-10-2019 | 74 | 74.2 | 687 | 814.75 |

| | | | | | |
|---|---|---|---|---|---|
| 32 | 22-10-2019 | NO OPERATION | | | |
| 33 | 23-10-2019 | 74.5 | 75 | 696 | 821.58 |
| 34 | 24-10-2019 | 75.5 | 75.8 | 704 | 825.66 |
| 35 | 25-10-2019 | 76 | 76.2 | 708 | 830.67 |
| 36 | 26-10-2019 | 76.5 | 76.8 | 714 | 835.77 |
| 37 | 27-10-2019 | 77.2 | 77.3 | 721 | 840.8 |
| 38 | 28-10-2019 | 77.6 | 77.9 | 723 | 846.2 |
| 39 | 29-10-2019 | 78 | 78.2 | 731 | 852.07 |
| 40 | 30-10-2019 | 78.8 | 79 | 737 | 861.17 |
| 41 | 31-10-2019 | 79.5 | 79.7 | 744 | 869.8 |
| 42 | 01-11-2019 | 79.9 | 79.9 | 745 | 879 |
| 43 | 02-11-2019 | 79.9 | 79.9 | 746 | 888.24 |
| 44 | 03-11-2019 | 79.9 | 79.9 | 746 | 897.48 |
| 45 | 04-11-2019 | 79.9 | 79.9 | 747 | 906.77 |
| 46 | 05-11-2019 | 80 | 80.1 | 750 | 914.82 |
| 47 | 06-11-2019 | 80.2 | 80.2 | 753 | 923.2 |
| 48 | 07-11-2019 | 80.5 | 80.6 | 755 | 928.04 |
| 49 | 08-11-2019 | 80.4 | 80.5 | 754 | 929.58 |
| 50 | 09-11-2019 | 81.2 | 81.2 | 763 | 937.75 |
| 51 | 10-11-2019 | 81.9 | 81.9 | 768 | 946.51 |
| 52 | 11-11-2019 | 81.9 | 82 | 769 | 954.34 |
| 53 | 12-11-2019 | 82.2 | 82.2 | 772 | 962.61 |
| 54 | 13-11-2019 | 82.2 | 82.2 | 773 | 966.56 |
| 55 | 14-11-2019 | 82.3 | 82.5 | 775 | 974.29 |
| 56 | 15-11-2019 | 82.3 | 82.3 | 774 | 982.42 |
| 57 | 16-11-2019 | 82 | 83 | 769 | 990.85 |
| 58 | 17-11-2019 | 82.3 | 82.5 | 775 | 998.93 |
| 59 | 18-11-2019 | 82.8 | 82.9 | 779 | 1006.86 |
| 60 | 19-11-2019 | NO OPERATION | | | |
| 61 | 20-11-2019 | 83 | 83.1 | 781 | 1014.92 |
| 62 | 21-11-2019 | 83.6 | 83.7 | 785 | 1022.18 |
| 63 | 22-11-2019 | 83.8 | 83.9 | 786 | 1029.53 |
| 64 | 23-11-2019 | 83.1 | 83.2 | 782 | 1038.07 |
| 65 | 24-11-2019 | 83.1 | 83.2 | 785 | 1046.96 |
| 66 | 25-11-2019 | 83.8 | 83.8 | 785 | 1471.13 |
| 67 | 26-11-2019 | 83.8 | 83.8 | 789 | 1063.03 |
| 68 | 27-11-2019 | 84.2 | 84.2 | 793 | 1068.99 |
| 69 | 28-11-2019 | 83.7 | 84 | 791 | 1076.35 |
| 70 | 29-11-2019 | 84.7 | 84.7 | 796 | 1083.96 |
| 71 | 30-11-2019 | 84.5 | 84.7 | 797 | 1091.97 |
| 72 | 01-12-2019 | 85.1 | 85.1 | 803 | 1100.34 |
| 73 | 02-12-2019 | 85.3 | 85.3 | 806 | 1108.82 |

| | | | | | |
|---|---|---|---|---|---|
| 74 | 03-12-2019 | 85.5 | 85.5 | 808 | 1113.02 |
| 75 | 04-12-2019 | 85.8 | 85.8 | 809 | 1120.47 |
| 76 | 05-12-2019 | 85.7 | 85.9 | 811 | 1128.6 |
| 77 | 06-12-2019 | 86.2 | 89 | 843 | 1134.69 |
| 78 | 07-12-2019 | 89.9 | 89.9 | 851 | 1142.21 |
| 79 | 08-12-2019 | 90 | 90.1 | 856 | 1150.16 |
| 80 | 09-12-2019 | 90.5 | 90.5 | 859 | 1155.22 |
| 81 | 10-12-2019 | NO OPERATION | | | 0 |
| 82 | 11-12-2019 | 90.5 | 90.5 | 861 | 1162.19 |
| 83 | 12-12-2019 | 90.4 | 90.4 | 858 | 1167.03 |
| 84 | 13-12-2019 | 89.4 | 89.4 | 848 | 1176.29 |
| 85 | 14-12-2019 | 88.4 | 88.5 | 838 | 1185.34 |
| 86 | 15-12-2019 | 88.5 | 88.5 | 837 | 1195.76 |

The above data includes the elongation details of the rope during first three months of the shortening. Continuation recording of this data will enable in determining nature of elongation of the rope.

| LORRY SCALE READING WITH RESPECT TO RUNNING HOURS AFTER SHORTENING FOR PERIOD 01/01/20 TO 31/01/20 | | | | | |
|---|---|---|---|---|---|
| DATE | LORRY SCALE POSITION BEFORE ACQUISITION | LORRY SCALE POSITION AFTER ACQUISITION | HMI READING IN MM | ROPEWAY CUMULATIVE RUNNING HOURS | DAILY RUNNING HOURS |
| 01.01.20 | 95.50 | 95.50 | 912 | 1337.57 | 9.37 |
| 02.01.20 | 95.90 | 95.90 | 917 | 1344.93 | 7.29 |
| 03.01.20 | 96.20 | 96.30 | 922 | 1353.29 | 8.25 |
| 04.01.20 | 97.00 | 97.00 | 928 | 1361.25 | 8.08 |
| 05.01.20 | 96.30 | 96.90 | 921 | 1369.91 | 8.44 |
| 06.01.20 | 96.40 | 96.40 | 922 | 1378.64 | 8.48 |
| 07.01.20 | 95.30 | 95.30 | 911 | 1387.5 | 9.01 |
| 08.01.20 | 94.40 | 85.20 | 805 | 1395.47 | 8.12 |
| 09.01.20 | 84.50 | 85.90 | 811 | 1404.19 | 8.54 |
| 10.01.20 | 86.80 | 83.60 | 821 | 1411.56 | 8.45 |
| 11.01.20 | 87.80 | 87.90 | 831 | 1420.70 | 8.42 |
| 12.01.20 | 88.40 | 89.20 | 838 | 1429.55 | 8.59 |
| 13.01.20 | NO COMMERCIAL OPERATION | | | | |
| 14.01.20 | 88.70 | 89.00 | 843 | 1436.65 | 7.05 |
| 15.01.20 | 89.20 | 89.30 | 847 | 1444.69 | 8.03 |

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| | | | | | |
|---|---|---|---|---|---|
| 16.01.20 | 90.00 | 90.00 | 854 | 1452.66 | 8.03 |
| 17.01.20 | 89.70 | 90.60 | 860 | 1461.04 | 8.26 |
| 18.01.20 | 91.50 | 92.00 | 874 | 1467.93 | 7.01 |
| 19.01.20 | 92.40 | 92.90 | 884 | 1476.67 | 8.46 |
| 20.01.20 | 93.90 | 94.10 | 897 | 1485.21 | 8.38 |
| 21.01.20 | 94.30 | 58.80 | 526 | 1492.14 | 7.09 |
| 22.01.20 | 58.70 | 95.00 | 901 | 1500.27 | 8.38 |
| 23.01.20 | 95.20 | 95.30 | 911 | 1508.76 | 7.57 |
| 24.01.20 | 96.30 | 87.70 | 828 | 1515.00 | 6.38 |
| 25.01.20 | 88.10 | 88.30 | 837 | 1523.49 | 8.27 |
| 26.01.20 | 88.30 | 89.40 | 848 | 1532.20 | 8.53 |
| 27.01.20 | 90.10 | 91.50 | 869 | 1539.93 | 7.51 |
| 28.01.20 | **NO COMMERCIAL OPERATION** | | | | |
| 29.01.20 | 92.00 | 93.00 | 885 | 1546.33 | 6.35 |
| 30.01.20 | 93.20 | 94.40 | 901 | 1553.23 | 6.52 |
| 31.01.20 | 95.40 | 95.70 | 941 | 1555.33 | 2.42 |

The above mentioned reading were taken continuously to determine the elongation rate and to determine life period o the rope hence this would help in determining the future costs for the operation of the ropeway.

| DATE | LORRY SCALE POSITION BEFORE ACQUISITIO N | LORRY SCALE POSITION AFTER ACQUISITIO N | HMI READING IN MM | ROPEWAY CUMULATIV E RUNNING HOURS | DAILY RUNNING HOURS |
|---|---|---|---|---|---|
| 18.12.20 | 123.00 | 123.10 | 1204.00 | 2048.16 | 03:53 |
| 19.12.20 | 123.50 | 123.50 | 1208.00 | 2055.95 | 08:03 |
| 20.12.20 | 124.00 | 124.00 | 1208.00 | 2064.08 | 08:11 |
| 21.12.20 | | | | | |
| 22.12.20 | 124.00 | 124.20 | 1214.00 | 2066.70 | 02:42 |
| 23.12.20 | 124.00 | 124.80 | 1216.00 | 2074.93 | 08:15 |
| 24.12.20 | 125.00 | 125.10 | 1227.00 | 2083.31 | 08:21 |
| 25.12.20 | 125.08 | 125.08 | 1231.00 | 2092.53 | 09:33 |
| 26.12.20 | 126.00 | 126.01 | 1235.00 | 2101.62 | 09:07 |
| 27.12.20 | 126.08 | 127.02 | 1246.00 | 2111.13 | 09:35 |
| 28.12.20 | 124.01 | 87.00 | 824.00 | 2119.03 | 08:03 |
| 29.12.20 | 87.05 | 122.09 | 1200.00 | 2127.59 | 08:41 |
| 30.12.20 | 123.02 | 123.04 | 1206.00 | 2136.10 | 08:26 |

## V. CONCLUSIONS

### *A. Conclusion*

From the above studies it was observed that the factors like variable span ,uneven distribution of loads, windy conditions can impact aerial ropeway also in urban conditions .The inclusion of aerial ropeway in urban mobility can boast the transportation system up to a higher instinct but at the same time we need to keep cost factor in consideration ,with this study we can make cost factors much stable and the transportation can be safe.

*1)* Aerial ropeway as monocable gondola including with other different ropeways can be used for urban mobilisation by introduction of various safety measures/structural modification.
*2)* With span modification the transportation of the cabins will be more smooth less oscillation free safe secure.
*3)* The tension in the line will remain balance which will help in minimum elongation of the rope hence economical.
*4)* The load distribution in the line will remain constant which will help in less elongation constant movement, minimum drag, lift and economical transportation as well.
*5)* The modification of the gauge length along with the sheave width in combination with the placement of structural anti derailment devices will help in operation of the ropeway at higher wind conditions .the system will remain stable even the impact of wind on the operation will be minimised.
*6)* The consistency of the spans will help in operation of the ropeway safely at higher wind conditions with tension along the spans with minimum sag or balanced sag the impact of the wind in the line will be minimum.
*7)* As due to modification of spans the elongation of the rope will be minimum hence less shortenings and the durability of the rope will get increased which will result in lesser installation cost, minimum maintenance cost /minimum maintenance period.
*8)* As the cost of the maintenance and the installation gets minimized the fare during the urban transport will also be less hence much affordable for common people also.

### *B. Limitations1*

The placement of the supports posts needs the clear area which might always not be available.2:- Under high wind conditions if the height of ground clearance is maximum people might get afraid.

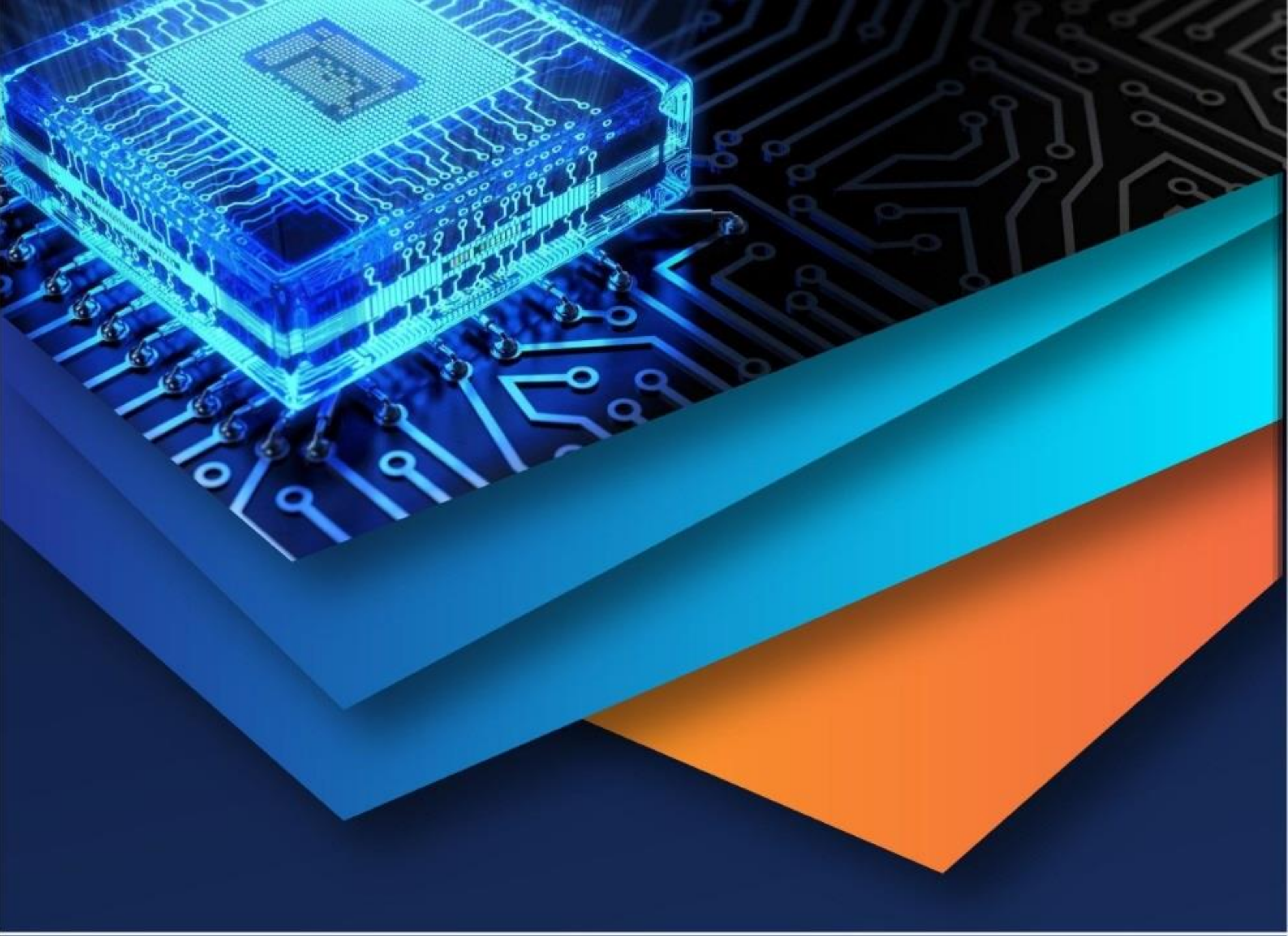
### *C. Scope for future work.*

In India various ropeway projects are coming which will act as an urban mobility transport e.g. Dehradun- Mussorie ropeway. The 5.6 km long ropeway will act as an urban transport and will reduce a lot of traffic flow on Dehradun -Mussorie road. Kedarnath connectivity is another potential ropeway the same will be also used to transport pilgrims to kedarnath temple. Dharamshala – Mcleodganj ropeway is another example of urban mobility ropeway. Along with these there are various potential ropeway like in Goa etc which will be explored in future.

## REFERENCES

[1] Technical Recommendations, Studies and Statistics for Aerial Ropeways. International Organisation for Transportation by Rope (O.I.T.A.F.).
[2] Indian Standard. Codes of Practice for the Construction of various types of Aerial Ropeways: IS 5228:2003; IS: 5229:1998; IS 5230:2003.
[3] American National Standard Institute (ANSI). ANSI B77.1 –2011. For Passenger Tramways –Aerial Tramways, Aerial Lifts, Surface Lifts and Tows:- Safety Requirements
[4] British Standard BS EN 10264:2012 - Steel wire and wire products – Steel wire for ropes Part 1, 2 & 3.
[5] British Standard BS EN ISO 80000-1:2013 - Quantities and units Part 1 – General.
[6] Outdoor Lighting Handbook Lumsden. et al.
[7] British Standard BS 5266: Part 1:2011. Code of Practice for the Emergency Escape Lighting of Premises.
[8] Red graves Health and Safety in Factories. Fife and Machin.
[9] British Standard BS EN 1991-1-4:2005+AI: 2010 - Eurocode 1: Actions on structure Part 1-4: General actions – Wind actions.
[10] Typhoons in Hong Kong and Building Design. Faber and Bell.
[11] British Standard BS EN 62305:2011 - Protection against Lightning.
[12] Regulations for the Electrical Equipment of Buildings (Institute of Electrical Engineers Regulations)
[13] Geotechnical Manual for Slopes, 2nd Edition (1997) Geotechnical Engineering Office of Civil Engineering Department
[14] Commission of the European Communities (EC), Regulation of the European Parliament and of the Council, relating to cableway installations designed to carry persons.

[15] British Standard BS EN 12385-1-2-8-9: 2002+AI: 2008 – Steel wire ropes – Safety – Part 1: General requirements; Part 2: Definitions, designation and classification; Part 8: Stranded hauling and carrying-hauling ropes for cableway installations designed to carry persons; Part 9: Locked coil carrying ropes for cableway installations designed to carry persons.
[16] British Standard BS EN 12929-1-2: 2015 – Safety requirements for cableway installations designed to carry persons – General requirements.
[17] British Standard BS EN 12930: 2015 – Safety requirements for cableway installations designed to carry persons – Calculations.
[18] British Standard BS EN 12927-5-6: 2004 - Safety requirements for cableway installations designed to carry persons - Ropes Part 5 - Storage, transportation installation and tensionioning: Part 6 –Discard criteria
[19] British Standard BS EN 1909:2004 - Safety requirements for cableway installations designed to carry persons — Recovery and evacuation.
[20] British Standard BS EN 1709:2004 - Safety requirements for cableway installations designed to carry persons — Pre-commissioning inspection, maintenance, operational inspection and checks.
[21] British Standard BS EN 13796:2005 - Safety requirements for cableway installations designed to carry persons — Carriers.
[22] British Standards EN Series concerning safety requirements for cableway installations designed to carry persons comprising the following parts:
EN 1907 – Terminology EN 12929 – General requirements EN 12930 – Calculations
EN 12927 (all parts) – Ropes EN 1908 – Tensioning devices
EN 13223 – Drive systems and other mechanical equipment EN 13796 (all parts) – Carriers
EN 13243 – Electrical equipment other than for drive systems EN 13107 – Civil engineering works
EN 1709 – Precommissioning inspection, maintenance and operational inspection and checks
EN 1909 – Recovery and evacuation EN 12397 – Operation
EN 12408 – Quality assurance
This series of Standards forms a complete set with regard to the design, manufacture, erection, maintenance and operation of all cableway installations designed to carry persons.

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