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Proposal of Curvo Cable Car as an Alternative Means of Public Transport in Surat City

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Abstract - *This project is to get possible solution for current chaos of transportation system in Surat. To provide pollution free, electric cable car transportation system. To get rid of traffic and nuisance of traffic. The idea is flexible enough that it can be provided in the normal traffic heavy road of any city area. We can design more comfortable and futuristic cable car or say cabin in which passengers travelling through one spot to another. It should be design for more passengers with more comfort ratio.*

Key Words: Cable car, Curvo, Traffic, Transportation, Aerial

1. INTRODUCTION

Presently, fuel engine driven vehicles, constitute the main transportation force, requiring considerable growth in infrastructures, in city roads and flyovers, for accommodation of vehicular spaces, resulting in ascending carbon emissions, lung related diseases which are assuming an alarming level, particularly, in children. Plus, casualties in city roads are going up by leaps and bound. Curvo Cable car will be an elevated and aerial mode of urban transport, which is a unique non -linear concept permitting Ropeway to be amenable and adaptable to bends and curves of city roads. Which makes it easy to cope up with the curves of the roads in Surat city.

2. CURRENT TRAFFIC SITUATION IN SURAT

Transportation in Surat helps the residents to travel to all the parts of the city. This city in the recent years has developed to become an important industrial center in Gujarat. Thus, communication system has also developed along the infrastructure of the city. The commuter access different modes of transportation available in the city.

There are different modes of transportation in Surat are as follows: Buses, Rail, Taxis, Auto-Rickshaws, Air.

2.1. Density of Vehicles

The vehicles registered in Surat (RTO) area has raised from four lakh in 1994 to thirty-six lakh in 2011-2012.Two wheelers comprise nearly 40% of total number of vehicles while cars constitute about 17%.
Presently there are about fourteen lakh two wheelers and 84099 Auto-rickshaws registered with Surat RTO. The breakup of the vehicular composition in the city and the percentage change in the city is shown in table below:

Table -1: Vehicle Growth Rate (RTO, Surat)

Types of Vehicle	Number of Vehicles		% Change per year	
	2015-2016	*2016-2017*	*2015-2016*	*2016-2017*
2 Wheeler	1370899	1495610	7.3	8.3
3 Wheeler	79980	84099	6.5	4.9
4 Wheeler	189370	220932	12.6	14.3

3. THE CURVO CABLE CAR

It will be an elevated and aerial mode of urban transport. It will run along existing arterial and other roads on steel portal frames spaced at 90-100 meters. Supporting the ropes. It will need nominal ground space for stations and rope supporting portal frames.

It will have no interference with road spaces and vehicular traffic below, or with pedestrian flow. Running on electricity CURVO eliminates polluting effect of poisonous and greenhouse gases as systematically spewed by vehicular transport. By the same token CURVO being reasonably noiseless, wages no decibel war.

Cabins aesthetically designed and spaced at 22-25 seconds interval, cruise by overheard, a pleasing sight to the beholding public at large in comparison to vehicular congestion below.

Cabins would have a capacity of 8-10 seats. Since, under no circumstances, as opposed to vehicular or metro rail travels, no standing or overloading can be allowed on the ropeways, the quality of ride will be extremely comfortable for the commuters.

It will, on any designated route, provide boarding / deboarding facility at every 750 meters. or so, making it convenient for commuters to approach their intermediate destinations. The stations will be provided with elevator service to assist passengers reach level of the station.

In the system, once a cabin reaches a station, doors open automatically and facilitate boarding / deboarding at very low speed.

3.1. Transportation Potential

Curvo system is similar to conventional detachable Monocable Ropeway, other than its unique CURVO feature. Transport capacity of 2000-2500 pph has been considered per line. On wider roads, particularly, on dual carriage way with Divider, as shown, transport capacity 4500 pph in each direction could be achieved. All urban roads are wide, where CURVO system overhead, would be able to transport 4500 commuters per hour in each direction.

3.2. Speed and Power Consumption on Curvo Cable car

Line speed of Curvo System assumed to be 4 M/s, equivalent to 14.5 Km/hr. With very slow speed over boarding / deboarding areas at stations, average travel speed would be around 3.5 m/sec or 12.6 km/hr. on the CURVO system. As for power, over 5.0 Km Drive section, installed power need, will be around 175 KW. Thus, on a total Curvo network of 250 Km in a city the maximum consumption will be 8.0/9.0 MW, if operated at full load, whereas power consumed by the city Auto Vehicles would be equivalent to over 500 MW, to negotiate the same distance and commuter load. Commuter conveyance capacity even up to 100,000 passengers per hour, in each direction, could be achieved in a city, with CURVO Ropeways over multiple roads, thus providing enormous potential to contain the increasing imposition of auto vehicular system.

Layout of Surat, an Indian metro city, in Sketch, shows approximately so many wide roads, leading towards the city's commercial Centre, which could have overhead CURVO's on them, and generate moving capacity of more than 200,000 commuters per hour, equivalent to more than 2000 bus loads, which, normally, would consume not less than 50 K-liters of gasoline during a day, giving rise to enormous carbon emission alone, not to speak of other hazards and losses to exchequer.

3.3. Risk Element

Curvo Ropeway like any other passenger ropeway, whether in Alps, Colorado, Denver and Whistler Mountains and other places in Asia, are so designed and constructed that there will be hardly any element of risk, which could result in casualties, because of the safety features incorporated at all possible points, which might result in any type of abnormal features, and the system is such designed, that they will be promptly detected and reflected on the system for emergency stoppages. A press report relating to casualties from vehicular traffic states that, in Indian, urban cities alone, constituting 8 to 10 of them, annually, 130,000 is the number of casualties.

4. SYSTEM CONSTRUCTION

Normal Detachable Grips, used on Ropeways, presently, are illustrated in Sketch. They comprise horizontal Grip Structures equipped with vertical actuating device for Locking and Unlocking operations at Terminal and Intermediate stations.

Curvo Ropeway system with unique nonlinear feature has vertical Grip Structures, unlike others, and equipped with horizontal actuating device for Locking and Unlocking of the said Grips.

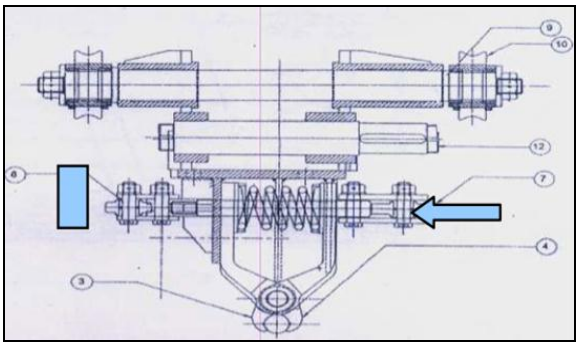

Fig -1: Vertical grip structure

Curvo Grip The crux of the CURVO Ropeway's invention /development lies in designing the Gripping Device of the rope, in its vertical structure with respect to the rope, along with horizontal actuation of gripping means, and rendering it possible to shift centroid of suspended Cabin / Carriage, essentially required to negotiate the horizontal curve at line speed, keeping the grip structure clear of the Battery Rollers, whose main function is to provide horizontal support to the tensioned rope negotiating the curve. This could be done with relational adjustment of levels of the rails supporting the two-wheel bogies on either side of the rope effecting changed suspension, and relief of the Rope on the Battery Roller system.

Depending on city configurations, the Curvo lines should be able to cross each other. A Comparative Statement of the inherent features of both Auto Vehicular and CURVO Ropeway systems in urban commutation is given below. It highlights the attractive features of CURVO System.

5. OPERATION OF CURVO CABLE CAR

At the station, an incoming cabin suspended from the vertical grip will get detached from the moving rope, decelerated, and taken to the boarding / Deboarding area, preceded by automatic opening of cabin doors. Boarding / Deboarding by commuters will take place, while the cabin will be on move at a very slow speed with its doors opened. Once boarding will

be over, cabin doors will get automatically closed at a prefixed location, followed by its discharge to the locking area, where the grip along with the cabin after having attached with the moving rope will proceed on the line at the designed line speed towards next station. Similar operation will be there on the other side of the station, also. Movement of commuters on the stations will be controlled, so that there is no interference with moving cabins.

Terminal Stations of a section will be equipped with a Drive at one end and a tensioning device by hydraulic means, at the other. The Drive and Tension Station will be equipped with necessary provision for boarding/ Deboarding too and elevating of the commuters to the station platform areas, as in case of Intermediate Stations.

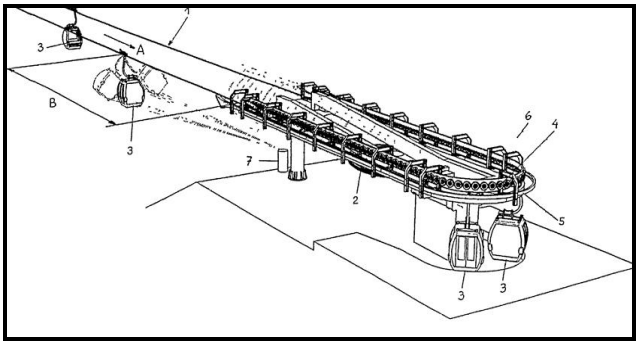

Fig -2: Turning point station

Operation of the CURVO system, section wise, would be from the Drive Station Control Room. CCTV facility will be there, at each station to monitor smooth operation of the system, and Drive stations to have monitors for all the stations, under its control. The operational sections will be interlocked so that, in the event of any unlikely stoppage, the adjoining section would also stop, and then start, simultaneously.

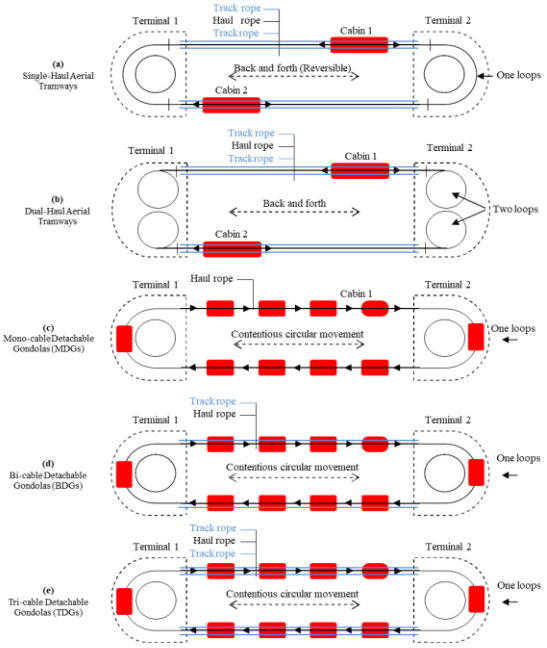

Fig -3: Detailed illustrations of RTS technologies IRJET

Control of the CURVO system will be with the control room operators, only.

In these regulations, unless the context otherwise requires- "carrying-hauling rope" means a rope that is powered by a drive system and is designed, manufactured or used to perform both the functions of a hauling rope and a track rope; "competent person" , in relation to any duty required to be performed by him under these regulations, means a person who- (a) is employed by the owner of an aerial ropeway as a competent person pursuant to regulation has been approved under regulation; "controller" , in relation to any duty required to be performed by him under these regulations, means a person who- (a) is employed by the owner of an aerial ropeway as a controller pursuant to regulation has been approved under regulation; "defector graph" means any apparatus for the detection of broken wires in a rope; "hauling rope" means a rope that is powered by a drive system and is designed, manufactured or used solely for hauling carriers on an aerial ropeway; "operator", in relation to any duty required to be performed by him under these regulations, means a person who is employed by the owner of an aerial ropeway as an operator pursuant to regulation has been approved under regulation; "station" means any terminal station or intermediate station; "surveyor", in relation to the carrying out of any test or examination required to be performed by him under these regulations, means a person who- (a) not being employed by the owner of an aerial ropeway, is appointed by the owner to carry out any test or examination; and (b) has been approved under regulation; "track rope" means a rope that is designed, manufactured or used solely for supporting carriers on an aerial ropeway; "work car" means a car which is used, or adapted for use, along the line for the repair or maintenance of an aerial ropeway or its equipment.

6. MAINTENANCE

(1) The competent person in charge of an aerial ropeway shall, within the period specified in, submit for the approval of the Director a written schedule of the systematic maintenance of all parts of the ropeway, which schedule shall include intervals between the inspection, lubrication and adjustment of- (a) all ropes, including an examination for broken wires and the gauging of circumferences; (b) all sheave trains, sheaves, bushes, pins and all bearings; (c) the drive system, including auxiliary and stand-by drive systems, braking systems and generators; (d) the communication systems; (e) all electric circuits, controls and switchgear; (f) all cars, including hangers, grips and car doors; (g) trestle structures and foundations; (h) earthling cables; and (i) station buildings.

(2) The Director may require any maintenance schedule submitted to him under to be amended before he approves it.

(3) Where the Director has approved any maintenance schedule, he may require the competent person in charge of the aerial ropeway to amend that schedule.

CONCLUSION

It is a safe, pollution free, for both in terms of emission and noise. Its runs on electricity and does not use organic fuels, thereby permitting the government to cut down on fuel subsidy expenditure. It is also accident proof having automated drive system, instead of multiple human controls behind the wheels as is the case with vehicular transport. Thus, the Curvo system has the potential of opening up a new chapter for a safe and comfort urban Arial commutation.

REFERENCES

[1] Alexis Nzapfakumunsi, Leopold Mbereyaho, Aloys Dushimimana "Proposal of Aerial Cable Car as an Alternative Means of Public Transport in Kigali City" International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 8 (2018) pp. 6216-6224.

[2] Sergej Težak, Ph.D., Drago Sever, Ph. D., Marjan Lep "Increasing the Capacities of Cable Cars for Use in Public Transport" Journal of Public Transportation, Vol. 19, No. 1, 2016.

[3] Prathmesh Nagare, Dr.A.S.Wayal "Alternate Ropeway Transit System For Manpada Road" Civil Engineering and Urban Planning: An International Journal (CiVEJ) Vol.3, No.3, September 2016.

[4] J. Winter, I. Sesma, and M. Funda, "A Case Study of Cable-Propelled Transit to be an Alternative Application to Conventional Means of Public Transportation " in Proceedings of the 15th International Conference on Automated People Movers and Automated Transit Systems, Toronto, Ontario, Canada, 2016, pp. 262-277.

[5] Dgsdg F. Carlet, "An Overview of Aerial Ropeway Transit and Its Potential in Urban Environments," in SBE16 Towards Post-Carbon Cities, 18-19 February 2016, TORINO, 2016, pp. 228-295.

[6] Ghada Mohammad Elrayies, "Aerial Ropeways as Catalysts for Sustainable Public Transit in Egypt" Journal – IJIRSET, Vol. 6, Issue 8, August 2017.