

# The Next Level of Mobility Ropeways as a Means of Urban Transport





## Rethinking mobility

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Mobility is a major factor determining quality of life and the attractiveness of a city as an economic center. There is a growing awareness for topics such as environmental protection, inclusion and the desire for a fast and straightforward means of getting from A to B, along with a new emphasis on these aspects when planning a contemporary and attractive mobility offer.

>> I viewed my mission as mayor to build the city physically as well as socially and economically. The ropeway is one physical build that I am proud of.

*Vera Katz, former mayor of Portland*



## Urbanization is increasing – worldwide

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Urban areas are growing worldwide as ever more people move away from the countryside and into the city. This development brings new challenges. Traffic volumes are rising, noise and air pollution are negatively impacting urban quality of life. Mobility and sustainable urban development are closely

connected. Because how we get from A to B on a daily basis also determines the appearance of our cities. Mobility needs to be designed so that it provides an attractive offer and helps to improve quality of life.



## Responsible use of natural resources

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The conservation of natural resources is the prerequisite for the sustainable development of our living spaces. Mobility is an area where a lot can be done to protect the environment. Transport systems with a

small ecological footprint thanks to energy efficiency and low emissions make a valuable contribution in densely populated areas.

## Requirements for mobility solutions

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A successful mobility offer meets the requirements of planners and users. When it comes to planning, it is important to create a concept that improves quality of life. An efficient, future-proof transport system is defined by a series of factors. Means of transport should offer a high level of availability and a high transport capacity, must guarantee a punctual and reliable service as well as comfortable travel for all passengers, and operate independently of obstacles

or traffic jams. They also need to be low on emissions and noise. In a densely populated city, available space is limited and should preferably be used as places of encounter. How can requirements like these be met by mobility solutions? With multimodal transport concepts. Because the answer lies in combining the benefits of the individual means of transport available for urban or transport planning to achieve maximum reliability and comfort.



## Taking transport to a whole new level

When transport routes on the ground are permanently overloaded or when space limitations prevent the introduction of new systems and the expansion of existing networks, it is time for new approaches. The aerial ropeway opens up an entirely new level for urban transport. Because the ropeway cabins simply glide above the city and the streets below. In addition, aerial ropeways possess a whole series of benefits and features that harmonize extremely well with other means of transport. As part of well-conceived, integrated transport concepts, aerial ropeways open up new possibilities by making use of a new, independent level that is not hindered by other forms of transport.

Integrating ropeway systems into existing transport systems is not only straightforward but can also serve a wide range of purposes: filling gaps, providing relief at specific points or acting as a bridge. Passengers benefit from trip times that remain constant throughout the day as well as from the safety and comfort that this means of transport offers. That's mobility taken to the next level.



### Mobility for all

The aerial ropeway is an affordable mode of transport for everyone. Thanks to completely barrier-free access, the ropeway can be used by mobility-impaired passengers without any difficulty. Baby strollers, wheelchairs or bicycles can also be carried at all times.



### Cost-effectiveness

A ropeway system can be planned and built within a very short time. In comparison with other means of transport, the costs of construction are manageable and also pay off in daily operations. With a small structural footprint, standardized layout concept, low energy consumption, plus optimized operations and maintenance, a ropeway system is impressively cost-effective.



### Attractive means of transport

A ropeway system is an attractive means of transport all round. Planners value the ease with which it can be integrated into existing transport networks as well as its environmental friendliness. Operators benefit from cost-effective operations and low construction costs. Passengers are delighted by a safe, reliable and comfortable means of transport that makes every trip an experience thanks to the views.



### Digitalized

Smart cities call for mobility solutions that are completely integrated into digital data and information networks. This includes information on the operational status of the entire public transport network at all times so that the next journey can be conveniently planned. The ropeway also provides information for the digital network and can be included in trip planning. The digitalization of operational information enables operators to monitor processes and continuously optimize them in real time. Functions like Wi-Fi, infotainment and much more are all part of a comfortable and connected urban ropeway experience.



### Urban integration

Ropeway stations can be harmoniously integrated into the urban environment, both in terms of the architectural design, the physical integration of the station and the integration of additional uses in the stations. Examples can be found worldwide: stations that have been incorporated in new or even existing buildings, underground stations or multi-functional stations housing offices, shops and restaurants.



### Proven technology

Ropeways have a successful track record of operating under the most challenging climatic conditions spanning decades and carry millions of people day in, day out in cities around the globe. They are proven as a safe and reliable means of transport.



### Short construction time and low space requirement

Optimized building processes using prefabricated elements for towers and stations enable short completion times for ropeways. The structural footprint is low as only the towers and stations require space on the ground. This makes construction possible even in built-up urban environments.



### Time-saving

Ropeway passengers lose no time because this means of transport runs continuously and its transport capacity is impressive. Traffic jams, hustle and bustle, and congested roads do not obstruct it. The ropeway is above it all and brings its passengers – commuters, families or tourists – quickly and reliably to their destination. The result is a very short and plannable journey at any time.



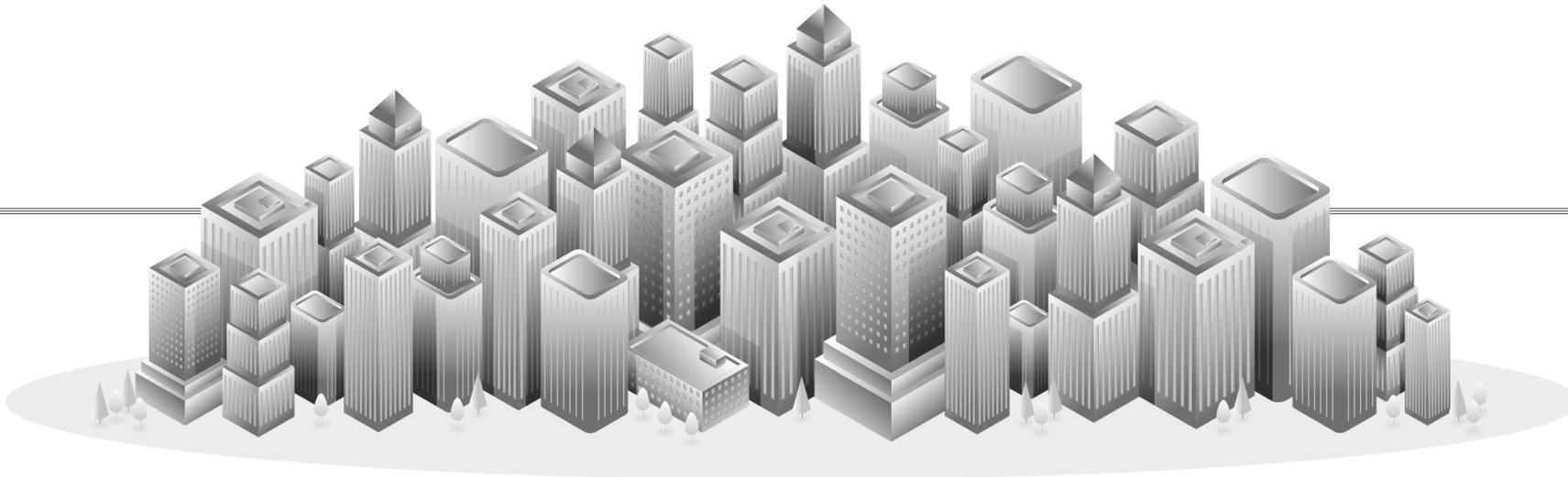
### Environmentally friendly

A ropeway system is an environmentally friendly means of transport. There are no local emissions thanks to its electric drive. With the use of renewable energies, operations can even be entirely carbon-neutral.



### Integrated

A ropeway system can be seamlessly integrated in order to expand or upgrade a transport network. Integration is made easier by the fact that existing timetables do not have to be modified as the ropeway operates continuously. This means improvements in the mobility offer can be performed quickly and simply.





## Sustainable urban mobility with aerial ropeways

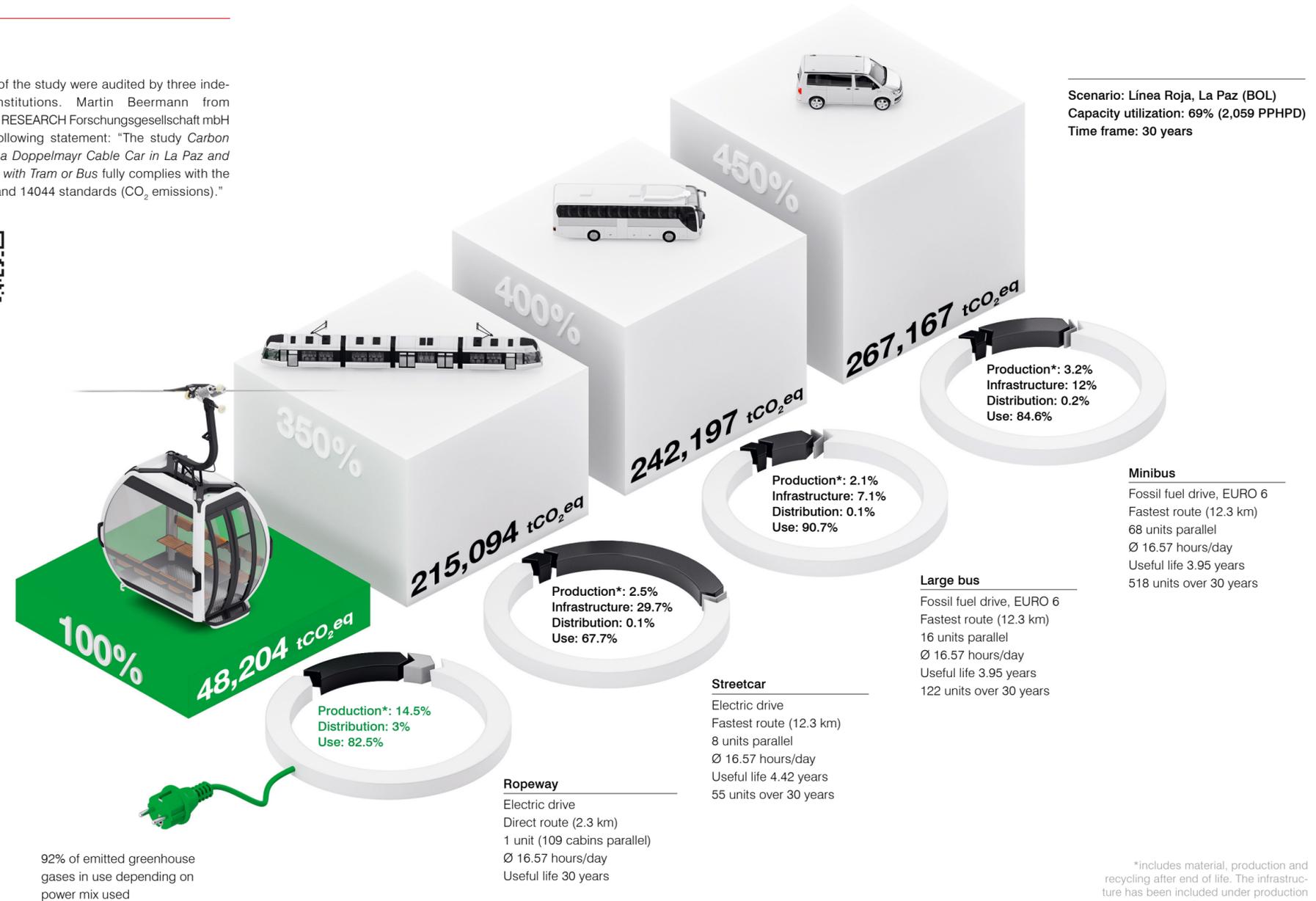
The University of Düsseldorf and sustainability experts from denkstatt GmbH examined and compared the carbon footprints of different modes of public transport on the basis of a scientific life cycle analysis. To ensure unequivocal comparability, the mobility requirements were combined to form a functional unit (same transport capacity, identical operating hours, etc.). In accordance with the standards ISO 14040 and 14044, the life cycle assessments of an aerial ropeway, buses and a fictitious streetcar were evaluated.

A Bolivian transport example was used for the purposes of the study. This involves a route in La Paz, which is now covered by the urban ropeway line known as the "Línea Roja". The ropeway system, opened in 2014, extends over an inclined length of 2.35 kilometers from the center of La Paz to El Alto. As an alternative, the transport connection could have been provided by buses or a streetcar over a distance of 12.4 kilometers.

### Ropeway has smallest carbon footprint

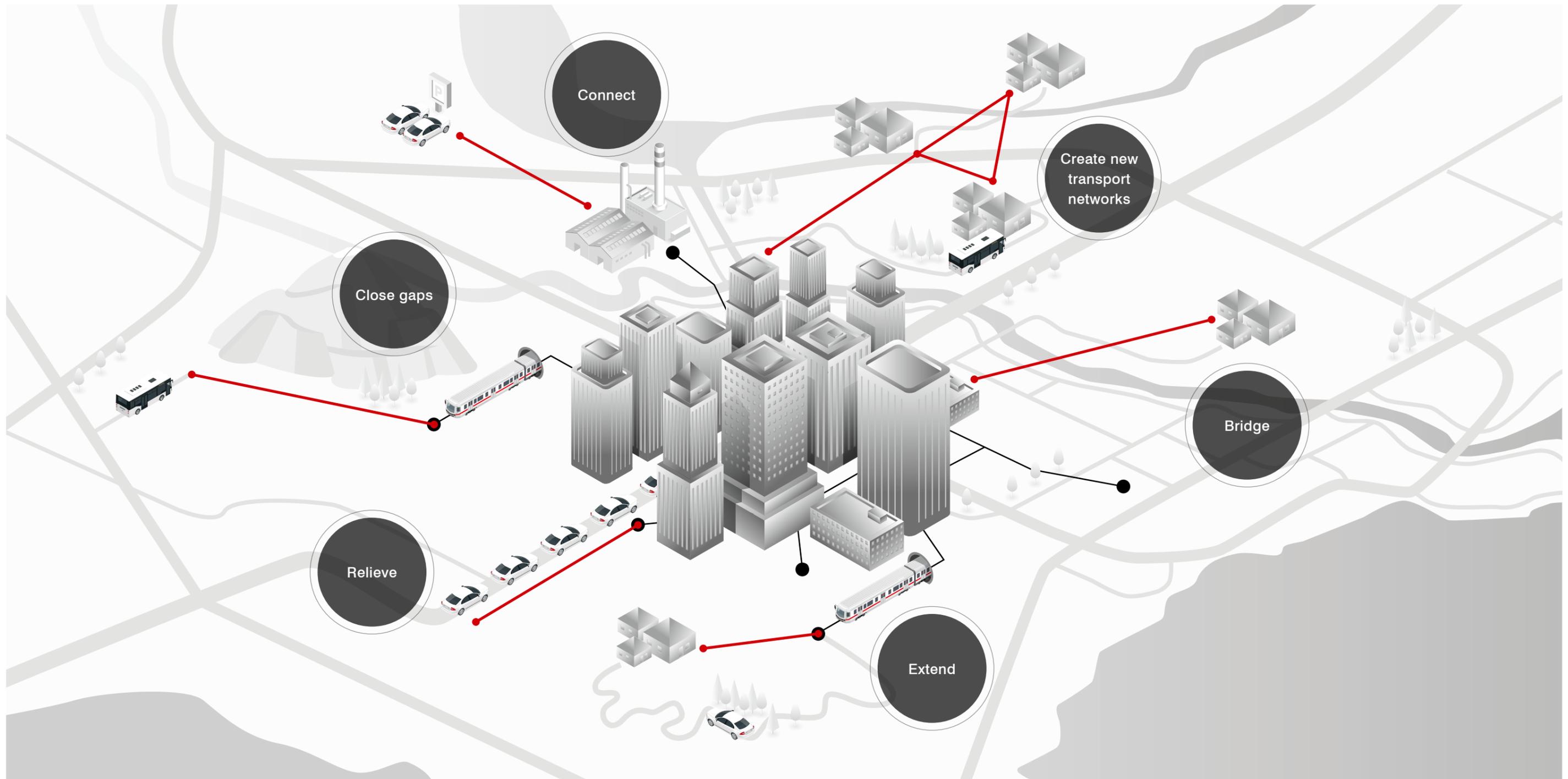
The ecological analysis showed the ropeway to be the most environmentally friendly mobility solution. The ropeway has the smallest carbon footprint. Assuming an operating lifetime of 30 years, the ropeway produces less than a quarter of the tons of carbon dioxide equivalent (tCO<sub>2</sub>eq) generated by the other means of transport (see graphic).

The results of the study were audited by three independent institutions. Martin Beermann from JOANNEUM RESEARCH Forschungsgesellschaft mbH made the following statement: "The study *Carbon Footprint of a Doppelmayr Cable Car in La Paz and Comparison with Tram or Bus* fully complies with the ISO 14040 and 14044 standards (CO<sub>2</sub> emissions)."



## Functions performed by ropeways

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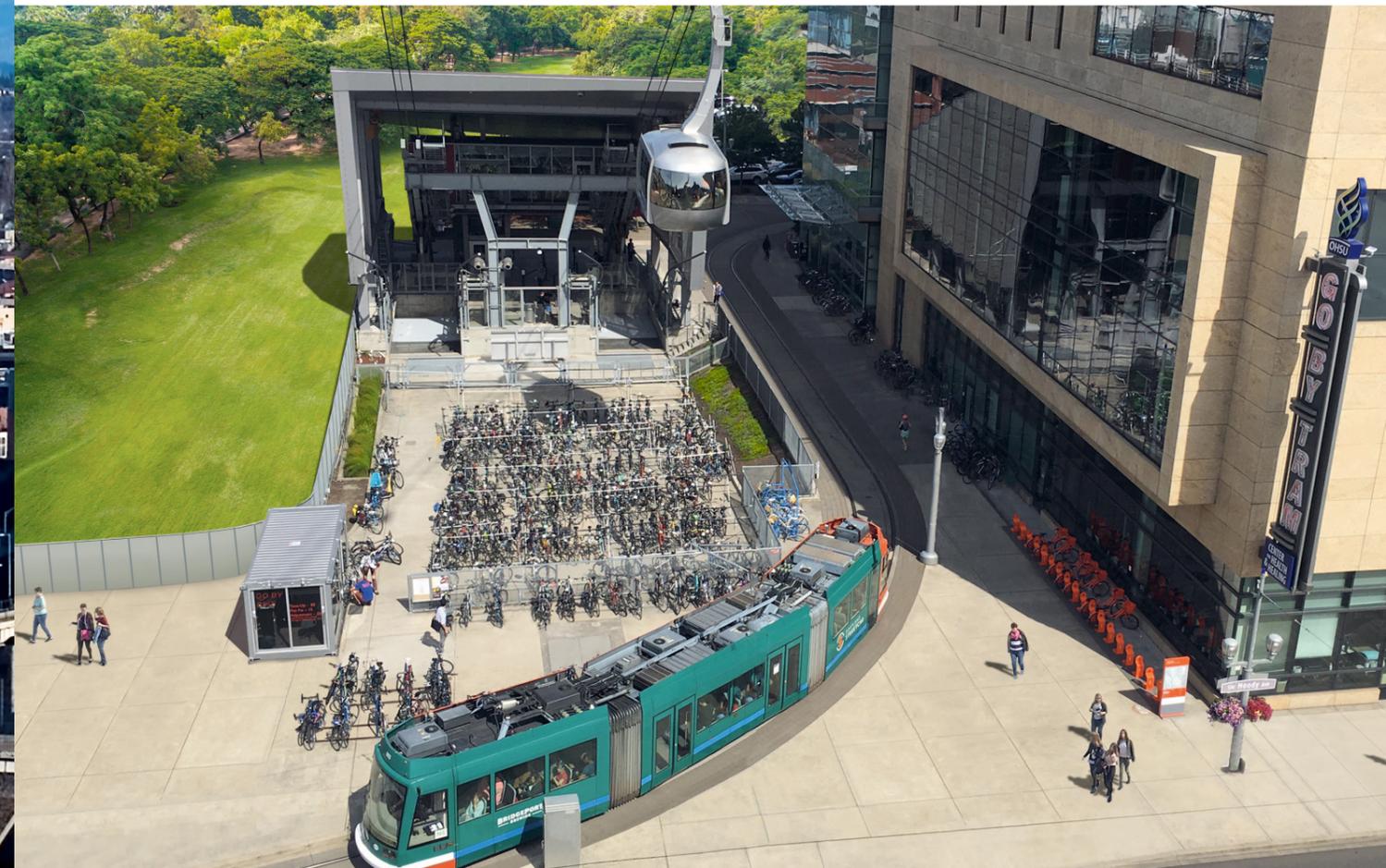


## Portland: Urban development by aerial tramway



The Oregon Health and Science University (OHSU) is the largest employer in Portland in the US state of Oregon. All its institutes are concentrated on one campus in the south of the city. Short distances between the individual institutes are essential for employees and patients. However, when the time came for a building expansion, there was no room directly on the campus and a site not far away had to be used. In order to maintain the short distances and easy reach of all the institutes, a reliable link was created with a reversible aerial tramway.

The Portland Aerial Tramway (ATW) incorporates two stations, one tower and two cabins. The silvery cabins appear light and airy. As well as offering space for 78 passengers, they can also be used to transport hospital beds. The tramway links up with the streetcar at the South Waterfront Station. Cyclists can park their bikes directly next to the station. The tramway made it possible to better integrate the OHSU into the city and to ensure a close connection between the expansion site and the campus despite the distance between them.

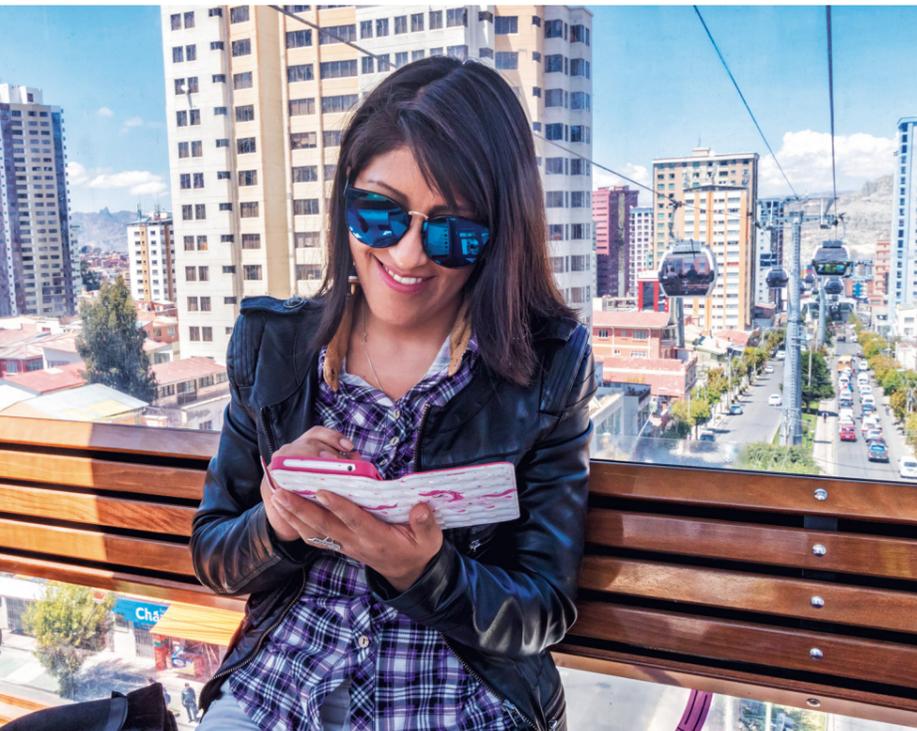


## The world's biggest ropeway network in La Paz

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Since 2014, aerial ropeways have been part of everyday life for the residents of La Paz and El Alto in Bolivia. These environmentally friendly and efficient installations make it easier for people to get from A to B, reduce travel times and guarantee that they will get where they want to go on time. The ropeway network constitutes the principal mode of transport for the two South American metropolises and consists of ten lines with an overall length of over 30 kilometers. Every day, Mi Teleférico is used by some 300,000 people – as a means of getting to work, going shopping, going to school or accessing leisure-time activities. Over 300 million passengers have been carried to date. Commuters benefit from significant time savings and escape from the daily road congestion by using the ropeway.

The stations are barrier-free and can also be used by mobility-impaired passengers with no problem. Many of the stations are multifunctional and also serve as community centers, providing a boost to the attractiveness of the local neighborhood. Free Wi-Fi in the cabins is a popular and frequently used additional benefit. The world's biggest ropeway network has had a positive impact on the many people who live and work in La Paz and El Alto, and improved their quality of life. Mi Teleférico is a visionary mobility solution that provides an outstanding example for others around the globe to follow.





## Luxembourg's first urban ropeway



The Pfaffenthal-Kirchberg funicular in Luxembourg ensures smooth and convenient handling of the commuter flows in this district. As part of the public transport network, it creates a fast and direct link between the Pfaffenthal railroad station on a busy commuter line and the Kirchberg commercial district. Although the railroad passes this district, there was no connection to the Kirchberg plateau. That meant having to change trains several times. With an inclined length of 200 meters, the funicular fills this gap and provides a direct link to the Kirchberg plateau, where there are connections to buses and streetcars. For commuters, this brings a major time saving. The funicular is optimally adapted to suit the needs of commuter traffic. Two parallel, independent

systems carry up to 7,200 passengers an hour at maximum capacity. This is sufficient to bring the passengers from two simultaneously arriving suburban trains to Kirchberg within just ten minutes. Outside of peak times, only one of the trains runs. The visual design also makes for a seamless interchange: In line with the specifications of the operator, Société Nationale des Chemins de Fer Luxembourgeois (CFL), the car exterior and fittings were chosen to match the CFL buses and tram.

## A popular means of transport in Singapore

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The 8-passenger gondola lift in Singapore has been carrying passengers from the mainland to Sentosa Island since 2010. Famous for its beaches, hotels and attractions, Sentosa is a popular destination for local residents and tourists. The ropeway not only provides a convenient means of reaching the island but also makes the journey there an experience. Passengers glide through the air high above the cruise ship harbor and get to enjoy the views of the ocean and the ships. The installation is perfectly integrated into the urban architecture and the transport system. The intermediate station is situated on level 15 of HarbourFront Tower Two, which is adjacent to a

shopping mall with access to a subway connection and a large number of bus lines.

As a special attraction, the cabins are converted into dining rooms for evening Sky Dining. During their trip in the gondola, passengers can enjoy fine food as the sun sets over the sea.





## Comfortable and eco-friendly trip across the Rhine

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The Koblenz Cable Car marked the first time worldwide that a tricable gondola was used in an urban environment. The route extends from Deutsches Eck in the city across the Rhine and up to the Ehrenbreitstein Fortress. The aerial ropeway was built as a transport solution for the 2011 Federal Horticultural Show to link the various exhibition sites distributed across the city. It was shown to be the means of transport that could meet the technical and ecological requirements for barrier-free access, high capacity and high reliability, plus low environmental footprint. The gondola was built with UNESCO's approval at the World Heritage Site "Upper Middle Rhine Valley" and praised as a sus-

tainable transport solution. It continues to be the preferred means of transport for reaching the public park next to the Ehrenbreitstein Fortress. An added bonus is the panoramic view that opens up during the trip. Doppelmayr set new benchmarks in urban ropeway construction by implementing its recovery concept for the first time worldwide on the Koblenz Cable Car. This guarantees that in an evacuation scenario all the cabins can be returned to a station where the passengers can safely disembark.



## Stepping into autonomous mobility



Pioneering innovations are the hallmark of a successful enterprise. Innovations that provide the right answers to what moves people. One example is the autonomous operation. This is an area where Doppelmayr is thinking ahead with the introduction of AURO (Autonomous Ropeway Operation). AURO ropeways bring passengers safely and reliably to their destinations – with unmanned operations and cutting-edge digital network technology. This concept is pointing the way for the future of rope-propelled mobility.

Cameras and sensors ensure smooth processes and monitor the installation – particularly cabin loading and unloading. The system independently identifies situations that deviate from “normal operation”. If, for instance, a passenger’s shoe becomes caught in the cabin door, the system reacts immediately and the installation automatically shuts down. It is restarted by a ropeway operative who has an overview of operations from the Ropeway Operation Center (ROC). The perfect synergy of human and cutting-edge technology results in high availability of the ropeway.





## FAQs

### ➤ Which ropeway systems can be used for urban applications?

Continuous-movement monocable ropeways, reversible aerial tramways, tricable gondola lifts, Funiculars or Cable Liners are suitable for urban applications.

### ➤ What does a ropeway cost?

The costs of a ropeway are dependent on a large number of parameters. These include ropeway type, length, transport capacity and the number of stations. Topography affects the number of towers required and the choice of system. This, in turn, affects the price. The costs of a ropeway installation therefore depend very much on the individual project. As a rough rule of thumb, it can be said that a ropeway costs around one-third that

of a streetcar and one-tenth that of a subway.

### ➤ How many people can a ropeway carry?

The capacity of a ropeway depends on the system. The maximum transport capacity is around 6,000 passengers per hour and direction. By way of comparison: To transport 12,000 passengers an hour (6,000 in each direction), 240 bus trips are needed with 50 passengers each or 2,400 automobiles with 5 passengers each. This, in turn, requires more road space and produces noise and emissions.

### ➤ How environmentally friendly are ropeways?

In terms of carbon footprint, ropeways are the most environmentally friendly means of transport. This is confirmed by independent, reviewed studies. Ropeways have an electric

drive, which means no local emissions and very little noise. Both the local area and the passengers benefit as a result. Ropeways also help to achieve the goal of conserving the soil as a natural resource. As their structural footprint is low, soil sealing is minimized.

### ➤ How fast do ropeways travel?

A continuous-movement monocable ropeway runs at up to 7 m/s (25.2 km/h); a tricable gondola lift at up to 8.5 m/s (30.6 km/h). Examples from road transport: In Vienna, the average speed of road traffic is 21 km/h; in Berlin it is 18 km/h and in Stuttgart 17 km/h. The great advantage of a ropeway is that it can travel without being affected by other means of transport (buses, automobiles, etc.). Furthermore, the ropeway takes virtually no detours as it moves in a straight line in places where a road follows a bend. That also saves traveling time. Another

factor in its favor is that a ropeway operates continuously (with no timetable and no stops).

### ➤ How big are ropeway cabins?

Ropeway cabins come in many sizes and variations. Depending on the ropeway system, these can hold from 8 (continuous-movement monocable ropeway) to 34 (tricable gondola lift) and as many as 230 (reversible aerial tramway) passengers. The cabins are designed to suit the respective purpose. Individual adaptations can be made to ensure enhanced comfort or for carrying freight, for instance. Passengers with wheelchairs, bikes or strollers can be carried without any problem.

### ➤ How long does it take to build an urban ropeway?

As a rule, ropeway projects have a completion time of 6 to 18 months.

The use of prefabricated elements for stations and towers makes such short construction periods possible. The fact that these installations have a low space requirement is also a contributing factor as less ground needs to be prepared. In addition, the flexibility of station architecture allows adaptation to a wide range of urban planning situations. The time required to build the world's biggest urban ropeway network in La Paz with 10 lines was roughly 6 years in two construction phases.

### ➤ Are ropeways barrier-free?

Ropeways are barrier-free. They are designed to carry all types of people – seniors, families with children, people with physical impairments, etc. – and also for transporting cargo. Cabins provide space for transporting bicycles, wheelchairs, baby strollers, luggage and pallets. Level walk-in in the stations ensures easy access.

### ➤ What are the parameters of a ropeway?

A ropeway is defined by transport capacity, length and the number of stations. These parameters determine the choice of system and further technical specifications like the number of towers and the number and size of the cabins.

### ➤ How is a ropeway integrated into an urban environment?

Ropeways are a highly flexible mode of transport. Their structures (stations, towers) can be integrated into the existing urban environment (houses, transport hubs, etc.) and their architecture individually designed to harmonize with the cityscape. Ropeways can also be linked with and integrated into a local transit network (combined stations, ticketing, etc.). The towers take up little space and additional amenities like shops, info points or restrooms can be provided in the stations.





Photos on pages 1, 2, 4 and 5; unsplash.com  
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**Doppelmayr Seilbahnen GmbH**  
Konrad-Doppelmayr-Straße 1, Postfach 20  
6922 Wolfurt / Austria  
T +43 5574 604  
dm@doppelmayr.com, doppelmayr.com

**Garaventa AG**  
Birkenstrasse 47  
6343 Rotkreuz / Switzerland  
T +41 41 859 11 11  
contact@garaventa.com, garaventa.com

