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PUBLIC VERTICAL TRANSPORT

TRANSPORTE PÚBLICO VERTICAL

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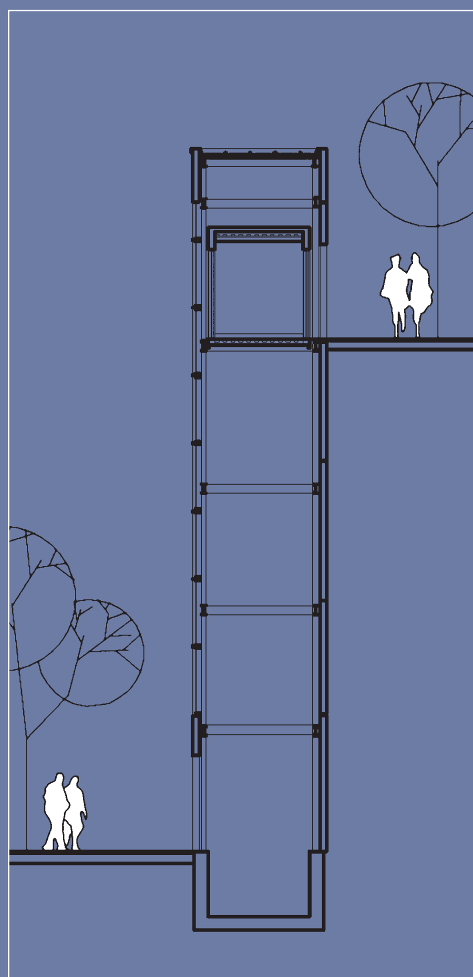
Donostiako Udala
Ayuntamiento de San Sebastián



PUBLIC VERTICAL TRANSPORT | TRANSPORTE PÚBLICO VERTICAL

A short guide to a reflection on lifts and escalators in the city of San Sebastian

Breve guía para la reflexión sobre ascensores y escaleras mecánicas en San Sebastián

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A short guide to a reflection on lifts and escalators in the city of San Sebastian

Breve guía para la reflexión sobre ascensores y escaleras mecánicas en San Sebastián

Intelligent Energy Europe

Donostiako Udala
Ayuntamiento de San Sebastián

snowball
Intelligent energy for integrated urban and mobility planning

PRESENTATION

This publication is the combined result of a technical study and a citizen participation process fomented by the city's corporation in order to create a framework for public reflection on the installation of vertical transport systems (lifts and escalators) as a way of linking the high and low districts of Donostia, getting round their difference in height. In this context, a workshop gathering various social agents and citizens' organisations was set up in April 2006; it amended and completed a first draft of this document. The version which is presented now is intended to establish a general framework and criteria to be followed in implementing town actions in this field. So, it is to be used by citizens and the Administration as a supporting tool for public participation in the next stages of the introduction of such public vertical transport systems in our city.

Vertical transport activities carried out in Donostia-San Sebastian, including the public participation process, are announced and analysed through the European project "Snowball" (Intelligent energy for integrated urban and mobility planning"), integrated in the programme STEER-IEE (Intelligent Energy for Europe). The proyect involved the cities of Stockholm, Hilversum, Trnava, Verona, Martin, Zvolen, San Fernando de Henares and Ludwigsburg. Companies from various European countries also take part in this project. Participating countries are, along with Spain, the Netherlands, United Kingdom, Sweden, Slovakia, Italy, Germany and Poland.

THE SPREAD OF A RENEWED PUBLIC TRANSPORT OPTION

Although installing lifts and funiculars is not new in the Basque Country, there have been technological, social and economic changes in the last few years which have considerably increased the chances to build both these and other new types of vertical transport systems.

By the heat of those changes, many towns in the Autonomous Region were struck by a bout of lift, escalator and inclined trav-olator building "fever". These systems even became a widespread proposal for or claim of hillside areas. But, applying this type of vertical transport systems to certain places may not be justified in environmental, social and economic terms.

From a sustainable mobility standpoint, those systems must be designed as aids to pedestrian traffic, cycling and public transport. In this regard, they can be part of a global alternative to the indiscriminate use of private cars in town. As a matter of fact, their characteristics allow conceiving them as means of collective public transport to complement the existing bus and railway services.

It is the purpose of this short guide to provide a framework for reflection which can ease the debate on said systems, their opportuneness and limits, as means of improving mobility and accessibility to areas built on the hillsides of Donostia-San Sebastian.

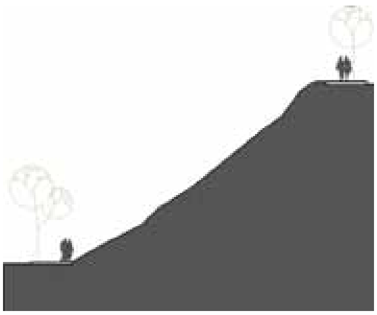
DIFFERENT SYSTEMS TO COPE WITH DIFFERENT CIRCUMSTANCES AND NEEDS

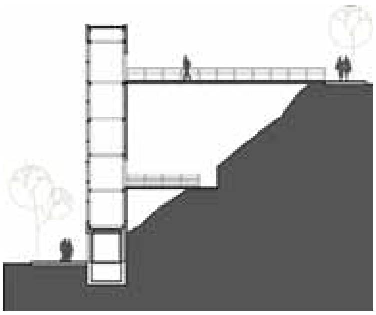
In the last few years, new vertical transport systems were developed and those with more than one century of existence experienced intense technological innovation. When assessing the suitability of a vertical public transport system for the specific requirements of a district or a particular place, the following set of criteria must be considered.

SLOPES AND HEIGHT DIFFERENCES

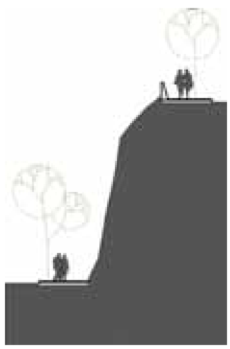
Each type of vertical public transport system differently adapts to the ground, slopes and difference in height of the points of departure and arrival to be linked.

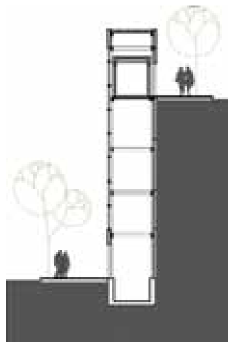
Lifts are principally intended for sites with a vertical or nearly vertical drop, but in combination with footbridges, they will be a good

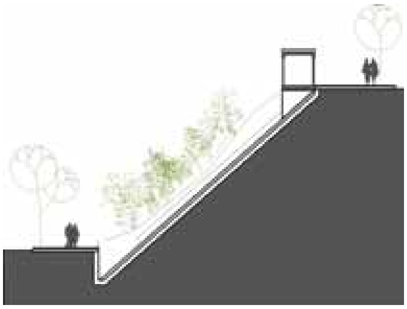


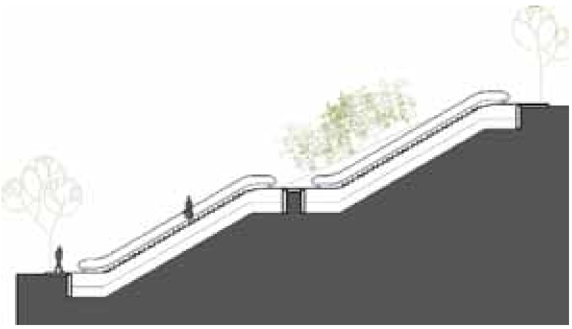


match for a variety of other areas. Moreover, oblique lifts are being installed, as they suit gentler slopes. The first oblique lift ever installed in the Basque Country Autonomous Region was inaugurated in Bilbao in 2004; it has a slope of 35 degrees. Over the last decades, the range of lift rises has also widened, in line with the demands of skyscraper construction. However, for outdoor use, covered distances are usually between 8 and 30 metres and there must be intermediate landings with emergency exits every 11 metres to meet the requirements of the prevailing regulations.



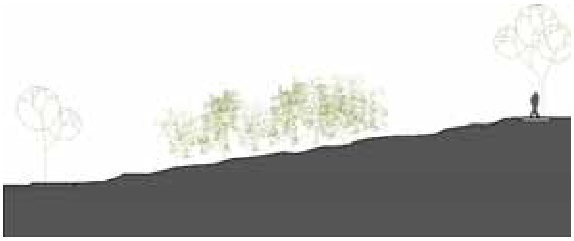


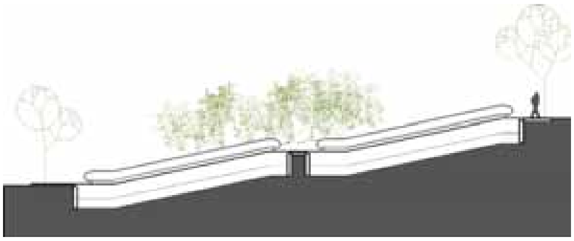




Outdoor escalators are relatively recent systems compared to indoor ones which were first installed at the end of the 19th century. Technological innovation in this field has led to the manufacture of system components that can be exposed to the weather with sufficient reliability to ensure uninterrupted service.

They are fit for slopes of 30 degrees or 35 degrees where the span is more than 6 metres in height. When several escalator sections

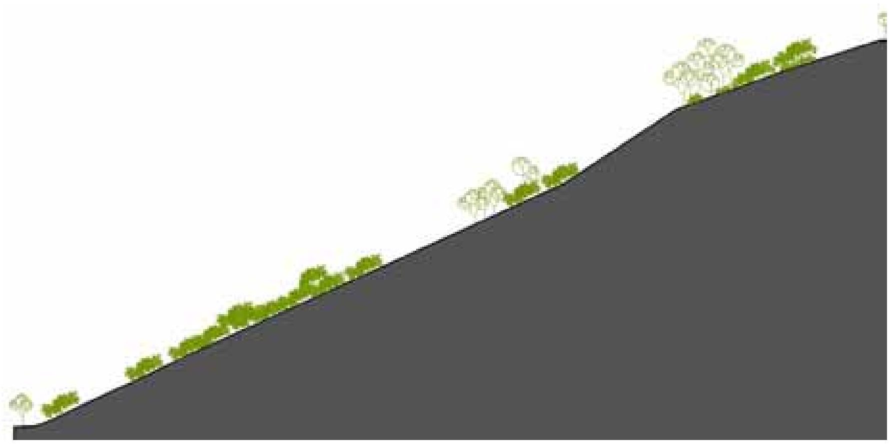




have to be installed, they must be separated by a minimum clearance of 2.50m.

Outdoor passenger conveyors (also known as trav-o-lators) are even more recent; they are designed for not so steep slopes, for slopes of less than 12 degrees; this is why each section permits to rise above small heights. Their technical and regulatory requirements are similar to those of escalators.

Finally, for major differences in height, there exists the option of installing a **funicular**. This is a railway system operating by cable driven by a fixed machine, and usually with ascending and descending cars counterbalanced. By way of reference, let's mention



A TRANSPORT SYSTEM MORE THAN ONE HUNDRED YEARS OLD

the funicular to Mount Igeldo (San Sebastián) which rises 151 metres, whereas that at Artxanda, Bilbao ascends 226 metres and the modernest one at Bulnes 402m. Moreover, they can be installed on variable slopes, ranging from 8.5 to 30 degrees.

TRANSPORT CAPACITY

A second point for reflection relates to the number of persons the aforesaid systems can transport. This determines the type of system to be installed with regard to the needs of the area concerned and the expected pedestrian flows in each case. Obviously, a high-capacity system would be economically, environmentally and socially unjustified in an area where the number of potential users is small, since the energy and financial costs would shoot up if the system operates at low occupation efficiency.

The carrying capacity of those systems is measured as the number of persons transportable per hour in each direction. This implies that several factors must be taken into account, namely: the escalator width, lift car area, seats of a funicular, travelling speed, population time and travel time.

For lifts, common specifications are a rated load of 8 persons and a travelling speed of 1.6m/s. If you add the loading, offloading, acceleration and braking times to those figures, you can estimate the carrying capacity to be slightly less than 500 passengers per hour in each direction for a 25-metre rise. Based on these figures, such a transport option would comfortably meet peak-hour demands not exceeding 350 passengers/ direction, which represents a daily pedestrian flow of 3500 people/ direction. In areas with a higher population density or exceptional conditions of access to certain facilities, an increase in carrying capacity could be considered, subject to increasing the size or number of lift cars.

The carrying capacity of escalators and trav-o-lators is much greater, varying from 4500 to over 13,000 passengers per hour according to their width and travelling speed (between 0.5 and 0.75 metres/second). The 18 flights of escalators installed at Eibar were used to make about 20,000 journeys a day in 2005.

The modernest funiculars operate at relatively high speeds: 6m/s at Bulnes (Asturias) against 1.5m/s at Mount Igeldo. Their carrying capacity depends on the size of the vehicle, its speed and the rise. As an example, let's mention that the funicular at Montjuic (Barcelona) can transport 8000 passengers/hour/direction. These vehicles carry from tens of passengers (50 in the event of Igeldo) to hundreds (400 at Montjuic).

INVESTMENT AND MAINTENANCE COSTS

For all those systems, the investment costs are split into two major items: the construction works and the vehicle or transport system; comparisons, even of one and same system, are therefore always hard to make. Indeed, whereas the vehicle or apparatus has a fixed price set by the manufacturer, civil engineering implies extremely variable dimensions, conditions and costs.

By way of reference, the two lifts planned to cover a drop of 35m at Larratxo have an estimated material implementation cost rounding 240,000 Euro. The feasibility study of escalators in the same district showed a material implementation cost of ca. 720,000 Euro for 4 flights to get round a height difference of 22 metres. This cost for escalators which almost triplicates the price of lifts can be used as a benchmark for comparisons in other districts.

Another reference could be the four spans of passenger conveyors installed in Andoain at a cost of 1.3 million Euro. The investment cost of funiculars is obviously of a different magnitude. So, for instance, the Bulnes funicular operating in a tunnel cost 12 million Euro.

When analysing the viability of those systems, it is also essential to bear in mind their operation and maintenance costs, since there are significant differences between one system and another. For this purpose, maintenance is deemed to include inspection, monitoring, cleaning, energy and repair costs. As a reference, let's mention that the maintenance costs, excluding repairs, of the lift at Mundaiz-EUTG amounted to 2100 Euro in 2005 and should be increased by 1400 Euro for energy consumption (about 600kWh per month).

In the event of escalators and trav-o-lators, this item also exceeds the lift figures, reaching in the order of three times as much.

With 400,000 users in 2000, the lifts at La Salve drew approx. 28,000kWh of electricity (meaning a cost of 6,000 Euro at the then prevailing rate), equal to 0.07kWh per passenger. Energy demand by escalators and passenger conveyors is high. For instance, the four spans of trav-o-lators in Andoain have an annual consumption of over 8,000 Euro.

ACCESSIBILITY AND INTEGRATION INTO THE CITY ENVIRONMENT

Accessibility, or ease of use by people with different psychophysical conditions, is an essential criterion when selecting a public vertical transport, since slopes are more detrimental to given groups of population, like the elderly, disabled, children or people carrying weights or pushing trolleys or bicycles.

The accessibility of lifts and passenger conveyors, by permitting the traffic of wheelchairs, is quasi complete, whereas escalators are

usable only by manual wheelchairs pushed by a carer and are also inaccessible to other people, including but not limited to those making use of a pair of sticks. Another point to bear in mind is that difficulties at certain slopes occur not only when going up, but also when descending; in such events, in order to equal the lift functionality, it would be necessary to build double escalators or trav-o-lators, at the additional costs.

Transporting bicycles in those systems is feasible, provided this function has been considered in the initial design and is adequately regulated. So, for instance, the size of the car is a key factor in lifts; it must be at least 1.8 metres in length. Transporting bicycles on escalators may be allowed under specific conditions and recommendations. There are funiculars adapted to wheelchair users and they can carry bicycles as well.

In terms of urban integration and appearance of vertical transport systems, the installation options are multiple and varied. There are lifts accessible through buildings or tunnels dug into rocks. Esca-

NOT ALL ARE ACCESSIBLE
TO EVERYBODY

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ACCESSIBILITY TO THE ELDERLY

lators also permit a choice of urban integration, either by occupying part of the pavement or being built parallel to stairs, or else by mounting them in excavations into the ground (Perugia).

Vertical transport systems may have an added scenic or tourist value if sensibly designed and built in the appropriate places.

A CAREFUL DESIGN WILL PERMIT INTEGRATING THOSE SYSTEMS EVEN INTO WORLD HERITAGE SITES, SUCH AS THE HISTORIC CENTRE OF TOLEDO

Worth mentioning in that respect are Eiffel's beautiful lifts in Lisbon, Bilbao's inclined lifts with Foster's hallmark, the escalators to the historical monuments of Toledo or the nostalgic attractiveness of the Igeldo funicular. Yet, they can be a source of nuisance for adjacent houses, if projected or maintained without all due care.

USER'S SAFETY AND ATTRACTIVENESS

Objective safety and the user's feeling of security are essential factors of successful vertical transport systems, above all where there are no permanent operators. Costs foster the installation of remote monitoring and operation control systems, based on cameras and remote controls.

Comprising a closed car, lifts are most liable to generate distrust during certain hours of the day and among concrete social groups; but they can be attractively designed, by incorporating transparent components which permit external control, avoid the sense of isolation and improve the perception of security.

Lighting is another important aspect for security at the accesses to any transport system.

Finally, the local climatic conditions must also be taken into account in the selection and design of the system in order to improve the users' comfort during the journey as well as while waiting (for lifts and funiculars).

RELIABILITY, OPERATION, MANAGEMENT AND FUNDING

As things happen with all means of transport, a high level of reliability is a key factor to the success of vertical transport systems, meaning users must be confident of service continuity and speediest possible response to failures or service interruptions. In that respect, although all the systems are offering sufficient operating guarantees, it is no doubt the long-established technologies (lifts and funiculars) which provide the highest performance reliability for the moment.

The conditions of use and operation of those systems largely vary, in terms of working hours, rates, user age limits, etc. Just to give an example, the EUTG lift has working hours linked to the Maria

THE TRANSPARENCY OF LIFT AS A SOCIAL REQUIREMENT

Cristina park it gives access to. For using several lifts in Bilbao, users must pay and there are passes available, like in other types of public transport; so, the lifts of La Salve and Ereaga as well as the Artxanda funicular are payable with the Creditrans pass that permits you to use the public transport system of Bilbao.

Also there exist different forms of management of these systems or of integration into the town's organizational chart. A municipal company (PARVISA) is responsible for the management of the Sagües lift, whereas the Mundaiz lift is run by the Office for Urban Services and Maintenance of the Town Council of Donostia-San Sebastian. In Bilbao, whereas some lifts are operated by municipal companies, others are run by private companies under a municipal licence.

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WHERE [THE SYSTEM IS] CLOSED AT NIGHT, ALTERNATIVE ROUTES WILL BE NEEDED

All those management options are also related to the funding of the investment and maintenance costs. The economic constraints to the spread of those transport systems could be reduced insofar as mechanisms are found, in order to complete the financing by the public administration or the public transport operators with funds contributed by certain beneficiaries.

[1] Based on a maximum car load of 8 persons, rise of 25 metres and travelling speed of 1.6m/s.

[2] Based on escalator or trav-o-lator widths ranging from 0.6 to 1 metre and travelling speeds varying between 0.5 and 0.65m/s. It should however be noted that a minimum width of 0.8m is required for access of wheelchairs to a trav-o-lator.

COMPARATIVE TABLE FOR LIFTS, ESCALATORS AND TRAV-O-LATORS

	LIFTS	ESCALATORS AND TRAV-O-LATORS
INSTALLATION COST	Relatively cheap, depending on the external finish of the apparatus	Relatively expensive
MAINTENANCE COST	Relatively cheap	Relatively expensive
ENERGY CONSUMPTION	Low	Medium
SLOPES WHERE INSTALLED	Very steep slopes, close to verticality; steep slopes if combined with footbridges, and medium slopes for inclined lifts	Medium (27-35º) for escalators and small (6-12º) for trav-o-lators
HEIGHT DIFFERENCE OVERCOME	There are lifts in more than 400m high skyscrapers; but in urban areas, lifts cover drops ranging from 8 to 30 metres, and under the law, a landing and emergency exit must be provided every 11 metres of rise	Each flight of escalator can overcome height differences from 6 to 10 metres according to their inclination. A single section of trav-o-lator will link two levels no more than 6-7 metres apart
CARRYING CAPACITY	480 persons/hour/direction[1]	From 4,500 to 11,000 persons/hour/direction[2]
ACCESSIBILITY	Virtually complete	There are limitations on access to escalators, above all for wheelchairs, prams, elderly people, and persons using a walking stick. Accessibility to trav-o-lators is almost unrestricted
WEATHER RESISTANCE	Very high	Acceptable
RELIABILITY	Good	Acceptable
SAFETY	Adequate	Adequate
ATTRACTIVENESS FOR USER	Acceptable where the car is not opaque; very high if the car is transparent	Very high
AESTHETICAL INTEGRATION INTO THE SURROUNDINGS	According to the site; lifts can even fit into areas of great tourist or heritage interest	According to the site. Adequate for sites with interesting views

PUBLIC VERTICAL TRANSPORT AND SUSTAINABLE MOBILITY

Reducing the environmental and social impacts of urban mobility is a priority accepted by all the institutions and social and economic agents throughout Europe. In order to achieve this goal, it is indispensable to redefine the presence of the car in the city, avoiding its current indiscriminate and irrational use. Sustainable mobility policies must provide a combination of measures to deter people from driving in the city and to foment travels by alternative means of transport: walking, cycling and collective transport. This group of alternative means of transport can include public vertical transport, since it makes it easier going on foot, riding a bicycle, travelling by bus or by train.

THE PUBLIC VERTICAL TRANSPORT SYSTEMS AS AN OPPORTUNITY FOR REASSESSING PUBLIC SPACE

COMBINING LIFT AND PUBLIC TRANSPORT

Justifying the installation of a lift or other vertical transport system economically, environmentally and socially has to do with the use of same by the population as well as with the system's capability to divert travels by car to other means of urban transport. If such an equipment fails to hold or be used by sufficient passengers, the economic and environmental balance will get out of balance, leading again to a situation of unsustainability. And if the equipment does not contribute to changing the mobility models, its contribution to sustainability will also be questionable.

For these reasons, beyond particular needs and requests, the public vertical transport systems must be valued from the standpoint of collective profit. To this end, it is necessary to weigh up their capacity to reinforce the networks of pedestrian, cycling and pub-

CYCLISTS CAN ALSO MAKE USE OF THE PUBLIC VERTICAL TRANSPORT SYSTEMS

lic transport routes and to form a unified system where each means of transport is used where it is most efficient to attain the objectives of urban sustainability.

CRITERIA FOR ASSESSING THE INTRODUCTION OF PUBLIC VERTICAL TRANSPORT SYSTEMS IN A DISTRICT OF THE CITY

Installing public vertical transport systems in a district of the city must be planned from the standpoint of sustainable accessibility and mobility, i.e. with all guarantees that the social, environmental and economic criteria supporting such an installation are established. The table below shows some of the criteria requisite for determining the suitability of those systems in a specific district of the city.

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POPULATION SERVED AND DEMOGRAPHIC CHARACTERISTICS (ELDERLY, CHILDREN, ETC)

The size of the target population and its demographic features constitute a first starting point in determining the importance and priority of a vertical transport installation. Even if accessibility problems sometimes deterred certain social groups, like families with kids, elderly or disabled people, from living in the district concerned, not only the current situation must be analysed; the future also must be thought of and thus foreseeable changes in local demography, including those the installation of a vertical transport system might bring, must be taken into account.

TRAVELS TO AND FROM THE DISTRICT CONCERNED (DISTRIBUTION AMONG THE DIFFERENT MEANS OF TRANSPORT)

The existing pattern of travels to and from the district concerned helps to evaluate the usefulness of a vertical transport system in order to reduce the number of travels by car and to increase walking, cycling and travels by collective transport. However, it is proper to consider also the population's capacity to change their travelling standards, for instance by fomenting mobility among people who travelled less often before the installation of the vertical transport system.

CONCENTRATION OF PEDESTRIAN STREAMS

When pedestrian streams concentrate or can concentrate on specific areas in a district of the city, it will be easier to get a sufficient demand to justify the installation of a vertical transport system. Consideration must however be given to the fact that the existence of such a system will change some travelling habits (change of given routes, frequency of access to given places, etc.).

PEDESTRIAN AND CYCLE CONNECTIVITY

Vertical transport systems must be part of a district's global strategy to improve non-motorised mobility, by boosting the opportunities of walking and cycling as alternatives to car driving. In that sense, it is important that public vertical transport systems are installed at the same time as pedestrian routes and cycle lanes are developed in the district.

PUBLIC TRANSPORT ALTERNATIVES

A vertical transport system can serve to link a district with the conventional public transport network, by making bus and railway lines more attractive. It can however compete with said network; in this event, it is essential to thoroughly review its global repercussions and the need for deterrents to the use of the private cars.

The distribution and uses of the buildings as well as the activities existing in a district may determine the potential for a public vertical transport system. Also it may occur that a vertical transport system brings changes in the use of the surrounding buildings or contributes to the settlement of the population, by stimulating the district's activities and social wealth.

TOWN-PLANNING OF THE DISTRICT, AREAS OF ACTIVITY

As explained at the beginning of this publication, each type of vertical transport system fits into a district's topography differently and meets the needs arising from the location of the accesses to the different buildings and public spaces in a different way.

TOPOGRAPHIC FEATURES AND THEIR RELATION TO THE BUILDINGS AND ACTIVITIES

From those criteria, it will be possible to establish a plan of actions, in order of importance, to distribute the existing limited resources equitably.

VERTICAL TRANSPORT SYSTEMS MAKE IT POSSIBLE TO OPEN NEW PEDESTRIAN ROUTES TO LINK THE CITY'S DIFFERENT AREAS