Measure title: **Vertical Transport**

City: **Donostia–San Sebastián** *Project:* **ARCHIMEDES** *Measure number:* **57**

Executive Summary

In a city like Donostia-San Sebastián, surrounded by mountains and with half of the population living in hilly neighbourhoods, vertical transport systems can be very important elements of the transportation system, assisting pedestrians and cyclists over steep terrain and improving accessibility conditions to these neighbourhoods, thus favouring a non-motorized mobility culture in the city.

Aware of it, the Municipality of Donostia-San Sebastian (ADS) initiated in 2007 the development of a vertical transport network. Proven the effectiveness of the systems, within the CIVITAS project the city of Donostia-San Sebastián has expanded the existing vertical transport network by implementing 7 additional elevators and 6 new escalators/ramps to support cycling and walking inside and towards the city centre.

The evaluation of this scheme has provided the following results:

- Vertical transport is recognized by the majority of the population. A huge majority of the population (98% in 2011) approved the system (ranked the system with a score of 5 or higher), providing it with an average rate of 8,9 out of 10. It is mostly agreed that vertical transport increases the accessibility of hilly neighbourhoods and contribute to increase non-motorized mobility, also increasing the attractiveness of the neighbourhood.

- Significant usage levels have been achieved, reaching 4.879 daily users in 2012 (2.801 in 2011 when only part of the network was in operation). An overall analysis of the data reveals that vertical transport is more used when located in highly populated neighbourhoods connecting hilly areas with important commercial areas and/or public transport nodes.

- The extension of the vertical transport network has contributed to a steady increase in the use of non-motorized modes. Although difficult to isolate the impact of this sole measure, which is estimated to be moderate, the CIVITAS project has achieved an overall reduction in car use of 0,1% as compared with the before situation. It should be highlighted that this achievement is made in a context of a steady increase in car travel, thus it can be considered a positive result.

- Regarding energy consumption and efficiency, even though an increase in energy consumption of the overall system has been experienced (2,3% increase between 2008 an 2011), the energy efficiency of the system has increased as a consequence of the CIVITAS project. It is estimated that in 2011 energy saving accounted for nearly 15 PET as compared with the BaU scenario. Both in terms of GHG and pollutant emission levels, significant reduction have been achieved by the CIVITAS project as compared to the BaU scenario (e.g. 2,5% reduction in Particulate Matter emission levels in 2011).

But lifts, ramps and escalators are very expensive infrastructures. The assessment conducted reveals that implementation and maintenance costs are much bigger for ramps and escalators than for lifts. For example, in Larratxo, the construction of the escalators was twice the cost of the construction of two lifts. While the maintenance cost of the three escalators is about 5 times the maintenance cost of the two lifts. It could be inferred that lifts are the preferred solution based on economic viability. But the topographic characteristics and the number of users can make it necessary to build ramps or escalators (like in the case of Lizardi). Ramps are best indicated for high density connections and main transport nodes (for example train stations). In some areas the topography makes it impossible to build lifts, therefore ramps or escalators are needed.

A Introduction

A1 Objectives and target groups

A1.1 Objectives

The measure objectives are:

(A) High level / longer term:

- Promoting walking and cycling

(B) Strategic level:

- To increase the number of cyclists by 30% as compared to 2008
- To maintain the high level of pedestrian mobility at 47% of the modal share

(C) Measure level:

- To assist pedestrians and cyclists over steep terrain to encourage travel by these modes in a difficult environment

A1.2 Target groups

The measure is mainly targeted at citizens living in the hilly areas (white area) which represent around 50% of the total population. Although hilly areas of the city are mainly residential, this measure may also have an impact on Donostia-San Sebastián visitors.

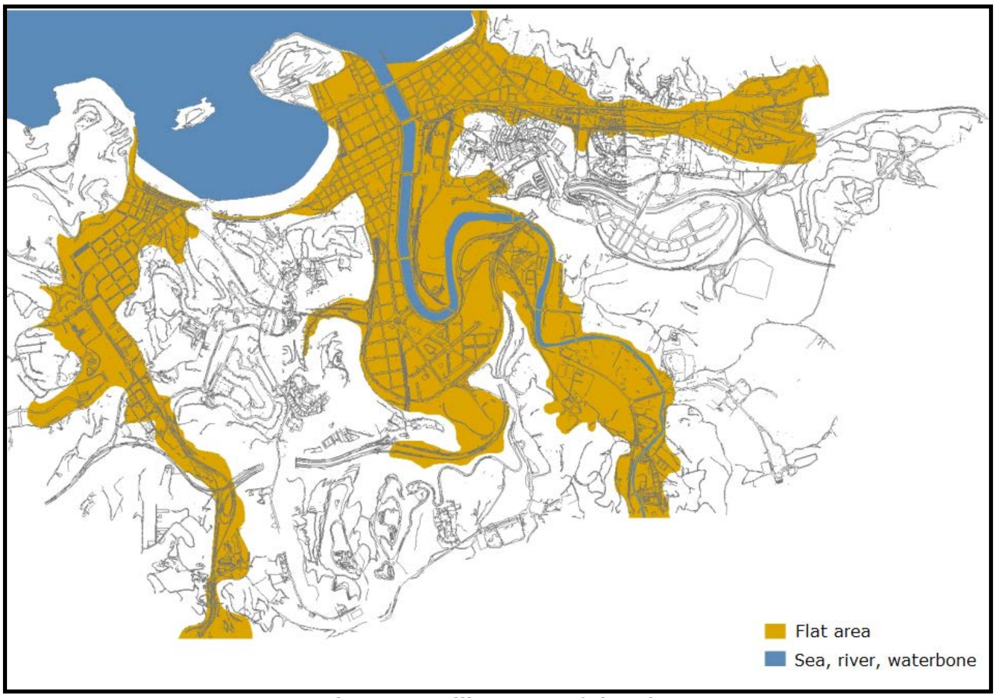


Figure 1.- Hilly areas of the city

A2 Description

The city of Donostia -San Sebastián overlooks the sea and is surrounded by mountains. Half of its population live in the hilly areas of the city. The steep topography of these neighbourhoods poses significant physical barriers for walking and cycling as a mode of transport to and from the flat areas of the city, especially for elderly and impaired people who are more sensitive to high slopes and long detours..

In order to assist pedestrians and cyclists over steep terrain and encourage them to travel by non-motorized modes, as well as to improve accessibility conditions to these neighbourhoods, the Municipality of Donostia-San Sebastian (ADS) initiated in 2007 the development of a vertical transport network.

Proven the effectiveness of the systems, within the CIVITAS project the city of Donostia-San Sebastián has expanded the existing vertical transport network by implementing 7 additional elevators and 6 new escalators/ramps to support cycling and walking inside and towards the city centre. Vertical transport systems facilitate walking and cycling thus encouraging its use.

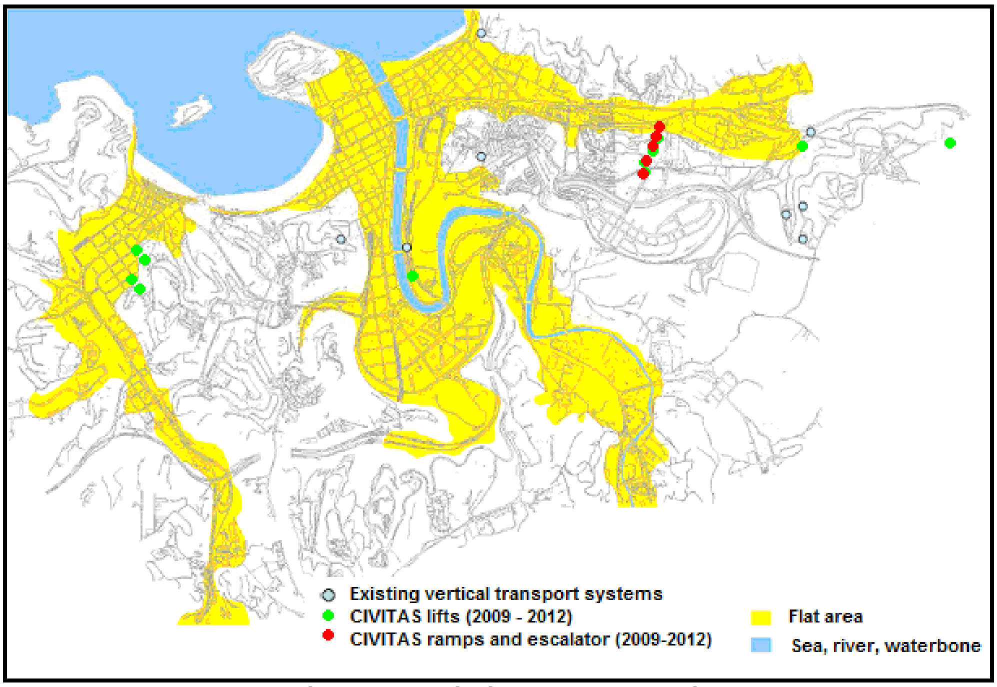


Figure 2.- Vertical transport network

The measure is also considered a step forward in the development of the non-motorized network (pedestrian paths and cycling infrastructures) since the vertical transport systems has not only improved the access to existing infrastructures but also interconnect them through the creation of new pedestrian and cyclists routes.

Figure 3.- Cycling network map integrating vertical transport connections

In fact, the improved Vertical Transport network should be understood as a complement to other mobility strategies: for pedestrians and cyclists, as explained above, but also for public transport, since they complement existing bus and train services, providing better access to them.

Within ARCHIMEDES the Municipality of Donostia-San Sebastián has issued a brochure to promote the use of the vertical transport systems as integral elements of the walking and cycling infrastructure.

Figure 4.- Vertical transport brochure

B Measure implementation

B1 Innovative aspects

The innovative aspects of the measure are:

- **New conceptual approach** (at international level). Public Vertical Transport System linking the non motorizes networks
- **New physical infrastructure solutions** (at city level)-- The offer of vertical transport aids (lifts, escalators) make walking and cycling trips easier towards the city centre and hence encourage their use.
- **New policy instrument** (at international level)-- The city of Donostia-San Sebastián (ADS) has expand the policy of vertical transport with a Plan for Public Vertical Transport

B2 Research and Technology Development

An evaluation of existing public vertical transport systems (lifts, funiculars, cycle lifts, etc) has been undertaken aiming to identify the most suitable locations and specifications of the vertical transport systems prior to its implementation as part of the demonstration measure.

Within the study, the criteria to be considered when facing the implementation of a new vertical transport system has been defined and analysed:

SUMMARY OF TECHNICAL SPECIFICATIONS FOR VERTICAL TRANSPORT SYSTEMS		
CONCEPT	LIFTS	ESCALATORS AND MECHANICAL RAMPS
Installation cost	Relatively cheap, depending on the external finish	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 ramps.
Height difference overcome	Lift cover drops ranging from 8 – 30 metres, a landing and emergency exit must be provided every 11 metres.	Each flight or escalator can overcome height differences from 6 to 10 metres,
Carrying capacity	480 persons/hour/direction	4500-11000 person/hour/direction
Accessibility	Complete	Limitation for wheelchairs, prams, elderly people, and persons using a walking stick.
Attractiveness for user	Acceptable so long as there is at least one glass window providing external visibility	Very high

Table 1.- Summary of technical specifications for vertical transport systems

In addition, ten neighbourhoods were assessed according to the following criteria in order to identify the more suitable areas for the implementation of vertical transport systems:

A. Population served and demographic characteristics.

B. Travels to and from the concerned district (distribution among the different means of transport)
C. Pedestrian and cycle connectivity
D. Public transport alternatives
E. Topographic features and their relation to the buildings and activities.

As a result, the study recommended six areas for the implementation of vertical transport systems, while identified seven additional areas where further considerations were required:

Recommended Vertical Transport Systems		
LOCATION	**TYPE**	**HEIGHT DIF**
AITZGORRI – AVANC	2 Lifts	40 m.
MONTPELIER	2 Lift	15 m.
ALDUNAENE	Lift	18 m.
AZKUENE -GOMISTEGI	Lift	20 m.
RUTILITA	Lift	7 m.
LIZARDI	4 ramps + 1 escalator	27m.

Table 2.- Recommended Vertical Transport Systems

Vertical Transport Systems for further consideration	
LOCATION	**TYPE**
ALDAKOENEA	Lifts
BIDEBIETA	Lift
LOIOLA – INTXAURRONDO	Lift
ESTACIÓN DE ATOCHA	Lift
AIETE – MORLANS	Lift
AVANCO – AIETE	Lift
AUNITZ –AKULAR	Lift

Table 3.- Vertical Transport Systems for further consideration

B3 Situation before CIVITAS

Before the CIVITAS project started there were nine vertical transport systems in operation in Donostia-San Sebastián. Two were sets of ramps and escalators and the other seven are lifts (which totals 9 lifts, since two of these systems are double-lift systems). Bellow there is a brief summary of their technical specifications, followed by a map showing it location within the city:

Vertical Transport network before CIVITAS			
LOCATION	**TYPE**	**OPENED**	**HEIGHT**
Sagües	Lift	2002	11 m.
Mundaiz	Lift	2003	10 m.
Larratxo	2 Lifts	2007	35 m.
Larratxo	3 Escalators	2007	21 m.
San Luis	Lift	2007	8 m.
Martín Santos	Lift	2008	23 m.
San Roque	4 Escalators	2008	35 m.
Aquarium	Lift	2008	13 m.
Buenavista	2 Lift	Sept 2009	23 m.

Table 4.- Vertical Transport network before CIVITAS

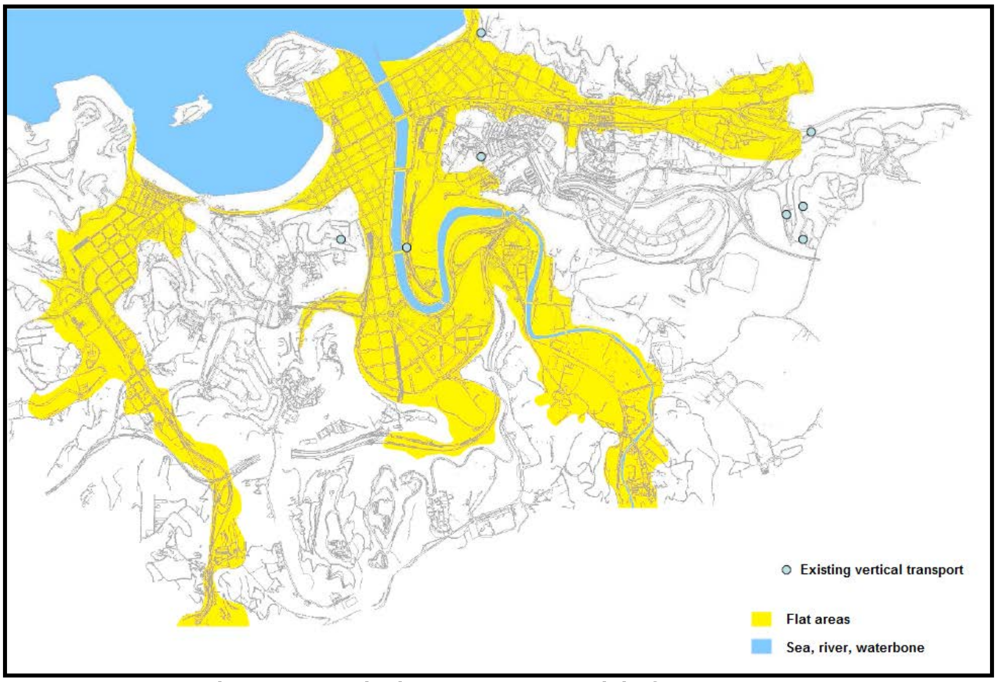


Figure 5.- Vertical transport network before CIVITAS

B4 Actual implementation of the measure

The measure has been implemented in the following stages:

Stage 1: Identification and Evaluation Phase. *(Sept. 2008 – Sept. 2009).* An evaluation of existing public vertical transport systems has been undertaken to identify suitable locations and systems to be implemented.

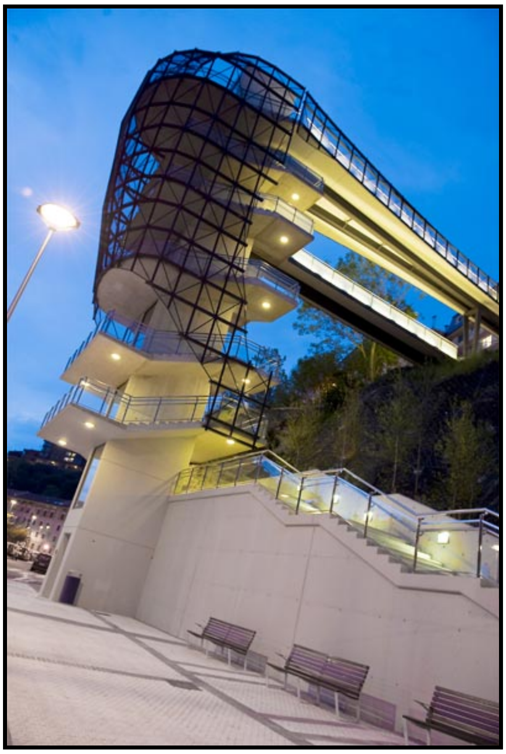
Stage 2: Project and design of Pedestrian/Cyclists Vertical Transport Systems. Interaction with citizens and neighbours associations. *(Sept. 2008 – Sept. 2009).* The Department of Public Participation has worked with the population of the potentially affected neighbourhoods in order to agree on the more suitable systems and operation conditions.

Stage 3. Construction of Pedestrian/Cyclist Vertical Transport Systems. *(Sept. 2008 – Sept. 2012).* ADS has expanded the vertical transport network to make walking and cycling trips towards the city centre easier and hence encourage people to use these modes of transport on a regular basis. The following systems have been implemented:

Vertical Transport systems implemented within CIVITAS			
Name	**System**	**Status**	**Neighbourhood**
Aizkorri	Elevator (2 unit)	Completed	ANTIGUO
Rutilita	Elevator	Completed	HERRERA
Montpelier	Elevator (2 unit)	Completed	ANTIGUO
Aldunaene	Elevator	Completed	CENTRO
Azkuene – Gomistegui	Elevator	Completed	BIDEBIETA
Lizardi	4 ramps and 1 escalator	Completed	INTXAURRONDO

Table 5.- Vertical Transport systems implemented within CIVITAS

The measure represents a 78% increase in the number of lifts and 85% in the number of ramps/escalators, as compared to the previous existing situation.



Picture 1.- Aizkorri Lift

Stage 4. Evaluation of the impacts and process. *(Sept. 2009 – Sept. 2012).* The vertical transport systems have been evaluated according to the MLEP.

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **Measure 24.** – **Extension of the infrastructure for cycling and walking in Donostia - San Sebastián.** The vertical public transport systems links the cycling and walking networks between the flat and the hilly city

Picture 2.- Pedestrians and cyclists waiting at the Aizkorri lift

C Planning of Impact evaluation

C1 Measurement methodology

C1.1 Impacts and indicators

C1.1.0 Scope of the impact

Within an overall strategy to reduce the number of private cars entering the city and circulating within its neighbourhoods, this measure is part of a package of measures directed to increase the use of non-motorized modes (Measures nº 24, 57 and 58).

The hilly configuration of Donostia-San Sebastián poses significant physical barriers for walking and cycling, especially for elderly and impaired people, who are more sensitive to high slopes and long detours. If conveniently accompanied by accessibility measures in the affected neighbourhoods, this measure contributes to curve these barriers by providing an efficient vertical transport system that improves non-motorized accessibility to hilly neighbourhoods, encouraging people to walk and cycle more.

Despite a major impact on modal shift, the implementation of vertical transport systems impact on walking and cycling level by significantly enhancing accessibility conditions, allowing for shorter and less costly trips. This has important positive implications in terms of equity, since elderly and impaired people see their accessibility and freedom of movement significantly improved by the measure.

Nevertheless, in combination with other measures directed towards an improvement of non-motorized mobility (like the above referred), vertical transport can promote an increased use of non-motorized modes, resulting in reduced transport related emissions and safer mobility patterns (fewer accidents). Moreover, the promotion of these modes of transport improves health values of the population, by favouring physical activity on a regular basis.

C1.1.1 Selection of indicators

NO.	EVALUATION CATEGORY	EVALUATION SUB-CATEGORY	IMPACT	INDICATOR	DESCRIPTION	DATA /UNITS
	ECONOMY					
2a		**Costs**	Costs	Capital costs	Capital cost per system or unit	Euros, quantitative
2b				Operating costs	Costs per pkm or vkm	Euros, quantitative, derived or measured
2b				Maintenance costs	Maintenance costs	Euros, quantitative, derived or measured
	ENERGY					
		Energy Consumption	Electricity Consumption	Number of kwh consummed	Electricity consumption of lifts and escalators	Kwh per system and user
3			Fuel Consumption	Vehicle fuel efficiency	Fuel used per vkm, per vehicle type	MJ/vkm, quantitatived, derived or measurment
	ENVIRONMENT					
8		**Pollution/Nuisance**	Emissions	CO_2 emissions	CO_2 per kwh	CO_2 per system and per user
8				CO_2 emissions	CO2 per vkm by type	G/vkm, quantitative, derived
9				CO emissions	CO per vkm by type	G/vkm, quantitative, derived
10				NOx emissions	NOx per vkm by type	G/vkm, quantitative, derived
11				Particulate emissions	PM10 and/or PM2.5 per vkm by type	G/vkm, quantitative, derived
	SOCIETY					
13		**Acceptance**	Awareness	Awareness level	Awareness of the policies/measures	Index (%), qualitative, collected, survey
14			Acceptance	Acceptance level	Attitude survey of current acceptance of the measure	Index (%), qualitative, collected, survey
15		**Accessibility**	Spatial Accessibility	Perception of accessibility	Perception of physical accessibility of vertical transport aids	Index(%), qualitative, collected, survey
	TRANSPORT					
29		**Transport System**	Modal split	Average modal split-trips	Percentage of trips for each mode	%, quantitative, derived
			Modal split	Number of pedestrians using vertical transport systems	Number of pedestrian using vertical transport aids (down and up)	Number
			Modal split	Number of cyclists	Number of cyclists using vertical transport aids (down and up)	Number
			Modal split	Number of uses of vertical transport systems	Number of journeys that use vertical transport aids (pedestrians and cyclists)	Number

C1.1.2 Methods for evaluation of indicators

No.	INDICATOR	TARGET VALUE	Source of data and methods	Frequency of Data Collection
2a	Capital costs		Data collected from financial records of ADS	When implementation takes place
2b	Operation and maintenance Costs		Annual budget for operation and maintenance of vertical transport systems	Annual
	Energy consumption		Derived from elevators and escalators usage according to the data provided from the supplier on energy consumption standards	Annual
3	Vehicle fuel efficiency		Model based on mobility survey and traffic flows data	Once in 2012
8	CO_2 emissions		Estimated according to energy consumption	Annual
8,9,10,11	CO_2, CO, NOx, PM emissions		Modelling results based on mobility survey and traffic flows data	Once in 2012
13, 14, 15	Awareness and Acceptance level; Perception of accessibility	More than half of the population	Data have been collected through a specific survey over a representative sample of citizens living in the hilly neighbourhoods. The target audience are citizens of all ages and gender living in the hilly neighbourhoods where vertical transport systems are implemented. The survey method has been on-street personal interviews .The questionnaire included questions regarding awareness, acceptance and accessibility perception levels. A sample size of 400 interviews is defined (95% confidence level)	Twice, after the launch of the system
29	Average modal split- trips	Maintain the high level of 47% of pedestrian mobility.	Modelling results based on mobility survey and traffic flows data	Once in 2012
	Number of pedestrians	Increase the number of pedestrian on the network	Counting of pedestrians at strategic points in the network and on the new vertical transport facilities	Twice, after the launch of the system
	Number of cyclists	Increase the number of cyclists on the network	Manual counting of cyclists at strategic points in the network and on the new vertical transport facilities	Twice, after the launch of the system

C1.1.3 Planning of before and after data collection

EVALUATION TASK	INDICATORS INVOLVED	COMPLETED BY (DATE)	RESPONSIBLE ORGANISATION AND PERSON
Analysis of financial accounts.	2a, 2b	Months 15, 27, 39	Ayuntamiento de Donostia-San Sebastián, Fermín Echarte
Data collection on energy consumption by the vertical transport systems		Month 15-27-39	Ayuntamiento de Donostia-San Sebastián, Fermín Echarte
Model based on mobility survey and traffic flows data	3-8-9-10-11-29	Month 42	Ayuntamiento de Donostia-San Sebastián, Fermín Echarte
Acceptance, awareness and accessibility perception levels	13-14-15	Month 24-36	Ayuntamiento de Donostia-San Sebastián, Fermín Echarte
Counting of pedestrians and cyclists at strategic points in the network and near the new vertical transport facilities		Month 24-36	Ayuntamiento de Donostia-San Sebastián, Fermín Echarte
Counting of the number of times in which each pedestrian and cyclist use the facilities		Month 24-36	Ayuntamiento de Donostia-San Sebastián, Fermín Echarte

C1.2 Establishing a baseline

OVERALL APPROACH TO EVALUATION

As already explained above, it is expected that the implementation of vertical transport systems result in a major impact on non-motorized mobility conditions by significantly enhancing accessibility conditions for walking and cycling (shorter and less costly trips) rather than promoting a significant modal shift towards non-motorized modes at the city level.

For that reason, the main scope of the evaluation process is to assess the usage of the newly implemented elevators, escalators and ramps, and its contribution to an improved accessibility for pedestrians and cyclists. Together with the costs associated to this infrastructures, as well as public perception and acceptance issues.

But vertical transport systems are considered an important feature of the overall non-motorized strategy deployed by the Municipality of Donostia – San Sebastián within the CIVITAS project. Therefore the results in terms of modal shift, as well as the impacts on fuel consumption and emissions prompted by the CIVITAS project have been also included in the evaluation of this measure.

TECHNICAL APPROACH

Given their different technical specifications and the higher maintenance requirements of escalators and ramps over lifts, it was decided to undertake a separate analysis of these systems to better understand their differences.

DATA COLLECTION

The data collection method for the evaluation of measure 57 is as follows:

1.- Data collected from other departments

It has been collected data from different departments of the municipality. Construction costs of lifts, ramps and escalators have been collected from ”Proyecto y Obras” Department. The maintenance costs have been collected from “Vías Públicas” Department (Public Roads Department).

2.- Survey

The perception of citizens regarding the construction of the new vertical transport systems has been analysed. Surveys were done in the areas where the measure has been implemented. Considering that this is the best way to assess this topic, as perceptions are a personal feeling, it has been considered that this is the best way to measure these results. The surveys were done in July 2010 and July 2011

3.- Model

A classic four step model has been designed to assess modal shift, traffic performance and emissions. Car traffic, public transport and non-motorized modes have been considered within the demand model.

In order to replicate trips generation (including origin and destination), modal share and traffic assignment to the road network, the following input has been used:

- Urban zoning according to Regional Mobility Survey traffic zones and census division
- Road network characteristics (nº lanes, speed management, traffic regulations, etc.)

- Non-motorized transport network characteristics (walking and cycling exclusive connections)
- Public transport service provision characteristics (frequency, capacity, etc.)
- Socioeconomic variables (population projections, income, etc.)
- Urban development plans
- Baseline modal share: actualization of the Regional Mobility Survey (Basque Govern) based on a field work campaign (mobility survey) conducted in the framework of the studies for the implementation of the metro network in Donostialdea
- Traffic counts from automatic traffic gauging devices in the main corridors entering the city
- Cycling levels from Bicycle Observatory statistical database

CUBE (Citilabs) modelling software has been used for calibration (taking into account existing records on traffic counts and modal split data) and future projections. CIVITAS and BaU scenarios have been projected (with and without CIVITAS developments, respectively). The modelling software includes an emissions module used to determine emission volumes in both scenarios.

4.- Counting of cyclists and pedestrians

The number of cyclists, pedestrians, disabled people and pedestrians with trolley for kids making use of the newly implemented vertical transport systems has been accounted. Data has been collected in two waves – May 2011 and March 2012 - one day in each case.

BASE DATE, AREA INCLUDED

For most indicators, data has been collected before and after the implementation of the vertical transport systems. In the later, data collection has been undertaken right after finishing the construction of the lifts and also some time after, in order to make it possible for people to get used to the use of the new infrastructure and consolidate new mobility patterns. While the Before situation includes years 2007, 2008 y 2009, the After situation refers to years 2010 and 2011.

The area considered in this measure includes all the hilly neighbourhoods in the city. Society indicators have been collected in the surroundings of the new infrastructures.

C1.3 Method for Business as usual scenario

If this measure would have not be implemented, the hilly neighbourhoods in Donostia-San Sebastián which actually doesn't account for a vertical transport system would continue lacking these facilities, discouraging the use of non-motorized transport in those areas. Mobility patterns would stay unaltered, thus motorized mobility would increase its modal share.

For evaluation purposes, a different approach has been followed depending on the variable being estimated:

Capital costs

Since the vertical transport policy in Donostia-San Sebastián was already initiated before the CIVITAS project started, it is considered that additional systems would have been implemented even in the absence of CIVITAS, although to a reduced extent. In particular, it has been considered that investment levels will reach a similar amount as in previous years.

For evaluation purposes, BaU capital costs have been estimated as the average investment of years 2007, 2008 and 2009.

Nevertheless, it should be highlighted that this assumption only applies to lifts, because in 2009 there was no plan to build additional ramps or escalators, given the high costs of this type of infrastructures so it is only used in very special cases.

Operation and maintenance costs
Following the assumption made for investment in vertical transport infrastructure, it is considered that operation and maintenance costs under the BaU scenario would have evolve in the same pattern as previous years. For evaluation purposes, the average yearly increase in both operation and maintenance costs during the period from 2007 to 2009 has been calculated. Then operation and maintenance costs under the BaU scenario have been estimated adding this average amount to the operation and maintenance costs of the previous year.

While operation and maintenance of lifts would be affected by this assumption, it should be noted that, according to the above referred assumption regarding investment in escalators and ramps, operation and maintenance costs of this type of infrastructures remain as in previous years.

Energy consumption
Regarding the energy consumed by the vertical transport systems in its operation, the estimation of the BaU scenario has followed a similar approach to operation and maintenance costs. It has been considered that energy consumption would have increase in the same pattern as in previous years. The average yearly increase of energy consumed by lifts has been added to the figure of the previous year.

Vehicle fuel efficiency
On the other hand, the energy consumption associated to the overall mobility in the city (vehicle fuel efficiency indicator) has also been assessed. In this case, BaU scenario has been estimated making use of the demand model calibrated within this measure according to the evolution in traffic levels without the implementation of the CIVITAS measure.

Society
Before the CIVITAS project there were not survey regarding user's acceptance and awareness of vertical transport systems, therefore is not possible to calculate BAU scenario for this variable

Emissions
Emissions have been estimated making use of the demand model calibrated within this measure according to the evolution in traffic levels without the implementation of the CIVITAS measure.

Modal split
Modal split have been estimated making use of the demand model calibrated within this measure according to the evolution in traffic levels without the implementation of the CIVITAS measure.

Number of pedestrian and cyclists
Before the CIVITAS project there were not a regular program for gauging the number of pedestrians and cyclists making use of vertical transport systems, therefore is not possible to calculate BAU scenario for this variable

C2 Measure results

C2.1 Economy

The following indicators have been assessed in this section:

- *Capital Costs:* Capital costs include the construction costs of the vertical transport systems in both the Before and After periods.
- *Operating cost:* Operating costs include the cost of the electricity, telephone and cleaning of all the lifts in the city. The goal is to see how the increase in the number of lifts has affected these costs.
- *Maintenance costs:* In this table, the maintenance and the reparation costs for each period has been included.

Table C2.1.1: Costs

LIFTS

Indicator	Before (2007)	Before (2008)	Before (2009)	BaU (2010)	BaU (2011)
2a. Capital costs	406.576,67 €	842.684,67 €	539.427,67 €	596.229,67 €	596.229,67 €
2b. Operating costs	9.823,61 €	17.146,78 €	23.978,82 €	31.056,43 €	38.134,04 €
2b. Maintenance costs	9.331,85 €	21.079,36 €	32.816,83 €	44.559,32 €	56.301,81 €

Indicator	After (2010)	After (2011)
2a. Capital costs	2.520.100,45 €	678.333,80 €
2b. Operating costs	36.121,71 €	52.848,85 €
2b. Maintenance costs	46.232,71 €	72.282,88 €

Indicator	Difference: After –Before (2010-2009)	Difference: After –Before (2011-2009)	Difference: After – BaU (2010 – BaU)	Difference: After – BaU (2011 – BaU)
2a. Capital costs	1.980.672,78 €	138.906,13 €	1.923.870,78 €	82.104,13 €
2b. Operating costs	12.142,89 €	28.869,66 €	5.065,28 €	14.714,81 €
2b. Maintenance costs	13.415,88 €	39.466,05 €	2.673,39 €	15.981,07 €

ESCALATORS AND RAMPS

Indicator	Before (2007)	Before (2008)	Before (2009)	BaU (2010)	BaU (2010)
2a. Capital costs	830.929,61 €	1.784.034,24 €	0,00 €	0,00 €	0,00 €
2b. Operating costs	2.448,00 €	11.436,68 €	15.926,00 €	15.926,00 €	15.926,00 €
2b. Maintenance costs	7.258,05 €	82.723,45 €	103.049,02 €	103.049,02 €	103.049,02 €

Indicator	After (2010)	After (2011)
2a. Capital costs	0 €	2.371.567,41€
2b. Operating costs	19.158,60 €	27.875,17 €
2b. Maintenance costs	103.608,53 €	141.841,78 €

Indicator	Difference: After –Before (2010-2009)	Difference: After –Before (2011-2009)	Difference: After – BaU (2010 – BaU)	Difference: After – BaU (2011 – BaU)
2a. Capital costs	0,00 €	2.371.567,41€	0,00 €	2.371.567,41€
2b. Operating costs	3.232,60 €	11.949,17 €	3.232,60 €	11.949,17 €
2b. Maintenance costs	559,51 €	38.233,25 €	559,51 €	38.233,25 €

As expected the investment in new vertical transport infrastructures has been accompanied by significant increases both in operation and maintenance costs.

A detailed analysis of these figures reveals that implementation and maintenance costs are much bigger for ramps and escalators than for lifts. For example, in Larratxo, the construction of the escalators was twice the cost of the construction of two lifts. While the maintenance cost of the three escalators is about 5 times the maintenance cost of the two lifts. The most expensive maintenance concept is the maintenance quota (a fixed amount pay to a company to take regular of the vertical transport systems).

C2.2 Energy

Table C2.2.1: Energy Consumption

The energy consumed by vertical transport systems in its operation has been calculated based on consumed electricity according to the records bills of the electricity supplier company.

As it can be seen in the tables below, the implementation trend (operation of the new systems progressively started in 2010 but it was only in 2011 when all of them were fully operative), combined with the increased energy efficiency of the new vertical transport systems (improved technology), resulted in reduced energy consumption in 2010 as compared with the BaU estimation. In 2011, the significant increase in the number of vertical transport systems in operation yielded an important increase in energy consumption, resulting in a 21% increase as compared with the BaU situation.

LIFTS

Indicator	Before (2007)	Before (2008)	Before (2009)	BaU (2010)	BaU (2011)
Number of kwh consumed	**5.600,00**	**33.549,00**	**48.391,00**	**64.521,33**	**80.651,67**

Indicator	After (2010)	After (2011)
Number of kwh consumed	**61.615,02**	**97.626,00**

Indicator	Difference: After –Before (2010 –2009)	Difference: After – Before (2011 – 2009)	Difference: After – BaU (2010 – BaU)	Difference: After – BaU (2011 – BaU)
Number of kwh consumed	13.224,02	49.235,00	-2.906,31	16.974,33

ESCALATORS AND RAMPS

Indicator	Before (2007)	Before (2008)	Before (2009)	BaU (2010)	BaU (2011)
Number of kwh consumed	-	42.800,00	64.903,95	64.903,95	64.903,95

Indicator	After (2010)	After (2011)
Number of kwh consumed	73.858,14	122.082,00

Indicator	Difference: After –Before (2010 – 2009)	Difference: After – Before (2011 – 2009)	Difference: After – BaU (2010 – BaU)	Difference: After – BaU (2011 – BaU)
Number of kwh consumed	8.954,19	57.178,05	8.954,19	57.178,05

Table C2.2.2: Vehicle fuel efficiency

On the other hand, given the difficulties in assessing the isolated effect of modal shift fostered by the vertical transport network, the overall fuel efficiency of the mobility system in Donostia-San Sebastian is evaluated.

Indicator	Before (2007)	Before (2008)	Before (2009)	BaU (2010)	BaU (2011)
Vehicle fuel efficiency	-	4,16 PET/1.000 v-km	4,12 PET/1.000 v-km	4,09 PET/1.000 v-km	4,06 PET/1.000 v-km

Indicator	After (2010)	After (2011)
Vehicle fuel efficiency	4,08 PET/1.000 v-km	4,05 PET/1.000 v-km

Indicator	Difference: After –Before (2010 –2009)	Difference: After – Before (2011 – 2009)	Difference: After – BaU (2010 – BaU)	Difference: After – BaU (2011 – BaU)
Vehicle fuel efficiency	-0,03 PET/1.000 v-km	-0,07 PET/1.000 v-km	-0,01 PET/1.000 v-km	-0,01 PET/1.000 v-km

Although an increase in energy consumption of the overall system has been experienced (2,3% increase between 2008 an 2011), as it can be seen in the tables above, energy efficiency of the system has increased as a consequence of the CIVITAS project.

It is estimated that in 2011 energy saving accounted for nearly 15.00 PET as compared with the BaU scenario.

C2.3 Environment

Emissions have been estimated making use of the demand model calibrated within this measure according to the evolution in traffic levels with and without the implementation of the CIVITAS measures (CIVITAS and BaU scenarios, respectively).

Indicator	Before (2008)	Before (2009)	BaU (2010)	BaU (2011)
8. CO_2 emissions	249.777,00 Ton/year	253.981,29 Ton/year	258.185,58 Ton/year	262.389,86 Ton/year
9. CO emissions	21.854,80 Ton/year	22.222,73 Ton/year	22.590,66 Ton/year	22.958,58 Ton/year
10. NOx emissions	1.562,00 Ton/year	1.588,22 Ton/year	1.614,45 Ton/year	1.640,67 Ton/year
11. Particulate emissions	11.301,40 Ton/year	11.456,46 Ton/year	11.611,51 Ton/year	11.766,57 Ton/year

Indicator	After (2010)	After (2011)
8. CO_2 emissions	257.753,23 Ton/year	261.943,75 Ton/year
9. CO emissions	22.556,88 Ton/year	22.923,32 Ton/year
10. NOx emissions	1.610,05 Ton/year	1.636,27 Ton/year
11. Particulate emissions	11.945,94 Ton/year	12.063,61 Ton/year

Indicator	Difference: After –Before (2010 –2009)	Difference: After – Before (2011 – 2009)	Difference: After – BaU (2010 – BaU)	Difference: After – BaU (2011 – BaU)
8. CO_2 emissions	3.771,94 Ton/year	7.962,46 Ton/year	-432,34 Ton/year	-446,12 Ton/year
9. CO emissions	334,15 Ton/year	700,59 Ton/year	-33,78 Ton/year	-35,27 Ton/year
10. NOx emissions	21,83 Ton/year	48,05 Ton/year	-4,40 Ton/year	-4,40 Ton/year
11. Particulate emissions	489,48 Ton/year	607,15 Ton/year	334,43 Ton/year	297,04 Ton/year

As in the case of energy consumption, there is an overall increase in emission levels as compared with the situation before the CIVITAS project, due to the increased mobility levels experienced in the city.

Nevertheless, both in terms of GHG and pollutant emission levels, significant reduction have been achieved by the CIVITAS project as compared to the BaU scenario (ranging from nearly 450 tonnes per year of CO_2 to 4,5 tonnes per year of NOx). The most significant reductions has been achieved in the case of Particulate Matter, reaching a 2,5% reduction in 2011.

C2.4 Society

The results of the Society indicators have been gathered through two on-street surveys in the neighbourhoods affected by the measure. The sample size was calculated with a 95% confidence level and a 5% margin of error over the population of Donostia-San Sebastián.

The following charts show the survey distribution in the two waves:

DISTRITS TO SURVEY	ANTIGUO	CENTRO	HERRERA	INTXAURRONDO	TOTAL
Population	17.411	14.200	20.396	17.155	69.161
% Population	25,17%	20,53%	29,49%	24,80%	100%
Nº Survey	**96**	**79**	**113**	**95**	**383**

DISTRITS TO SURVEY	ANTIGUO	CENTRO	HERRERA	INTXAURRONDO	BIDEBIETA	TOTAL
Population	17.411	14.200	21.806	17.155	7.296	77.868
% Population	22,36%	18,24%	28%	22,03%	9,37%	100%
Nº Survey	**86**	**70**	**107**	**84**	**36**	**383**

The three main indicators measured within the society category are the following:

- Acceptance level
- Awareness level
- Accessibility level

Table C2.4.1: Acceptance

Indicator	2010	2011	Difference: 2011-2010
13. Awareness level	31,78%	57,40%	25,62%
14. Acceptance level	92,06%	98,70%	6,64%

Regarding "Acceptance level" indicator, citizens were asked in both (2010 and 2011) surveys about their overall assessment of the vertical transport network of Donostia-San Sebastián. Answers ranked from 0 to 10 (very bad to very good).

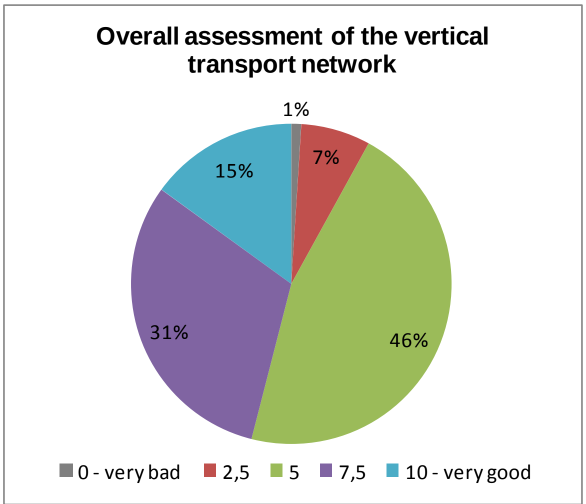


Figure 4.- Overall assessment of the vertical transport network (2010)

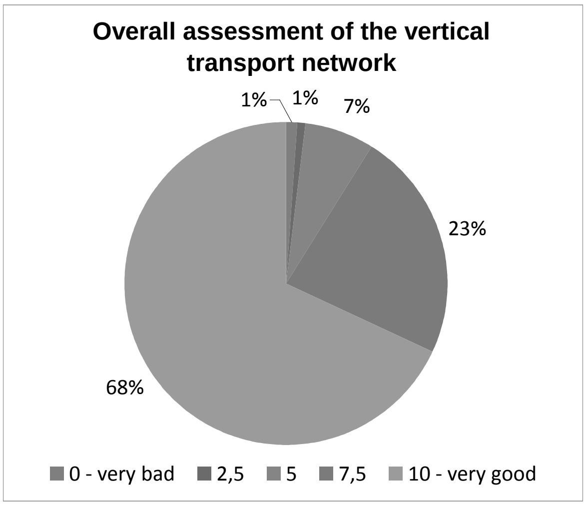


Figure 5.- Overall assessment of the vertical transport network (2011)

In 2010 a huge majority of the population (92%) approved the system (ranked the system with a score of 5 or higher). The average rate resulting from the survey reveals that the population of Donostia-San Sebastian has a positive perception of vertical transport systems (6,3).

One year after, in 2011, an even bigger share of the population (98%) approved the system, providing it with an increased average rate (8,9) as compared with the previous year.

The increased number of vertical transport systems and its effectiveness in providing better conditions for pedestrians and cyclists has improved the assessment of these infrastructures by the citizens.

To complement this figure, people were asked whether they believe that the existence of vertical transport may increase the attractiveness of a neighbourhood as a place of residence.

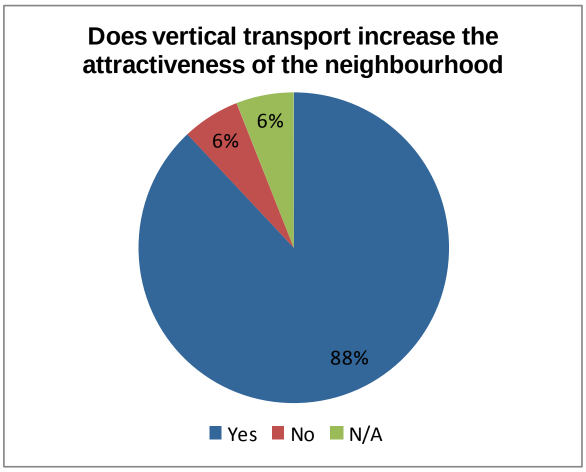


Figure 6.- Increased attractiveness provided by vertical transport (2010)

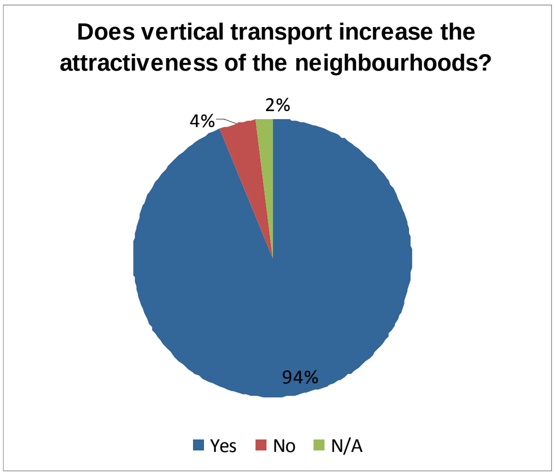


Figure 7.- Increased attractiveness provided by vertical transport (2011)

In 2010 a huge majority of the population (88%) believed that the vertical transport network increases the attractiveness of the neighbourhood. In 2011 the share of population who believes that increased (94%).

It is clear that vertical transport systems are unanimously considered a beneficial service and people's perception of the system improves as long as they start using the lifts, ramps and escalators. According to neighbours' reaction after its implementation, the installation of these elements has been very important in the neighbourhoods where they have been installed.

As for the "Awareness level" indicator, according to the survey made in 2010 there is a 32% of the population aware of the measures foreseen by the municipality in terms vertical transport, while in 2011 the awareness level reached 57% of the population in the affected neighbourhoods.

Table C2.4.2: Accessibility

Indicator	2010	2011	Difference: 2011 – 2010
15. Perception of accessibility	97,17%	98,96%	1.79%

In terms of accessibility, in 2010, the vast majority of the surveyed population (97%) believes that vertical transport increases the accessibility of hilly neighbourhoods. In 2011 this perception was shared by even a bigger share of population (99%).

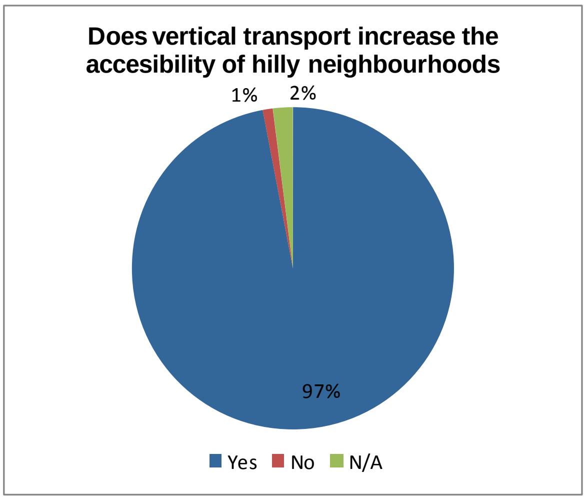


Figure 8.- Perceived accessibility provided by vertical transport (2010)

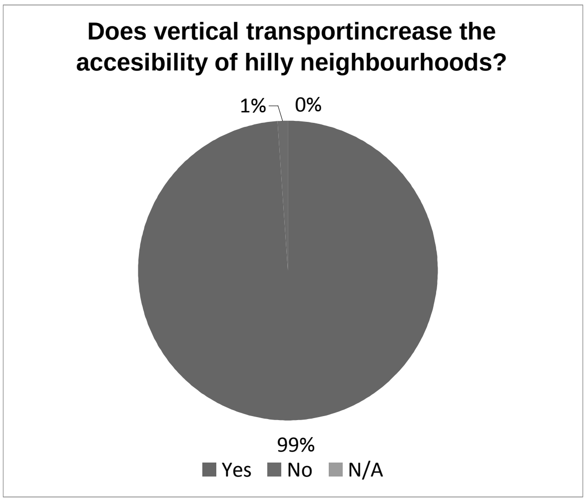


Figure 9.- Perceived accessibility provided by vertical transport (2011)

Moreover, in 2010 a big majority of the population (79%) believed that vertical transport systems contribute to increase non-motorized mobility. The share of population sharing this perception increased in 2011 (92%).

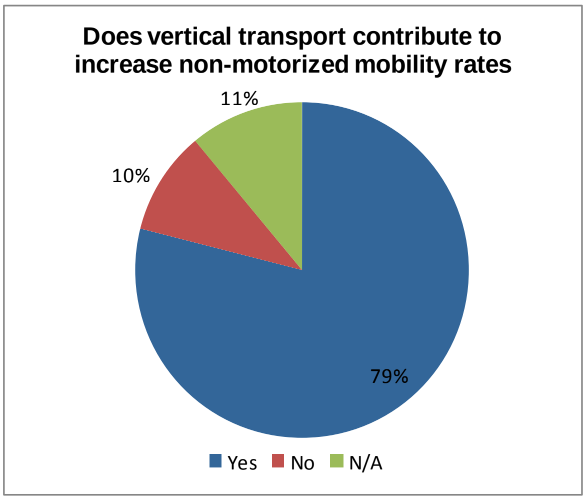


Figure 10.- Contribution of vertical transport to non-motorized mobility (2010)

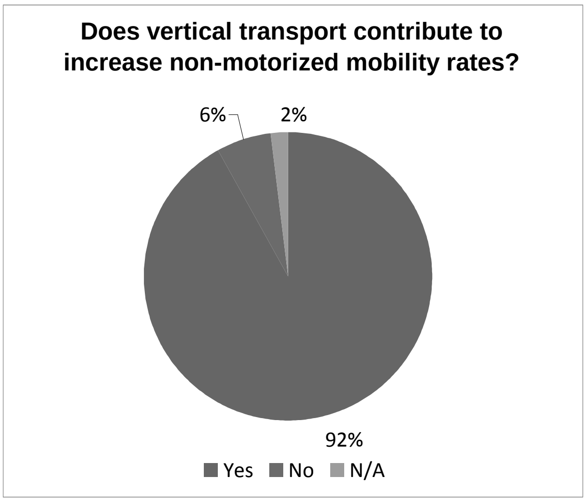


Figure 11.- Contribution of vertical transport to non-motorized mobility (2011)

It is also a general perception that vertical transport improves accessibility condition by favouring new trips that were not made before. In particular, 89% of the population in 2010 believes that vertical transport favours new journey, while in 2011 this share of population increased to 94%.

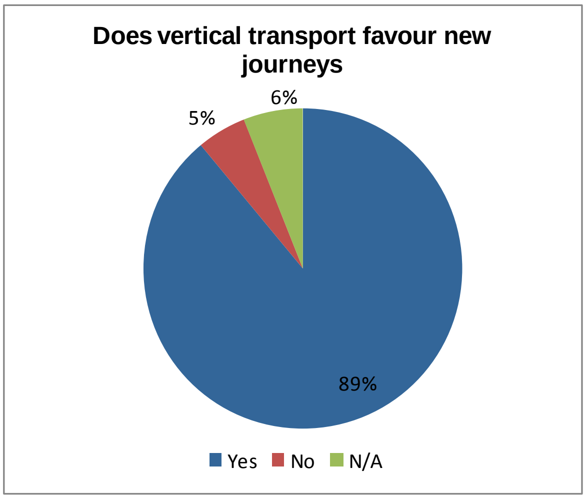


Figure 12.- Mobility induced by vertical transport (2010)

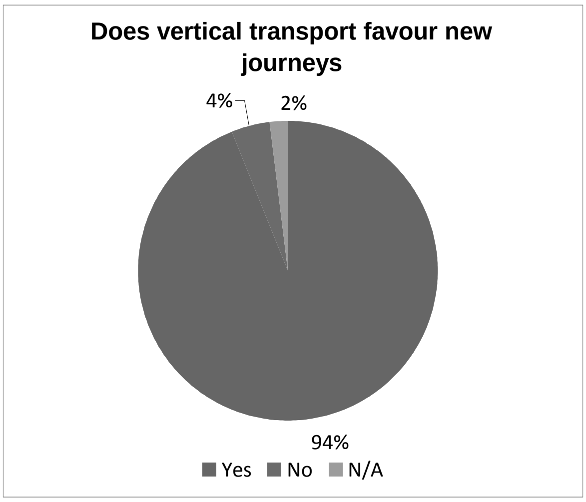


Figure 13.- Mobility induced by vertical transport (2011)

These results highlight the benefits that vertical transport provides to a neighbourhood and the mobility of its residents. The comparison of data corresponding to years 2010 (early after the implementation of the first new vertical transport systems) and 2011 (with vertical transport fully operative and people already used to the new systems), reveals how the perception of the citizens about vertical transport system has increase in different terms.

C2.5 Transport

As with fuel consumption, the modal shift prompted by the CIVITAS project on the overall mobility system in Donostia-San Sebastian has been evaluated, given the difficulties in assessing the isolated effect of modal shift fostered by the vertical transport network (which, as already expressed, is expected to be limited).

Table C2.5.1: Transport System (modal split)

Indicator		Before (2008)	Before (2009)	BaU (2010)	BaU (2011)
Average modal split- trips	**Car**	48,9%	49,0%	49,2%	48,7%
	Public Transport	15,3%	15,3%	15,2%	15,4%
	Cycle	4,5%	4,5%	4,5%	4,8%
	Walk	31,3%	31,2%	31,1%	31,2%

Indicator		After (2010)	After (2011)
Average modal split- trips	**Car**	48,8%	48,8%
	Public Transport	15,3%	15,3%
	Cycle	4,8%	4,8%
	Walk	31,1%	31,0%

Indicator		Difference: 2010 –2009	Difference: 2011 –2009	Difference: 2010 – BaU	Difference: 2011 – BaU
Average modal split- trips	**Car**	-0,20%	-0,20%	-0,3%	-0,4%
	Public Transport	0,00%	0,00%	0,0%	0,1%
	Cycle	0,30%	0,30%	0,3%	0,3%
	Walk	-0,10%	-0,20%	0,0%	-0,1%

The tables above reveals that modal shift in favour of sustainable modes of transport is moderate in the short term, achieving a reduction in car use of 0,1% as compared with the situation before the CIVITAS project started. It should be highlighted that this achievement is made in a context of a steady increase in car travel, thus it can be considered a positive result.

If compared to the BaU situation, the modal shift away from car achieves a 0,4% in 2011, while cycling increases by a 0,3%. On the contrary, walking levels seems to be slowly going down, which is not a desirable result. Attention should be placed to this issue in the coming years. Non-motorized accessibility improvements like vertical transport systems may help curving this situation in the future.

In addition to the overall impact on modal share, the evolution on the usage of the vertical transport systems has been evaluated, in order to have an impression on the contribution of this infrastructures to promote walking and cycling.

Table C2.5.2: Transport System (number of pedestrians and cyclists)

Indicator	Before	After 2011	After 2012	Difference: 2012 - 2011
Number of daily pedestrians using vertical transport systems	-	2613	4521	1908
Number of daily cyclists	-	91	129	38
Number of uses of vertical transport systems	-	2801	4874	2073

It should be noted that, according to the implementation process described above, in 2011 only four new elevators were in operation, thus addressed. While in 2012 the usage accounts for all 5 elevators and 1 escalator implemented within the CIVITAS project.

Data collected regarding the transport system includes:

1.- Percentage and number of each user type and lift. (Indicator)
2.- Number of users by gender and lift.
3.- Percentage of users by age and lift.
4.- Number of movements of the lift. (Indicator)

Regarding the different user types, the following is a summary of the distribution yielded by the two waves of data collection:

USER'S DISTRIBUTION 2011		**NUMBER**	**PERCENTAGE**
USER TYPE	Pedestrians	2613	93%
	Cyclists	91	3%
	Handicapped people	17	1%
	Parents with kids trolley	80	3%
TOTAL PEOPLE		2801	100%

USER'S DISTRIBUTION 2012		**NUMBER**	**PERCENTAGE**
USER TYPE	Pedestrians	4529	93%
	Cyclists	129	3%
	Handicapped people	14	0%
	Parents with kids trolley	202	4%
TOTAL PEOPLE		4874	100%

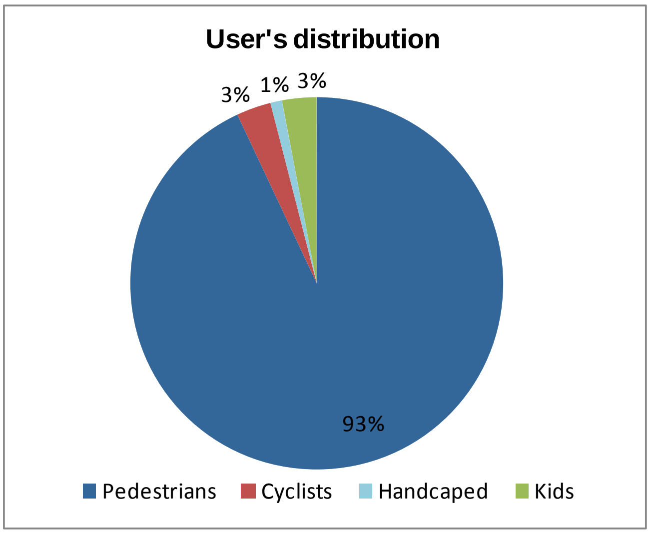


Figure 14.- Users' distribution (2010)

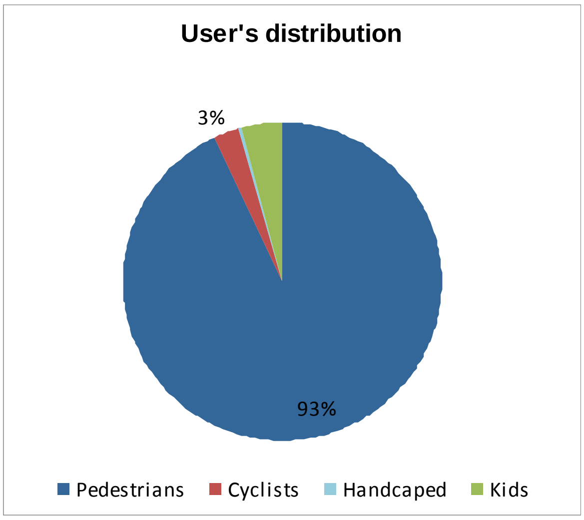


Figure 15.- Users' distribution (2011)

As it can be seen in the graphics, the user's distribution is almost the same in both years, with a big majority of pedestrians (93% of the users) followed by cyclists (3%). This proportion doesn't change with the new lifts, ramps and mechanical escalators.

A more detailed analysis of each lift separately has been undertaken. Following are the main conclusions:

USER'S DISTRIBUTION 2011		Rutilita	Aldunaene	Azkuene-Gomistegi	Aitzgorri
USER TYPE	Pedestrians	245	410	868	1090
	Cyclists	5	48	5	33
	Handicapped people	4	2	9	2
	Parents with kids trolley	38	1	27	14
TOTAL PEOPLE		**292**	**461**	**909**	**1139**

USER'S DISTRIBUTION 2012		Rutilita	Aldunaene	Azkuene-Gomistegi	Aitzgorri	Montpellier	Lizardi
USER TYPE	Pedestrians	184	352	1058	1152	872	911
	Cyclists	0	16	5	8	30	70
	Handicapped people	0	0	5	1	0	8
	Parents with kids trolley	23	3	36	29	81	30
TOTAL PEOPLE		**207**	**371**	**1104**	**1190**	**983**	**1019**

Although the total number of users in significantly higher in 2012, due to the higher number of systems in operation, considering the four lifts operating both in 2011 and 2012, it can be seen how the number of users has remained nearly the same: 2.801 users in 2011 and 2.872 in 2012.

There has been a decrease in the number or uses of the lifts of Rutilita and Aldunaene, but the number of users of Azkuene – Gomistegi and Aitzgorri have increased.

The two newest vertical transport systems are widely used, especially the mechanical ramps, considering that the movements in this system are only to go uphill.

An overall analysis of the data reveals that vertical transport systems are more used when they are located in high density population neighbourhoods like Aizkorri (2), Azcuene – Gomistegi (1), Montpelier (2) or Lizardi (5). In these particular cases, lifts connect hilly areas with the main commercial area of the city and important public transport nodes.

The lift of Rutilita, although providing an important connection with the public transport network and the commercial area, is located in a lower density neighbourhood, therefore less used than the other.

Aldunaene's lift is more used by students, which find it easier now to park the bicycle and go to the university by means of the lift.

In terms of usage by gender, in almost all cases vertical transport systems are slightly more used by women (55%). This observation is in line with the fact that there is an overall higher share of female pedestrians in the city.

USERS BY GENRE 2011		**Rutilita**	**Aldunaene**	**Azkuene-Gomistegi**	**Aitzgorri**
NUMBER OF USERS	MAN	113	171	435	605
	WOMAN	179	290	474	534
TOTAL NUMBER OF USERS		**292**	**461**	**909**	**1139**

USERS BY GENRE 2012		**Rutilita**	**Aldunaene**	**Azkuene-Gomistegi**	**Aitzgorri**	**Montpellier**	**Lizardi**
NUMBER OF USERS	MAN	80	121	529	553	403	520
	WOMAN	127	250	575	637	580	499
TOTAL NUMBER OF USERS		**207**	**371**	**1104**	**1190**	**983**	**1019**

As for the use of the vertical transport systems by age, there is a significant number of elder people, although they not represent a clear majority, since the systems seems to be equally used by people of all ages.

NUMBERS OF USERS BY AGE 2011					
		Rutilita	Aldunaene	Azkuene-Gomistegi	Aizkgorri
AGE	Less than 15	32	10	113	86
	15-24 years	21	290	124	126
	25-34 years	65	80	101	275
	35-44 years	46	20	126	191
	45-54 years	36	30	146	197
	55-64 years	44	16	131	168
	More than 65	48	15	168	96
TOTAL		**292**	**461**	**909**	**1139**

NUMBERS OF USERS BY AGE 2012							
		Rutilita	Aldunaene	Azkuene-Gomistegi	Aizkgorri	Montpellier	Lizardi
AGE	Less than 15	17	13	123	114	205	126
	15-24 years	16	200	188	205	62	144
	25-34 years	29	71	99	230	244	174
	35-44 years	28	37	139	204	164	205
	45-54 years	37	23	147	158	91	155
	55-64 years	37	8	162	105	104	112
	More than 65	43	19	246	174	113	103
TOTAL		**207**	**371**	**1104**	**1190**	**983**	**1019**

Finally, in terms of the total number of uses, the following tables summarises the figures for each vertical transport system:

2011		**Rutilita**	**Aldunaene**	**Azkuene-Gomistegi**	**Aitzgorri**
PEOPLE MOVEMENTS	Up	216	251	567	583
	Down	76	210	342	556
TOTAL PEOPLE MOVEMENTS		**292**	**461**	**909**	**1139**

2012		**Rutilita**	**Aldunaene**	**Azkuene-Gomistegi**	**Aitzgorri**	**Montpellier**	**Lizardi**
PEOPLE MOVEMENTS	Up	144	215	698	638	638	1019
	Down	63	156	406	552	345	0
TOTAL PEOPLE MOVEMENTS		**207**	**371**	**1104**	**1190**	**983**	**1019**

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	5 new elevators (7 new elevators constructed)	***
2	1 escalator (4 mechanical ramps and 1 mechanical escalator)	***
3	Maintain the 47% of pedestrian mobility on modal split	*
NA = Not Assessed O = Not Achieved ★ = Substantially achieved (at least 50%) ★★ = Achieved in full ★★★ = Exceeded		

C4 Upscaling of results

This measure can only be up-scaled to other hilly neighbourhoods where vertical transport is currently not available. In those areas, the changes in behaviour accounted in demonstration neighbourhood would be transferred considering population covered, pedestrian density and topographical factors.

C5 Appraisal of evaluation approach

These are the main difficulties encountered during the evaluation process:

Firstly, due to their different nature, it has been decided to undertake a differentiated assessment of lifts and ramps/escalators. Differences refer not only to technical specifications but especially to operation and maintenance costs. A combined analysis of these systems would have made it more difficult to draft adequate conclusions.

The demographic and topographic characteristics of the surroundings of each vertical transport system differ from each other, recommending a differentiated analysis for each infrastructure regarding several indicators.

Cost indicators have been difficult to calculate, because in many cases they are integrated in larger contracts not sufficiently detailed. The best possible estimation has been conducted.

Nevertheless, the main barrier for a more in-depth analysis of the impact of this measure is the difficulties to isolate the modal shift effect driven by the implementation of new vertical transport systems. A specific survey in this matter would have been recommended.

C6 Summary of evaluation results

In a city like Donostia-San Sebastián, surrounded by mountains and with half of the population living in hilly neighbourhoods, vertical transport systems can be very important elements of the transportation system, assisting pedestrians and cyclists over steep terrain and improving accessibility conditions to these neighbourhoods, thus favouring a non-motorized mobility culture in the city.

This is recognized by the majority of the population in Donostia-San Sebastián, as revealed by the surveys conducted within the CIVITAS project. A huge majority of the population (98% in 2011) approved the system (ranked the system with a score of 5 or higher), providing it with an average rate of 8,9 out of 10. The reason for this very positive public perception is that the vast majority of the surveyed population (99%) believes that vertical transport increases the accessibility of hilly neighbourhoods. Moreover, 92% of the population believes that vertical transport systems contribute to increase non-motorized mobility. While 94% of the population believes that the vertical transport network increases the attractiveness of the neighbourhood.

The positive public perception of the new vertical transport systems implemented within CIVITAS project are also reflected by significant usage levels, reaching 4.879 daily users in 2011 (2.801 in 2011 when only part of the network was in operation).

An overall analysis of the data reveals that vertical transport systems are more used when they are located in high density population neighbourhoods connecting hilly areas with important commercial areas and/or public transport nodes.

Although usage levels are conditioned by demographic and orography condition of each particular case, the evaluation conducted has revealed that in almost all cases vertical transport systems are slightly more used by women (55%). This observation is in line with the fact that there is an overall higher share of female pedestrians in the city.

But lifts, ramps and escalators are very expensive infrastructures. The evaluation process undertaken within CIVITAS has helped understand the economic dimension of vertical transport systems (real costs of construction, maintenance and operating), making it easier to take decisions for future infrastructures in the city (and in other cities). The assessment conducted reveals that implementation and maintenance costs are much bigger for ramps and escalators than for lifts. For example, in Larratxo, the construction of the escalators was twice the cost of the construction of two lifts. While the maintenance cost of the three escalators is about 5 times the maintenance cost of the two lifts.

It could be inferred that lifts are the preferred solution based on economic viability. But the orographic characteristics and the number of users can make it necessary to build ramps or escalators (like in the case of Lizardi). Ramps are best indicated for high density connections and main transport nodes (for example train stations). In some areas the orography makes it impossible to build lifts, therefore ramps or escalators are needed.

At the strategic level, the extension of the vertical transport network in Donostia-San Sebastian has contributed to a steady increase in the use of non-motorized modes in the city. Although difficult to isolate the impact of this sole measure, which is estimated to be moderate, the CIVITAS project has achieved an overall reduction in car use of 0,1% as compared with the situation before the CIVITAS project started. It should be highlighted that this achievement is made in a context of a steady increase in car travel, thus it can be considered a positive result.

Regarding energy consumption and efficiency, even though an increase in energy consumption of the overall system has been experienced (2,3% increase between 2008 an 2011), the energy efficiency of the system has increased as a consequence of the CIVITAS project. It is estimated that in 2011 energy saving accounted for nearly 15 PET as compared with the BaU scenario. Consequently, there is an overall increase in emission levels as compared with the situation before the CIVITAS project, due to the increased mobility levels experienced in the city. Nevertheless, both in terms of GHG and pollutant emission levels, significant reduction have been achieved by the CIVITAS project as compared to the BaU scenario (e.g. 2,5% reduction in Particulate Matter emission levels in 2011).

C7 Future activities relating to the measure

According to the surveys conducted within this measure, acceptance and awareness levels towards vertical transport policy in the city have increased over the last 12 months.

The evaluation process undertaken within CIVITAS has helped to understand the economic dimension of vertical transport systems (real costs of construction, maintenance and operating), making it easier to take decisions for future infrastructures in the city (and in other cities). Some of these possible future infrastructures were highlighted in the “Evaluation of existing public vertical transport systems” study developed as part of the measure.

Nevertheless, the economical situation makes it difficult to fund the construction of this kind of infrastructure in the near future.

D Process Evaluation Findings

D0 Focused measure

	0	No focussed measure
1	1	Most important reason
2	2	Second most important reason
5	3	Third most important reason

D1 Deviations from the original plan

The deviations from the original plan comprised:

CBA cancellation: as a focussed measure, it was planned to conduct a Cost-Benefit Analysis of this measure. But the nature of this kind if infrastructure development –requiring expensive investment and maintenance costs- and the expected limited impact of it in terms of modal shift –main driver for benefits within this measure-, combined with the difficulties to monetise the improvement of accessibility conditions (for elder and impaired people), soon made clear that, in monetary terms, costs are far beyond the expected benefits, highlighting the social character of this type of tool.

Therefore, it was decided to cancel CBA of this measure and conduct it over another CIVITAS measure in Donostia-San Sebastian in which results may be more uncertain and dependant on the technical approach and process evaluation conditions, thus making the assessment more interesting, allowing for transferrable knowledge to arise from it.

- **Unavailability of Regional Government mobility survey:** there was a delay in the delivery of the Regional Government mobility survey which has make it impossible to use this data source for evaluation purposes. A model based on the previous mobility survey and traffic flows data have been used instead. Due to the differences in the tools and data sources used, modal share results are not directly comparable. Therefore, the target objective of maintaining a 47% share of pedestrian mobility in modal share has been adapted to the actual situation regarding data sources.
- **Brochure to promote the use of the vertical transport:** the leaflet with vertical transport systems, lifts and mechanical ramps and escalators constructed within CIVITAS, has been be published in September.

D2 Barriers and drivers

D2.1 Barriers

The main barriers encountered for the development of measure 57 are:

<u>**Preparation phase**</u>

- **Political:** strong political involvement is needed to implement a project like this in one or more areas of the city. In some cases this kind of measures are used as a matter of political opposition, making it difficult to achieve the required level of involvement.

- **Cultural:** in some cases there is a misconception of the vertical transport. Elevators and ramps are not clearly seen as elements of the mobility scheme in the city by all citizens, who are sometimes reluctant to its implementation or do not provide an efficient use of this infrastructures. This is especially relevant given the economic dimension of this kind of infrastructures.
- **Involvement/Communication:** the dissemination of the new infrastructures is not always good enough, in particular the criteria for the selection of its location and typology, as well as the associated costs.

Implementation phase

- **Financial:** the capital cost for the construction of vertical transport systems is a very important issue and is not always possible to implement all the desired vertical transport systems at the desired rhythm, due to the limited availability of financial resources.

Operation phase

- **Cultural**: the already high operation and maintenance costs associated to vertical transport systems are sometimes increased due to vandalism actions.
- **Political/Strategic:** the topographic and demographic characteristics of the area play an essential role in the success of the measure. If the location is not correctly chosen usage its use may be neglected by a majority of citizens.

D2.2 Drivers

As for the drivers, the main ones affecting the measure are:

Preparation phase

- **Political/Strategic:** there is a clear commitment at the city level to support the development of non motorized modes of transport, including vertical transport systems, allocating increased technical resources and fund for that purpose.
- **Cultural:** the success of previous vertical transport infrastructures has helped improve the public perception of these costly infrastructures.
- **Positional:** the clear support to walking and cycling policies in the city has helped in the development of the vertical transport network, where this kind of infrastructures are required to provide continuity to non motorized networks. The extension of pedestrian and cycling networks gives a logical framework to the development of vertical connections.

Implementation phase

- **Financial:** the provision of vertical transport infrastructures requires a significant investment. The availability of European funds has meant a great opportunity to develop this measure.

Operational phase

- **Positional:** as in the preparation phase, once in operation, the vertical transport systems have benefitted from the clear support to walking and cycling policies in the city, where this kind of infrastructures provide continuity to non motorized networks, favouring its use.

D2.3 Activities

In order to handle the above referred barriers and/or to make use of the drivers, the following activities were taken during the implementation of the measure:

Preparation phase

- **Cultural:** ongoing promotional and awareness raising activities, including children and scholars. In addition, it is necessary to asses, in some way, the position of the citizens in the area towards the vertical transport systems being planned, in order to foresee potential opposition.
- **Positional:** careful attention should be placed over the selection of the location for vertical transport systems. In addition to demographic and orographic characteristic, attention should be placed over potential synergies with pedestrian and cycling network development.

Operation phase

- **Involvement/Communication:** dissemination of the vertical transport systems as an integral part of the walking and cycling networks.
- **Technical:** the design of vertical transport systems should include elements to prevent and discourage vandalism (lighting, transparent materials, etc.)

D3 Description of organisations and risks

D.3.1 Measure partners

Following there is a brief description of all project partners and its level of involvement with the measure:

- **DSS Municipality Mobility Department –** Responsible for the planning and implementation of the measure. Leading role.
- **DSS Municipality Public Works Department –** Construction of new infrastructural developments and maintenance of the lifts, ramps and escalators Principal participant.

D.3.2 Stakeholders

The main stakeholders involved in the measure are:

- **Mobility Advisory Council -** Advising for the proper implementation of the measure, in particular regarding the coherences and potential synergies with the development of the non-motorized networks.
- **Urban planning department –** The urban planning department has assisted in the selection of the better locations for vertical transport systems, since demographic variables are key in the success of this kind of infrastructures. This

department plays also a key role in the provision of accessibility improvements in the surrounding of vertical transport systems.

- **Neighbours' associations** – Vertical transport is a very sensitive issue, especially for elder and impaired people. It was the interest of the municipality to enforce the participation channels with the potentially affected neighbourhoods by conducting on-going consultation and participation processes. Neighbourhoods associations have revealed very active in this regard, forwarding numerous request in terms of the desired location and technology for vertical transport system. These requests were not always in line with the technical recommendation from the municipal staff, being sometimes difficult to explain the motivations without creating certain level of controversy. Although not major problems with this stakeholder group have been encountered.

D4 Recommendations

This measure could be taken up by other cities depending on the topographic characteristics and the demography of the neighbourhoods. The main condition is that there should be hilly areas with high density of population, connecting with commercial areas and/or main transport nodes.

The main recommendations derived from it are:

D.4.1 Recommendations: measure replication

- **Synergies with non-motorized developments** - The implementation of vertical transport infrastructures facilitates walking and cycling to residents in hilly areas, creating opportunities for new routes for cycling and walking in the city. Synergies with pedestrian and cycling network developments should be pursued. Moreover, a critical mass of pedestrians and cyclist is recommended to improve the effectiveness of these infrastructures.

- **Target users** - The construction of lifts or ramps makes easier and improve the mobility of people but especially elderly, impaired people and people with kids' trolley. An in-depth analysis of the demographic characteristics of the potential locations should be undertaken. Neighbourhoods with high rates of elder and impaired people should be prioritised.

- **Location** – A careful analysis of possible locations for vertical transport system is highly recommended, taking in count population density, topographic characteristics of the area, public transport connections, leisure and commercial areas, cycle lanes and walking routes. It is very important to define correctly the location of the infrastructure to serve as much people as possible to make the service efficient.

- **Design of the infrastructure -** A careful design of the different parts of the lifts or escalator and ramps should be undertaken, taking into account vandalism and weather inclemency. The cost of maintenance because of vandalism is high so it has to be considered in the project.

- **Funding of maintenance cost -** Funding for maintenance of the service and operating costs should be taken into account in the planning process. The maintenance and operating costs are very high, and can comprise a key issue in the decision making process.

D.4.2 Recommendations: process

- **Political involvement and consensus:** Is needed to agree on the required investment to build these infrastructures in different areas of the city.
- **Complementary actions:** In order to increase the effectiveness of the measure, infrastructural developments should be accompanied to incentives and promotion activities, as well as actions to restrict car use in the city.
- **Citizen's awareness.** It is very important that the citizens are involved in the strategies to change mobility behaviour, make citizens aware the existence of the vertical transport systems and the future plans of the municipality.
- **Preliminary studies –** Before getting into the planning phase, an extensive review of existing public vertical transport systems is recommended
- **Planning.-** A detailed time planning establishing priorities should be developed beforehand, using a clear criteria for prioritizing. This plan should be regularly updated.

F Annex I: Detailed results

Following is a separate analysis of each vertical transport system, according to the following indicators:

1.- Percentage and number of each user type and lift. (Indicator)
2.- Number of users by gender and lift.
3.- Percentage of users by age and lift.
4.- Number of movements of the lift. (Indicator)

RUTILITA

This lift is situated in the neighbourhood of Herrera and connects this area with the train station and bus stops. It is very useful for people that goes to work by public transport or commercial area. It makes possible for elderly and disable people to access to the highest area where there are most of the facilities.

This lift is used by people coming from a very populated neighbourhood called Alza and makes possible the access to the bus and train stations.

The new Cycling lane that connects this area with the city centre has been opened.

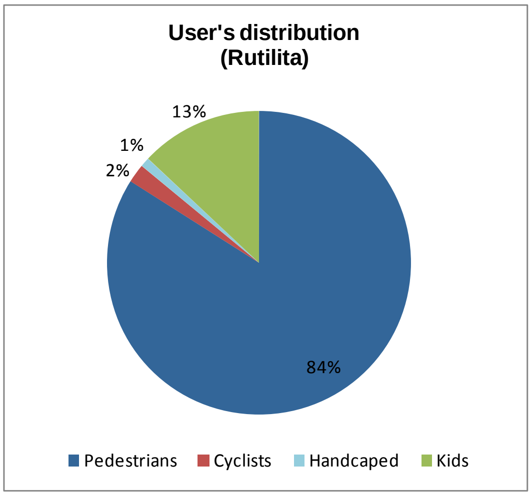
1.- Percentage and number of each user type and lift. (Indicator)

2011
As we can see in the graphic most of the people are pedestrians.

The use of the bicycle in the area is not high, because the cycling lane network is not finished in the area, but in two months the lift will be important because the new cycling lane will in place.

There is handicapped people in the area using the lift. It makes possible the access to public transport what means a reduction in the use of private vehicle.

The percentage of people using the lift with kids trolleys shows that there is a high share of young couples living in the area and the vertical transport system makes their movements easier and the use of public transport.

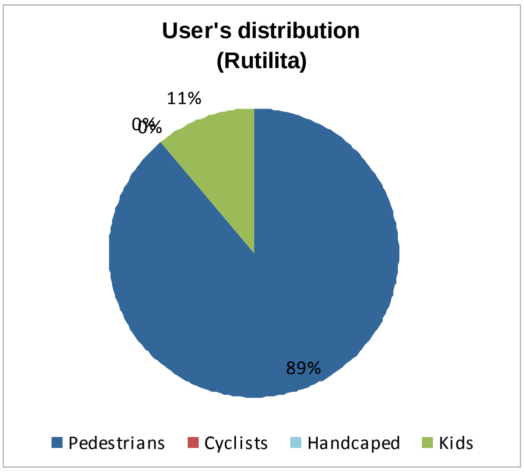


2012
As we can see in the graphic most of the people are pedestrians.

The use of the bicycle in the area is not high and has decreased comparing with the data before. People is using an other lift near to this one that goes directly to the new cycle lane.

There isn't an important number handicapped people in the area using the lift as it can be seen in both graphics.

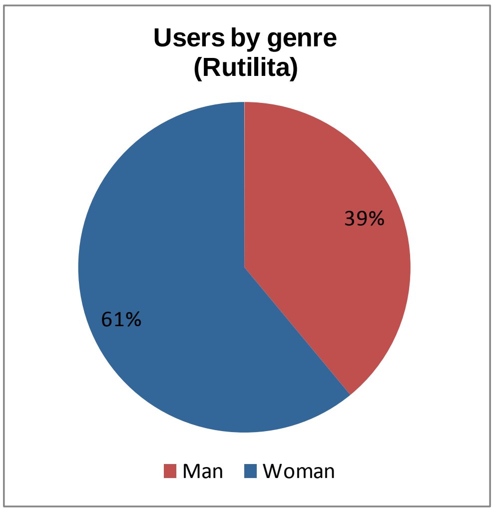
The percentage of people using the lift with kids trolleys shows that there is a high share of young couples living in the area and the vertical transport system makes their movements easier and the use of public transport.



2.- Number of users by gender and lift.

2011

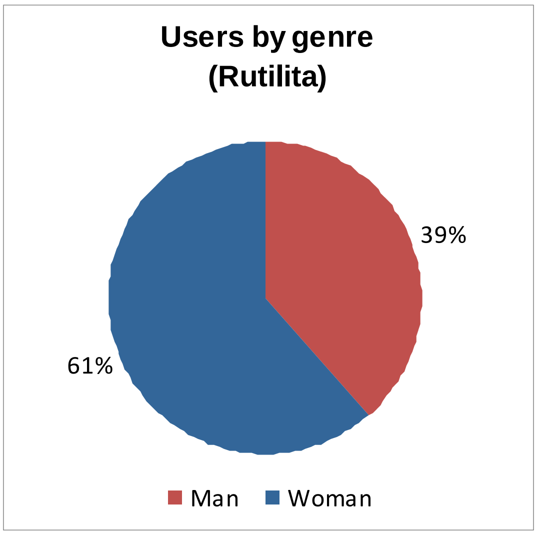
The 61 % of the people that uses this lift are women and the 39 % are men.



2012

The 61 % of the people that uses this lift are women and the 39 % are men.

The percentage of uses of man and woman is constant in 2011 and 2012.

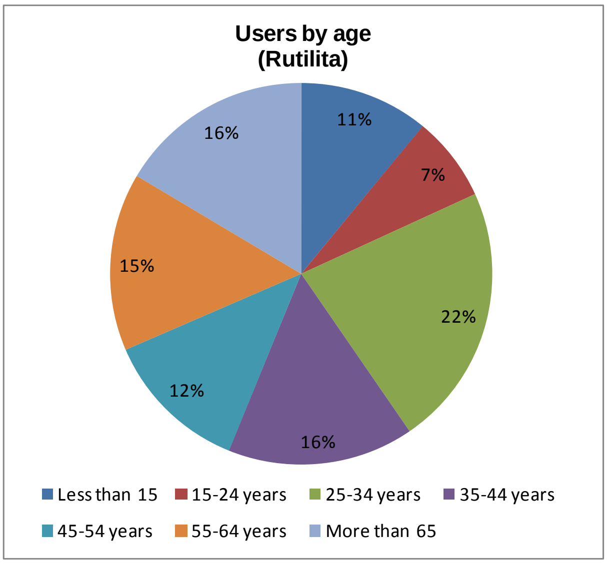


3.- Percentage of users by age and lift.

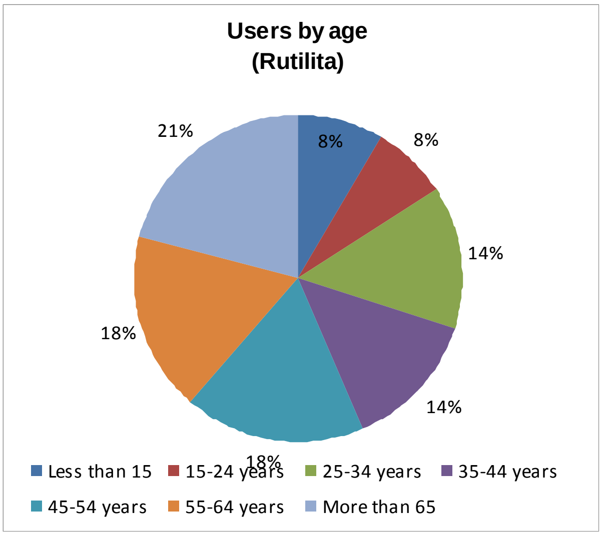
2011

As we can see in the graphic the percentages of use by age are balanced in all the ages. We can see that the highest rates corresponds to people between 25 –34 years, 35-44 years and more than 65 year. In this neighbourhood there is a mix between young and elderly people.

The lift is very helpful for young people with kids and elderly peoples with difficulties or handicaps.



2012

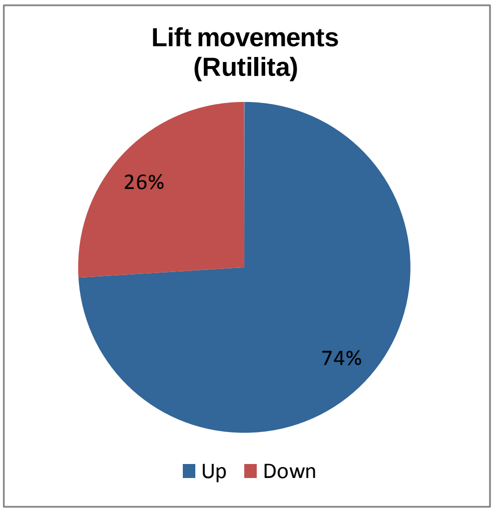


As we can see in the graphic the percentages of use by age are balanced in all the ages. We can see that the highest rates corresponds to people between 45-54 years, 55-64 years and more than 65 year. In this neighbourhood there is a mix between young and elderly people.

The lift is very helpful for young people with kids and elderly peoples with difficulties or handicaps.

4.- Number of movements of the lift. (Indicator)

2011

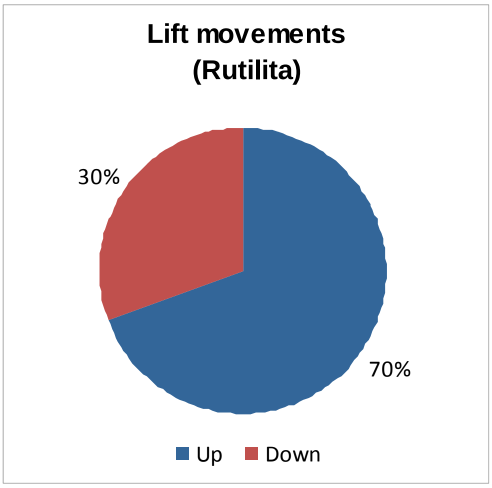


As we can see in the graphic most of the movements are made upwards (74% upwards and 26 % downwards).

If we have a look at the times where movements up are more important are at morning between 8:00 - 10:00 when people and kids go to work or school.

The total number of uses is 292 up/down, being the fourth most used new lift.

2012



As we can see in the graphic most of the movements are made upwards (70% upwards and 30 % downwards).

The total number of uses is 207 up/down, being the last most used new lift.

ALDUNAENE

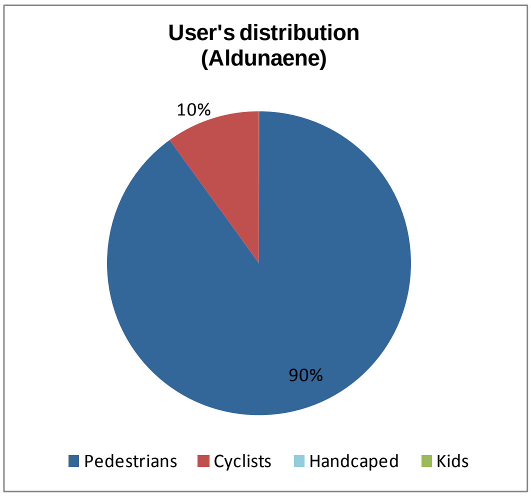
This lift is situated in the City Centre and connects the walking area beside the river and the cycling lane with the university. It is very useful for people that goes to the university. It also makes possible for disable people to easily access the university.

1.- Percentage and number of each user type and lift. (Indicator)

2011

As we can see in the graphic, most of the people are pedestrians.

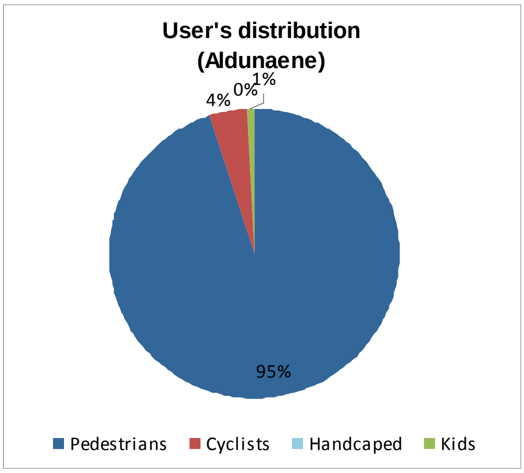
The use of the bicycle in the area is high, because the cycling lane has been constructed in the urban development where the lift was built. Nevertheless the number of users of the lift with bicycles is not very high because there is a bicycle parking area just beside the lift, so most of the people leave the bicycle there.



2012

As we can see in the graphic, most of the people are pedestrians.

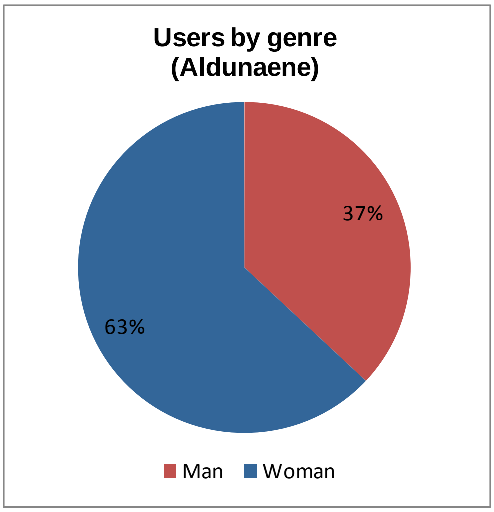
The use of the bicycle in the area decrease because there is a bicycle parking area just beside the lift, so most of the people leave the bicycle there.



2.- Number of users by gender and lift.

2011

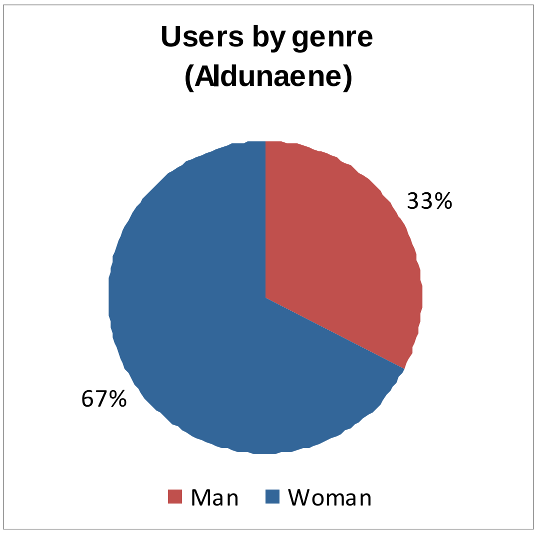
The 63 % of the people that uses this lift are women and the 37 % are men.



2012

The 67 % of the people that uses this lift are women and the 33 % are men.

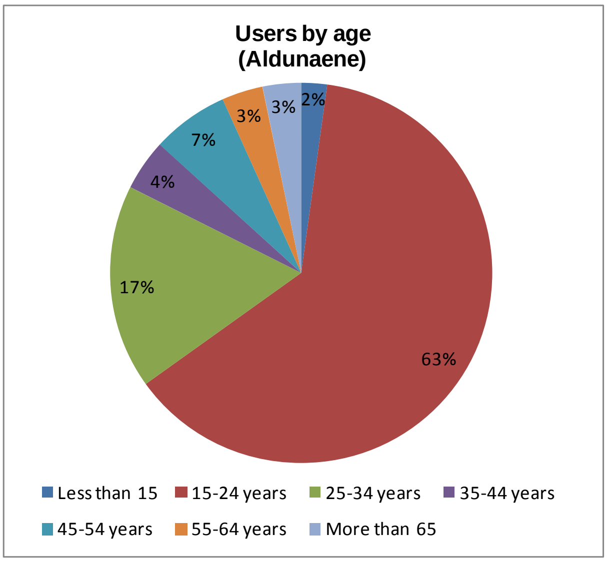
There hasn't been big differences between the first collected data and the second one.



3.- Percentage of users by age and lift.

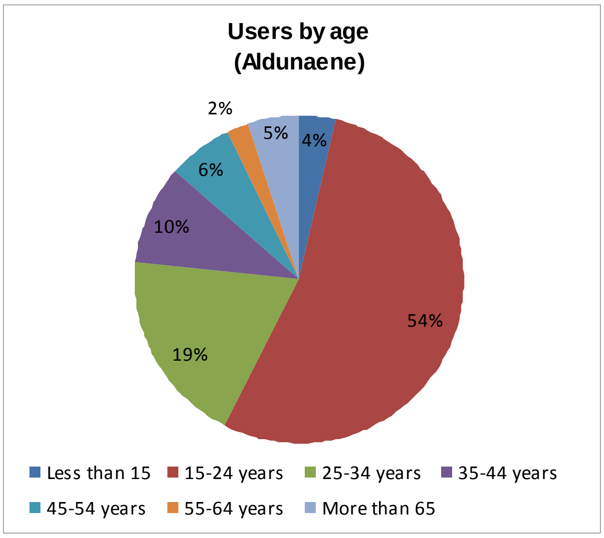
2011

As we can see in the graphic most of the users of the lift are students of the university between 18-35 year.



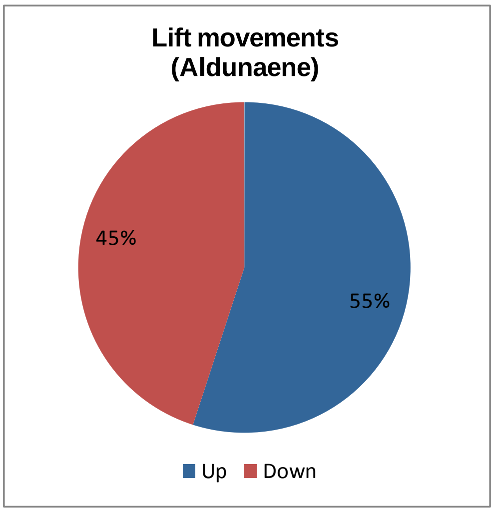
2012

As we can see in the graphic most of the users of the lift are students of the university between 18-35 year. We can see an increase in the number of users between 35 – 44 year because in the area there is a child school and parents can use it to go to the school instead of going by car.



4.- Number of movements of the lift. (Indicator)

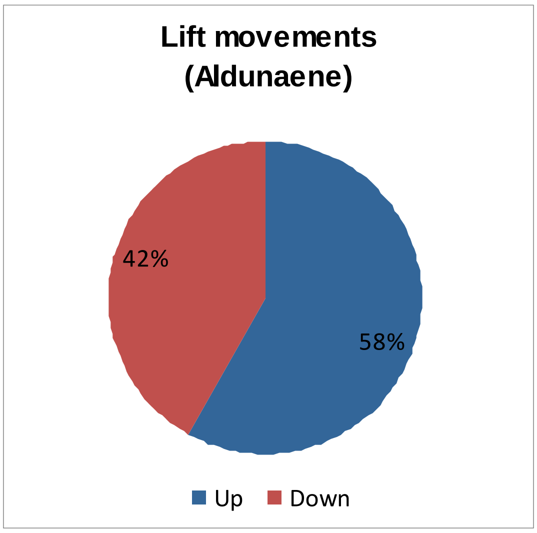
2011



As we can see in the graphic the 55 % of the movements are upwards and the 45 % are downwards.

The total number of uses is 461 up/down/day which means that is the third most used new lift. The use of this lift is mostly during the week.

2012



As we can see in the graphic the 58 % of the movements are upwards and the 42 % are downwards.
The number of movements are very same both years.

The total number of uses is 371 up/down/day which means that is the fifth most used new lift. The use of this lift is mostly during the week. There has been a decrease on the use of the lift comparing the year before.

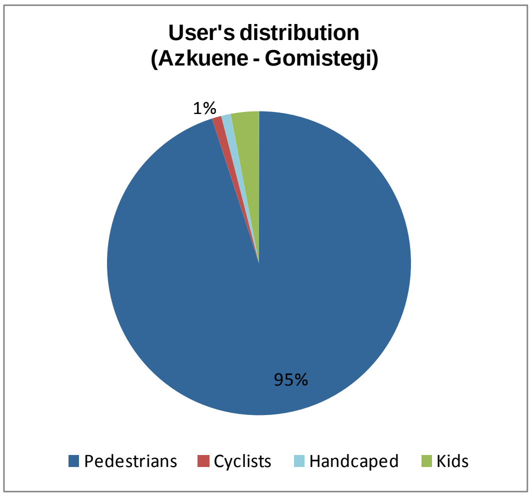
AZKUENE – GOMISTEGI

This lift is situated in the neighbourhood of Bidebieta which connects Donostia - San Sebastian with Pasaia. This lift connects the highest area of the neighbourhood with the commercial area of Pasaia. It is very useful for old people living in the area that before the construction of this lifts needed to use the stairs to go from the lowest to the highest area. The lift is also a very important access to the public transport that runs along the road below. In the next two months the new cycle lane will be opened in the area and the lift will be very useful for cyclists.

1.- Percentage and number of each user type and lift. (Indicator)

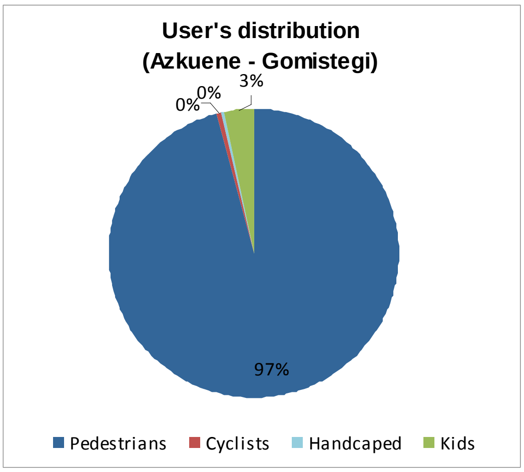
2011

As we can see in the graphic, most of the people are pedestrians.



2012

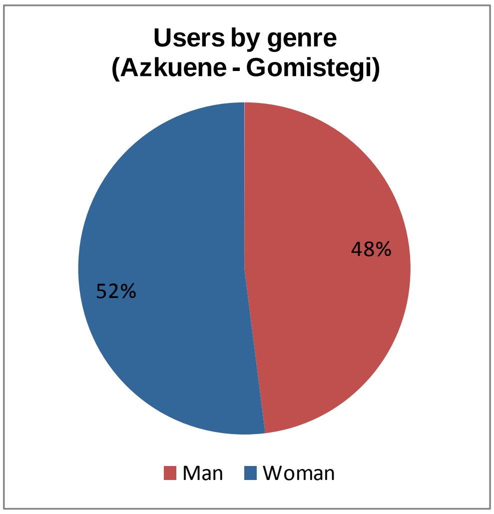
As we can see in the graphic, most of the people are pedestrians, even if we can see a 3 % of cyclist using the lift.



2.- Number of users by gender and lift/day

2011

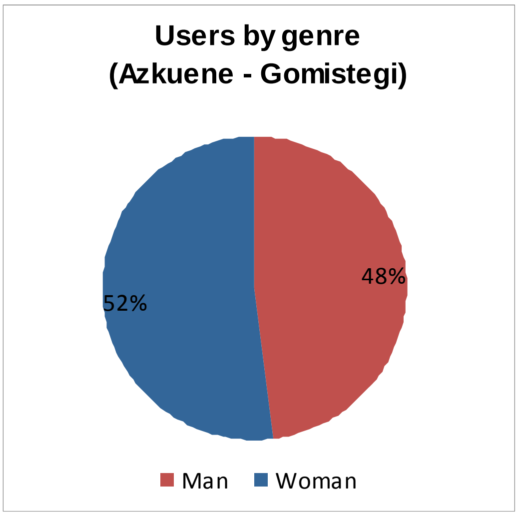
The 52 % of the people that uses this lift are women and the 48 % are men.



2012

The 52 % of the people that uses this lift are women and the 48 % are men.

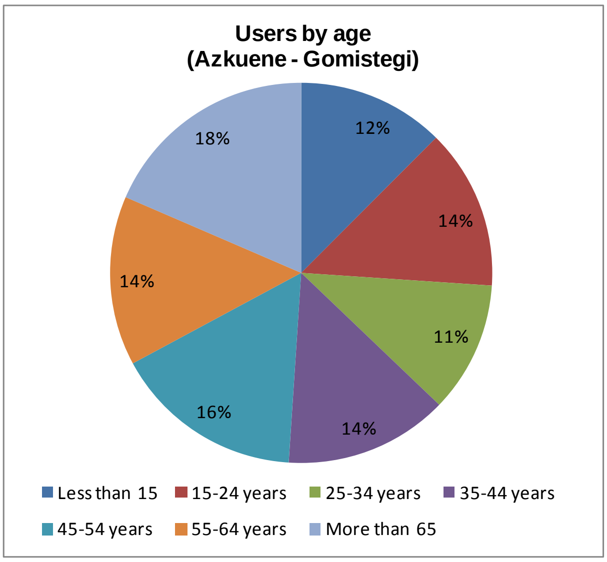
The data of both years are the same what means that most of the movements everyday are very same.



3.- Percentage of users by age and lift.

2011

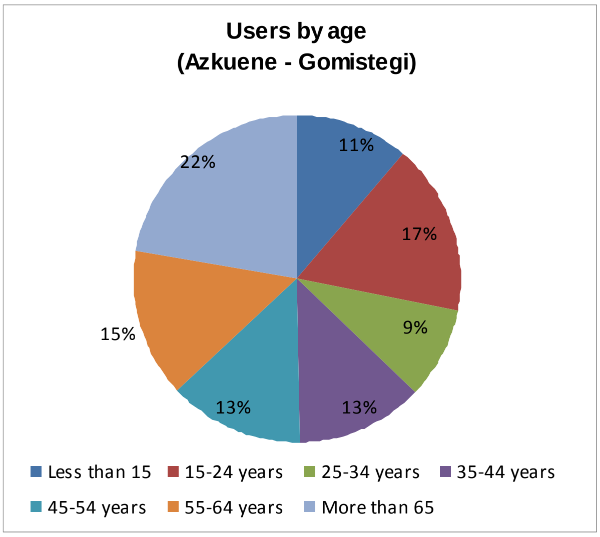
As we can see in the graphic, the 19% of the users are people with more than 65 years. This means that the population of the area is old and uses the lift to go to the commercial area or to access to public transport.



2012

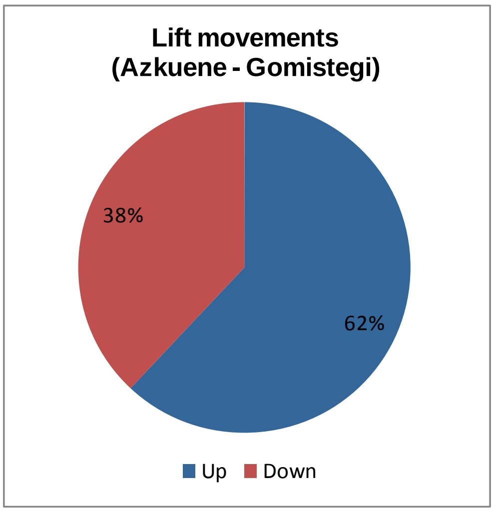
As we can see in the graphic, the 22 of the users are people with more than 65 years. This means that the population of the area is old and uses the lift to go to the commercial area or to access to public transport.

There has been an increase in the use of the lift by people with this age.



4.- Number of movements of the lift/day. (Indicator)

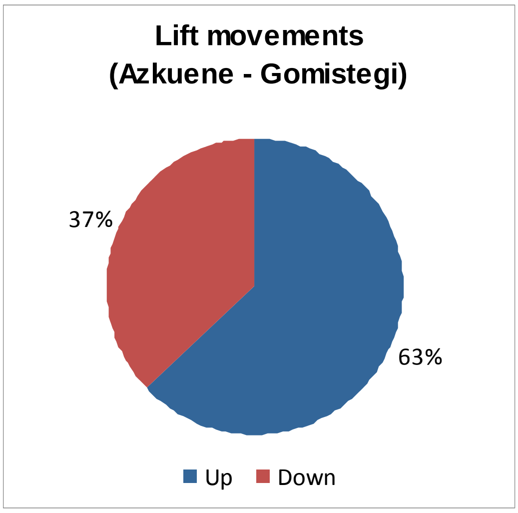
2011



As we can see in the graphic the 62 % of the movements are upwards and the 38 % are downwards.

The total number of uses is 909 up/down, which means that it is the second most used new lift.

2012



As we can see in the graphic the 63 % of the movements are upwards and the 37 % are downwards.

The total number of uses is 1104 up/down, which means that it is the second most used new lift.

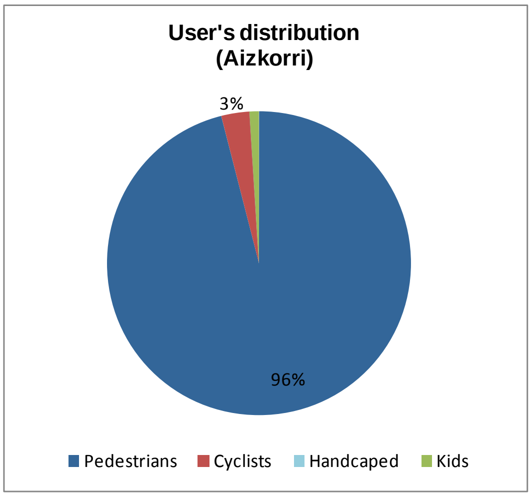
There has been an increases in the number of movements of 21 %.

AIZKORRI

This lifts are situated in the neighbourhood of Antiguo and they connect it with Aiete. This lifts connect the highest area of the neighbourhood with the commercial area of Antiguo. They are very useful for old people living in the area that before the construction of this lifts needed to use the stairs to go from the lowest area to the highest area. The lifts are also a very important access to the public transport that runs along the road below to the city centre.

1.- Percentage and number of each user type and lift. (Indicator)

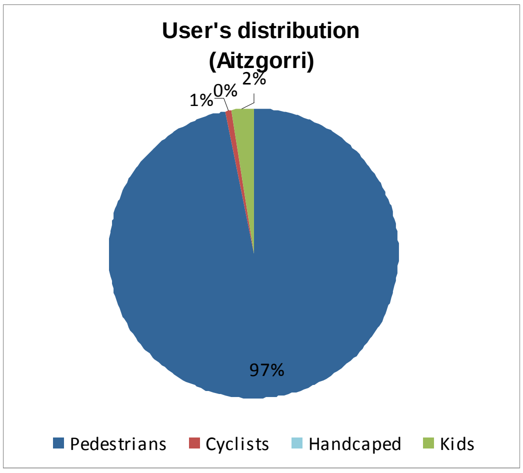
2011



As we can see in the graphic, most of the people are pedestrians.

The use of bicycle is around the 3 %. This lift has been constructed into a new 30-km-zone finished at the start of 2011. This 30-km-zone will make possible to connect the lift to the nearest cycling lane and make use the lift more by bicycles.

2012



As we can see in the graphic, most of the people are pedestrians.

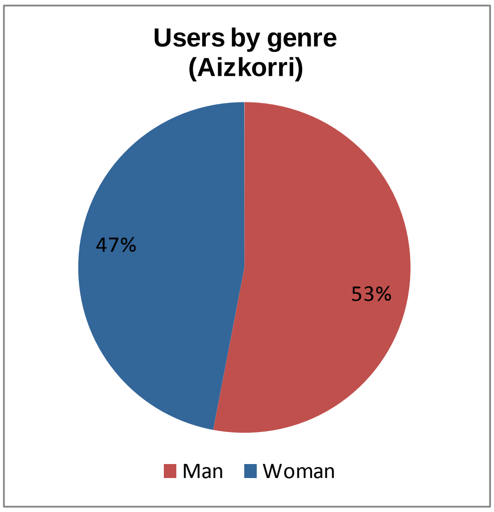
The use of bicycle is around the 1 %. It has decrease comparing with the data collected the year before. The Montpelier lift has been opened near to this lift and it is possible that people that used to use this lift, now they use the Montpelier lift. If we look at the Montpelier graphic we can see that there is a high percentage of cyclists using the lift.

There has been and increase in the number of people with trolleys and kids using the lifts.

2.- Number of users by gender and lift/day.

2011

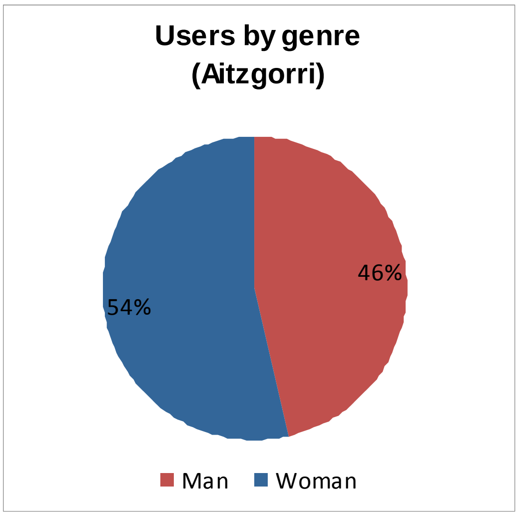
The 53 % of the people that uses this lift are men while the 47 % are women.



2012

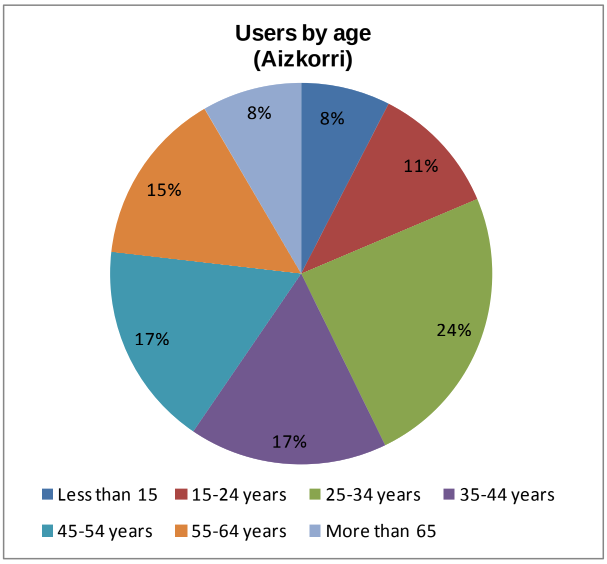
The 46 % of the people that uses this lift are men while the 54 % are women.

There has been a change in percentages of users by genre.



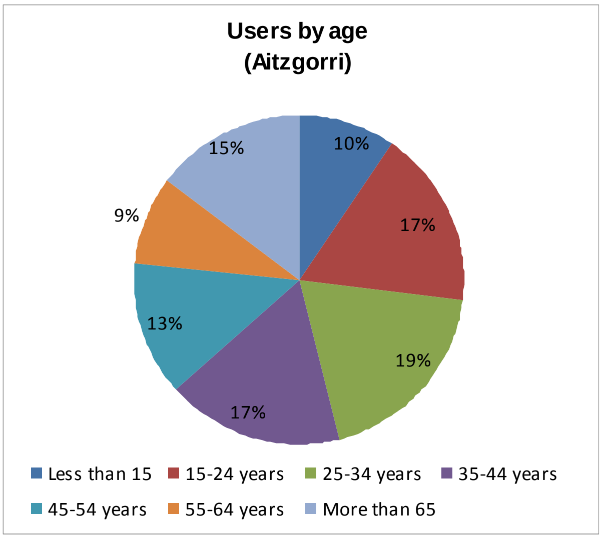
3.- Percentage of users by age and lift.

2011



As we can see in the graphic, the 24% of the users are people between 25-34 years. This means that the population of the area is young and uses the lift to go to the commercial area or to access to public transport.

2012



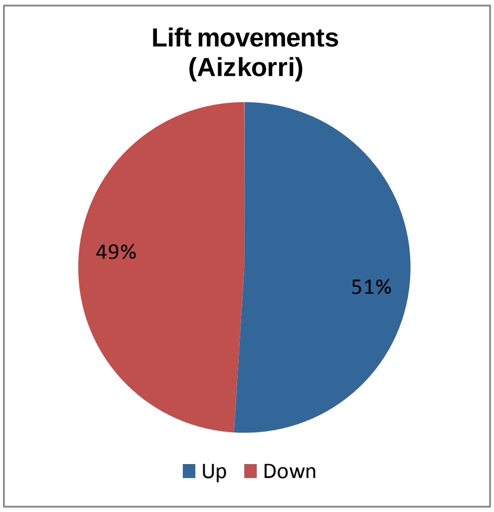
As we can see in the graphic, the 17 % of the users are people between 15-24 years, the 19% of the users are people between 25-34 years and 17 % of the users are people between 35 –44 years. This means that the population of the area is young and uses the lift to go to the commercial area or to access to public transport.

4.- Number of movements of the lift/day. (Indicator)

2011

As we can see in the graphic the 51 % of the movements are upwards and the 49 % are downwards.

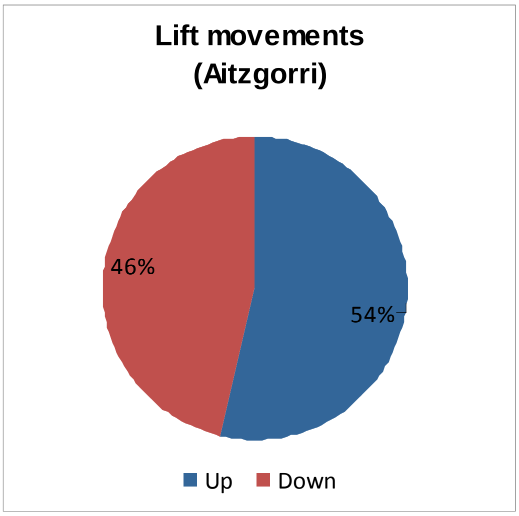
The total number of uses/day is 1139 up/down, being the most used new lift.



2012

As we can see in the graphic the 54 % of the movements are upwards and the 46 % are downwards.

The total number of uses/day is 1190 up/down, being the most used new lift. There has been an increase of 4,4 % compared with the year before.



LIZARDI

1.- Percentage and number of each user type and lift. (Indicator)

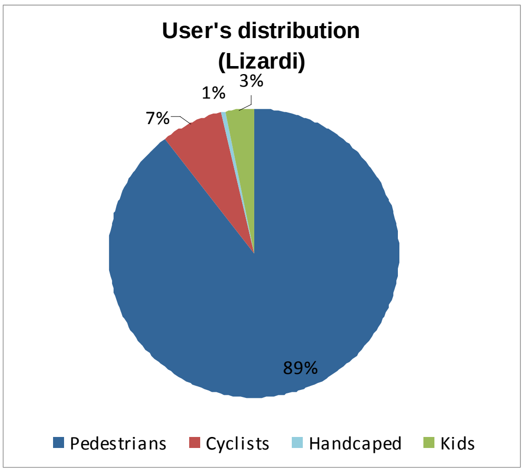
This ramps and escalators are situated in the neighbourhood of Intxaurrondo and they connect the oldest part of the neighbourhood with the new area. This ramps and escalator connect new train station with the highs area of the neighbourhood and as there is 5 ramps/escalators people living in the surroundings can use it at different high. They are very useful for old people living in the area that before the construction of this ramps and escalators needed to use the stairs to go from the lowest area to a middle point or the highest area. The ramps and mechanical escalators, are high density vertical transport systems, what makes possible to move many people at the same time. The location of the train station and the orography characteristics were the reasons why this solution of ramps/mechanical escalators was taken.

It is important to notice that all the data are to go uphill.

2012

As we can see in the graphic, most of the people are pedestrians.

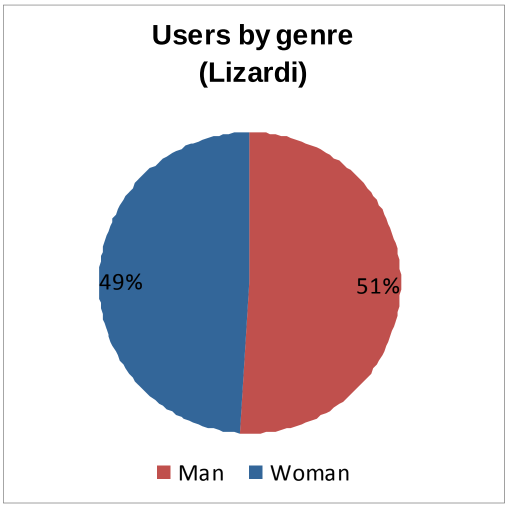
The use of bicycle is very high 7 %, compared with other vertical transport systems. A new cycle lane has been opened from the city centre to this area, passing near to the ramps and escalators, what makes possible to arrive to this vertical transport system and go uphill, instead of going by the existing cycle lane with a high slope.



2.- Number of users by gender and lift/day.

2012

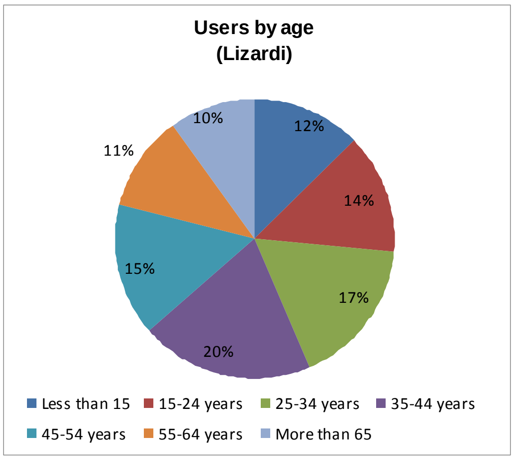
The 51 % of the people that uses this lift are men while the 49 % are women.



3.- Percentage of users by age and lift.

2012

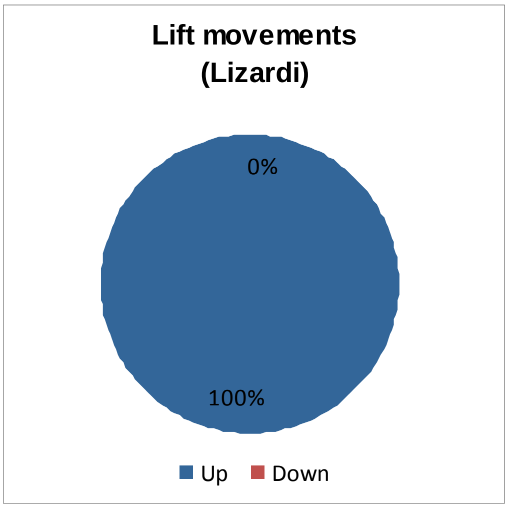
As we can see in the graphic, the percentage of people of different ages that use the ramps and mechanical escalator are very same, what means that in the area lives people of all the ages.



4.- Number of movements of the lift/day. (Indicator)

2012

This ramps and mechanical ramps has been contructed just to go uphill. That is why the 100 % of the uses has been going up.



MONTPELIER

This lifts are situated in the neighbourhood of Antiguo and they connect it with Aiete. This lifts connect the highest area of the neighbourhood with the commercial area of Antiguo. They are very useful for old people living in the area that before the construction of this lifts needed to use the stairs to go from the lowest area to the highest area. The lifts are also a very important access to the public transport that runs along the road below to the city centre.

At the same time that this lifts were constructed, a social building with apartments for young people was built in the area.

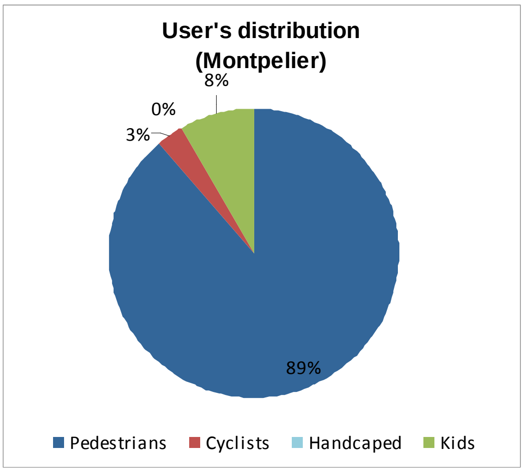
1.- Percentage and number of each user type and lift. (Indicator)

2012

As we can see in the graphic, most of the people are pedestrians.

The use of bicycle, is around the 8 %. It is a very high percentage of bicycles compared with other lifts in the city. As we have indicated in the lift of Aizkorri, the percentage of cyclists has reduced, what means that many cyclist use this one instead the one of Aizkorri.

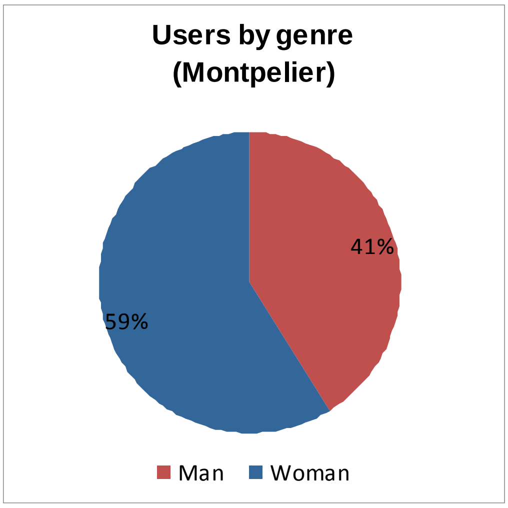
The construction of social buildings for young people may be another reason that explains the high percentage of use of the bycicle.



2.- Number of users by gender and lift/day.

2012

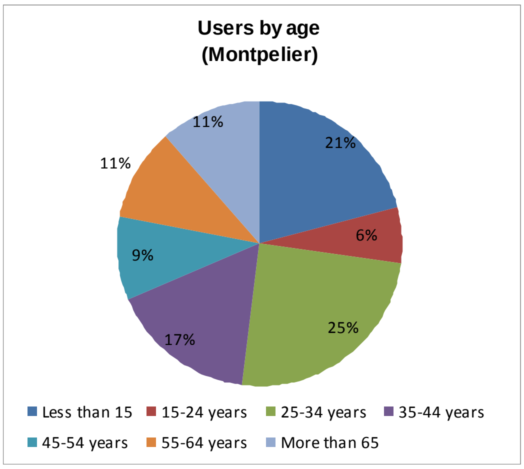
The 59 % of the people that uses this lift are men while the 41 % are women.



3.- Percentage of users by age and lift.

2012

As we can see, the highest percentage of users are young people between 25 – 34 years. The social building is the cause of this percentage. At the same time we can see the very high level of people with less than 15 years.



4.- Number of movements of the lift/day. (Indicator)

2012

As we can see in the graphic the 65 % of the movements are upwards and the 35 % are downwards.

The total number of uses/day is 983 up/down, being one of the most used new lifts.