

Cable Cars as a Mode of Transport

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Abstract

Cable cars (also referred to as ropeways or gondola systems) are used for public transport in cities and as attractions at leisure destinations alike. They have proved to be very adaptable for their different uses and present a safe and reliable mobility solution that uses proven technology. Apart from their function as a mobility solution they provide a positive user experience based on the comfort they offer. In an urban environment it allows for the provision of public transport despite limited space and in leisure destinations it can be implemented as an attraction and mode of transport. This article highlights the use of cable cars for public transport and as an attraction.

Keywords: Cable Car, Ropeway, Urban Planning, Transport Planning, Mobility, Public transport, Amusement park, Doppelmayr

1. A reflection on the use of cable cars in an urban environment

Cable cars (also referred to as ropeways or gondola systems) are probably best known for their use in ski resorts in the mountains. They provide transportation and take visitors to the top of the slopes.

Cable cars have become a more common sight: Be it in cities used for public transport, as attractions in amusement parks or in a hybrid application as a mode of transport and attraction at touristic spots. They all serve for transportation

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in some way but have to meet different requirements defined by the environment they operate in.

We are going to highlight and discuss the different applications below.

1.1 Global Trends

Let's have a look at the current global environment first. The climate crisis, rapid urbanization and the competition between cities for businesses, capital and a highly qualified workforce, have an impact on how we look at transportation. The urban dwellers' mobility is a significant factor for a city's success as a place to live and to conduct business. It is more than just movement of people. It will have an effect on the general quality of life, public health and environmental conditions.

The climate crisis requires a significant reduction of CO₂ emissions from the transport sector. Among other measures, this achieved by a modal shift towards public transport and non-motorized traffic. In the long term, transport has to become more energy-efficient and rely less on motorized individual transport. Public transport is a viable option to meet transport demand without harmful side effects. To achieve a high acceptance of public transport it is important to create an attractive offer with obvious benefits for the user such as significant time savings and increased travel comfort.

Another trend that requires a focus on urban public transport is the global rapid urbanization including the rise of mega cities with a population of 10 million or larger. It has proved impossible to provide mobility for all with individual motorized transport only. Cities become paralyzed by heavy traffic and road congestion. Yet, cities can only function with a mobile population that is able to reach places of work, education and health care easily. The challenge is to provide an attractive transport network that covers the whole city including areas hard to reach due to topographical or man-made barriers to movement.

With a growing number of cities, the competition among cities grows. They compete for capital investment, businesses and a qualified workforce. A qualified workforce is not only attracted by a high income from work but by many other factors such as availability and affordability of housing, quality of health care and of education, safety and finally the quality of public transport. The quality of life can be downgraded by recurrent road congestion and the inability to move around freely within a city. Since it has become obvious that car ownership isn't a guarantee for unrestricted movement anymore, the quality of public transport has gained importance.

1.2 The importance of public transport

Global development and trends point towards a growing importance of public transport to tackle the challenges arising. It is a tool to move a growing number of urban dwellers while reducing emissions from transport and tackling the climate crisis. In a global competition to be an attractive place, the availability and quality of public transport is a significant factor.

The importance of urban public transport is widely recognized but the challenge remains to provide the services that meet requirements and achieve set goals.

One global requirement is the accessibility of public transport. When we talk about accessibility we talk about physical accessibility e.g. how we can reach stops of public transport and whether physical access is possible for all. Then there is the social dimension of accessibility: Fares need to be affordable to avoid exclusion from the use of public transport which would limit the mobility of a proportion of the population.

1.3 Challenges to the provision of public transport

Space is scarce in cities: Most of the area is built up and open spaces are needed as green and recreational spaces. Implementing transport infrastructure often requires the replacement of other land uses. Demolition of existing structures to create space for new roads used to be a common approach in urban planning. Only a few cities escaped the demolition of whole neighborhoods in favor of infrastructure that catered for cars only. A visual reminder of vehicle centered planning is elevated highways that cut through our cities.

Seoul provided a striking example for this car centered approach to urban planning: The Cheonggyecheon stream that flows through the city was covered in the late 1950s to build roads on top of it later followed by an elevated highway, the Cheonggye Expressway in 1968. The stream disappeared underground covered by a wide stretch of concrete that cut through the city. The elevated highway was then seen as a symbol for modernity and no attention was paid to the negative impact it had on the urban fabric and the quality of public space. Planning for the private car was the widely pursued policy. Since then, new thinking about transportation has been introduced. The focus moved from a city designed for vehicles city to a city that has high quality spaces for pedestrians.

In Seoul, the elevated expressway was demolished and replaced by a linear park with a stream along its middle as a reminiscence of the one that was covered a long time ago. Since its opening in 2005, the park has become a popular destination for locals and visitors. It also acted as a catalyst for urban renewal in the surrounding local area.

Transportation is still deemed a vital component of a city but it should not compromise the quality of life in a city and ideally contribute to it. Space is not only needed for private

vehicles but public transport, too. A careful integration of transportation infrastructure into the urban fabric is required.

As cities grow, transport networks have to grow and adapt. They have to grow to cover newly developed areas of a city, they have to reach into existing areas previously not covered by public transport. (retrofitting). Or they have to adapt to meet changing user requirements

Generally, the growth of public transport network happens by extension of existing of existing metro lines or bus routes or the addition of new ones. The type and size of the addition to an existing network are determined by demand. It can prove more difficult to reach into existing urban areas for retrofitting. Streets might be too narrow, wind up a hill and a road network might only be rudimentary. This requires a suitable mode of transport that can operate in a challenging built environment. A similar challenge arises when the topography or man-made barriers compromise the provision of public transport.

Extensive demolition for transport infrastructure is not an option anymore. The provision of public transport in an existing urban area requires a creative approach including the use of tested technology applied in an innovative manner.

1.4 User requirements

User requirements for a public mode of transport and an attraction in an amusement park are different but there are certain requirements that cannot be negotiated such as those regarding health and safety. These are given. Cable car installations meet most of the stringent health and safety standards.

In cities, there is a wider range of users and access to a public mode of transport is -in theory- not restricted and open to all. In most cases, the use of a certain mode of transport is not by choice but by defined by origin and destination of a trip. There might be options on legs of a trip where users can choose between various modes of transport though. The

number of interchanges has an impact on travel comfort and passengers might prefer a longer trip with fewer interchanges or probably longer interchange times to a trip with more interchanges which is perceived as less comfortable even when achieving time savings. In this regard the modal integration plays a key role: It is vital that all modes of transport in a multimodal transport network are conveniently linked and interchanges can take place with comfort and without delays. Short walking distances and coordinated schedules and operating times are important.

The service provision in public transport has a higher value than economic considerations and subsidies can be granted for public transport operations. They are granted as public transport services have an impact on cities that goes beyond the transport function: A good transport network contributes to the quality of life in cities and is vital for economic activities.

Cable cars meet the requirements for a mode of public transport and are already integrated with the transport networks worldwide.

1.5 How the cable car came into our cities

It was the constraints of densely built up urban environments, an increasing number of residents in fast-growing cities requiring transport solutions and the urgent need to create transport networks reaching all that contributed to the discovery of the cable car as a successful mode of urban public transport. It turned out to be very suitable for this application after it had already proved to be popular for touristic applications.

A growing proportion of the world's population living in cities makes city and transport planning more complex and more challenging. Fast-growing cities require faster planning processes to provide vital urban infrastructure.

When transport planners were faced with new requirements for public transport, the scarcity of space in built up areas and the impracticality of extensive demolition to introduce

transportation infrastructure, they looked to add new tools to their tool box.

The cable car (also referred to as ropeway) was re-discovered as one solution for public transport. It proved to be adaptable, safe and reliable while offering a high level of comfort for the passenger. The integration into existing public transport networks is easy and usually does not require the coordination of schedules as the gondolas of most common types of cable cars are moving constantly and passengers can board once they arrive at a station.

Cable cars can easily meet the requirements for a public mode of transport and it is possible to implement cable cars in densely built up areas without extensive demolition. As cable cars are using space above ground exclusive to them, they are not affected by road congestion and can offer reliable services at any time of the day. While adding capacity to a transport network they do not put more pressure on congested road networks. Passengers benefit from a consistent travel time throughout the day, cities benefit from a reliable and safe mode of transport despite congested roads.

Cable cars meet all the requirements for a modern mode of public transport. Plus, they have unique characteristics that make them particularly suitable for use in cities.

Sustainability is the guiding principle for our development. It is also applied to the transport sector. Cable cars have various characteristics that make them go strong in this regard, too.

The small physical footprint reduces land sealing to a minimum. Open spaces – a scarce commodity in urban areas - can be preserved or given a new use as public spaces. Green spaces have a cooling effect and reduce the urban heat island effect.

Cable cars are inclusive: They can provide mobility for all. Cable cars are fully accessible for all user groups including users with mobility impairments. Social inclusivity is an integral component of the sustainability principle.

Studies have proved that cable cars have the lowest CO₂ footprint over their complete life cycle compared to other

modes of transport (for more information: <https://opus4.kobv.de/opus4-hs-duesseldorf/frontdoor/index/index/docId/2897>). The reduction of CO2 emissions from the transport sector is an important goal to prevent the imminent climate crisis.

Cable car installations are powered by electric energy from the grid. This means that there will be no local emissions and local air quality will not be compromised. – An important factor when a mode of transport serves an area where people live.

2. Cable cars as an attraction

Cable cars are also used in amusement parks where they serve as an attraction. The transport function remains: Users are taken from one point to another. The main difference is that a trip on the cable car is taken voluntarily for leisure or as a part of a leisure activity.

Operators of amusement parks appreciate the small physical footprint of a cable car installation: It allows to install a cable car despite limited space and add attraction. The user experience can be enhanced by equipping the cabin with additional amenities such as information screens, charging points for phones and WIFI among others. While traveling, passengers can be provided with information regarding their visit such as waiting times at certain attractions or be provided with information about the area visited.

An analysis of cable car installations that are used as an attraction or used at touristic destinations identified the following applications:

2.1 Internal transport

Cable cars are located inside an amusement park and transport passengers between two points both inside the site. The use is included in the entrance fee for the park. Passengers get a bird's eye view of the area.

2.2 Inter Site Link

A similar case is given when a leisure complex is spread over a number of nearby sites that are physically separated. A cable car has proved to be a good way to connect sites that belong together. For example: The extension of an amusement park occupies a separate site. To visit both sites is it necessary to go through ticket gates twice (once for each site). Additional ticket checks and queues are avoided when the cable car stations are located behind the ticket gates. The visitor experience is significantly improved: The transport between the sites is fast and uninterrupted and visitors are able to move around freely. Waiting times for transfer buses are omitted. The ride on the cable car is an additional attraction. The park management benefits from an added layer of security against the misuse of tickets as visitors do not have to leave the ticketed areas.

2.3 Last Mile Link

Parking facilities, a train station or other infrastructure are located apart from a leisure destination such as an amusement park. There is a need for a mode of transport that takes visitors from their point of arrival (car parking site, train station, bus stop) to their destination. The cable car has proved to be very useful when there are barriers to movement (such as a motorway or a water body) that block the most direct route between the point of arrival and the final destination. The cable car for the last mile adds to the attractiveness of the destination. It also allows to build parking facilities where the price of land is lower.

2.4 Access to the isolated site

When an isolated site becomes a tourist spot, the site's popularity can present a threat to its assets. Increasing visitor numbers lead to a demand for new facilities and infrastructure

including infrastructure to improve the site's accessibility. Access by vehicles is not suitable for sites of natural beauty with rich flora and fauna. Road construction will have a negative impact on the fragile natural habitat: It requires the removal of trees and other plants, soil is sealed and animal life will be disturbed by fumes, noises and vibrations from vehicles. The natural assets a site is known for are threatened by giving a growing number of visitors access to it. This isn't a sustainable approach.

Cable cars allow access to sites located in sites of natural beauty without the threat to its main assets. The installations' small physical footprint keeps the impact to the environment to a minimum. Only the towers and the stations require space on the ground. The cable car adds to a positive and unique visitor experience when visitors get a bird's eye view of mostly untouched natural environments. The cable car also allows for a management and control of visitor flows. Visitor numbers can be limited to avoid overcrowding.

2.5 Scenic route

Cable cars can be installed along scenic routes. Visitors can enjoy views while traveling comfortably seated. Due to cable car installations' characteristics, the impact on the natural environment is kept to a minimum and road construction to allow for a visit is not necessary. Visitor access to sensitive areas can be restricted or completely avoided when stations are placed outside areas that require protection. Visitors float above them without disturbing wildlife or damaging flora.

3. Modal integration

Modal integration describes the integration of one mode of transport into a transport network. The integration happens on an operational level through coordinated timetables and operating times, on an organizational level by offering a single payment system for example and on a physical level by providing built infrastructure to link different modes of

transport (such as a purpose-built interchange hub). Multimodal integrated transport networks offer the highest comfort for users.

A modal integration is also required when considering linking a cable car to a transport network. The ease of access and interchange movement contribute to the acceptance of a mode of transport among users.

The characteristics of cable cars put them in a good position for a modal integration:

The continuous movement of the cabins (also referred to as gondolas) means that there are minimum or even no waiting times for passengers of the cable car. Once at the station, they are able to board a cabin. Cabins leave the station in very short intervals that can be as short as 12 seconds. The continuous movement of the cabins makes a schedule and the coordination with other schedules redundant.

Integration into an existing fare system does require the same process as with other modes of transport. A basic requirement is an agreement for the integration into a fare system.

Cable car stations are highly adaptable to meet a wide range of requirements for their integration into any type of environment. Elevated stations can be built above roads or bus stops or other interchanges can be placed below them to create a multimodal interchange hub.

While the modal integration is a vital requirement for cable cars used for public transport it is a less important requirement in amusement parks where they serve as an attraction. Since a ride on the cable car will be taken for leisure purposes there are fewer time constraints regarding waiting times. Users will be prepared to wait to board the cable car as they are prepared to wait to enter other presentations.

The cable car does not necessarily require to be linked to other modes of transport in an amusement park but will benefit from proximity to strategic points where passengers wish to board or alight. This can be the proximity to the most

popular attractions. This way, the cable car can help to disperse visitors evenly on the park grounds.

4. Project Examples

4.1 Uldolmok Line A

The 10-passenger gondola crosses the ocean over a length of 900 meters at the historic site of Uldolmok. It is the location of an important historic event: Battle of Myeongryang in which Admiral Yi Sun-sin's 13 naval ships fought off 133 hostile warships. This victory saved the Korean nation. The site can now be explored with a sustainable and efficient transport solution: Visitors to the area can ride a cable car with 26 ten-passenger cabins across the ocean. Some of the cabins have a glass floor that allows for a special view onto the ocean below.

4.2 Peace Gondola

The Peace Gondola was built to serve a popular historic resort: The Imjingak Resort, which was created in 1972. It is located inside the demilitarized zone (DMZ), a four-kilometer-wide buffer zone between North and South Korea

The "Paju Imjingak Peace Gondola" takes its passengers across the Imjin River inside the resort. The cable car stations are conceived as multi-use buildings with shops and catering facilities integrated.

4.3 Samaksan Mountain Gondola

This cable car was built at the popular Samaksan Mountain near the city of Chuncheon. It crosses a reservoir while taking passengers to the Samaksan Mountain.

This installation demonstrates that difficult topography doesn't present an obstacle. One of the towers for this installation was placed inside the reservoir. This allowed to use the alignment most attractive for its touristic use: While riding on the cable car passengers are now able to enjoy spectacular views of the surrounding landscape.

4.4 Busan Air Cruise

The Busan Air Cruise is a cable car built at Songdo Beach in Busan. The area is a popular tourist destination. The cable car reaches from Songlim Park to Amnam Park east and west of Songdo Beach and crosses the sea. It was built as part of the revitalization program of the area. The cable car significantly increases the attractiveness of the area.

4.5 Cable network “Mi Teleferico”, La Paz / El Alto, Bolivia

The “Mi Teleferico” (Spanish: My Cable Car) is the world's largest cable car network with 10 connected lines and an overall length of 31 kilometers. Three lines connect the higher lying El Alto with La Paz located in a valley at a height between 3,200 and 3,600 meters above sea level and 7 lines provide public transport link within the cities of La Paz and El Alto.

The cable car network changed the way people move around due to its reliability and safety. It also acts as a catalyst for urban development by providing access to former inaccessible sites. The cable car network was conceived for public transport but has also become an attraction of La Paz and El Alto. It appears as the most popular tourist attraction in the area on travel websites.

5. Summary

Cable cars have proved to be an adaptable mode of transport suitable for public transport as well as being popular attractions at tourist spots. They have a small physical

footprint that is of advantage in all types of environments. In an urban environment it allows for the provision of public transport despite limited space and in leisure destinations it can be implemented as an attraction and mode of transport.

Their impact on a natural environment is minimal. The non-intrusive character makes it an ideal solution for sensitive areas where high visitor numbers might clash with the wish to provide a peaceful and quiet environment such as the Imjingak Resort. Visitors can experience an area from above. The ground remains mainly untouched.

The CO₂ footprint has been proved to be very low in independent studies. This is an advantage for its uses anywhere and will gain more importance might tax on CO₂ emissions be introduced. Combined with high energy efficiency, cable cars have been recognized to be a sustainable mode of transport.

Cable cars have become a new tool in the planner's tool box: Proven technology – applied in an innovative manner.

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