

MOBILITY PLAN OF THE UNIVERSITAT AUTÒNOMA DE BARCELONA. BELLATERRA CAMPUS

ENVIRONMENTAL AND SOCIAL EVALUATION



MOBILITY BOARD OF THE UNIVERSITAT AUTÒNOMA DE BARCELONA

Mobility Plan of the Universitat Autònoma de Barcelona. Bellaterra campus

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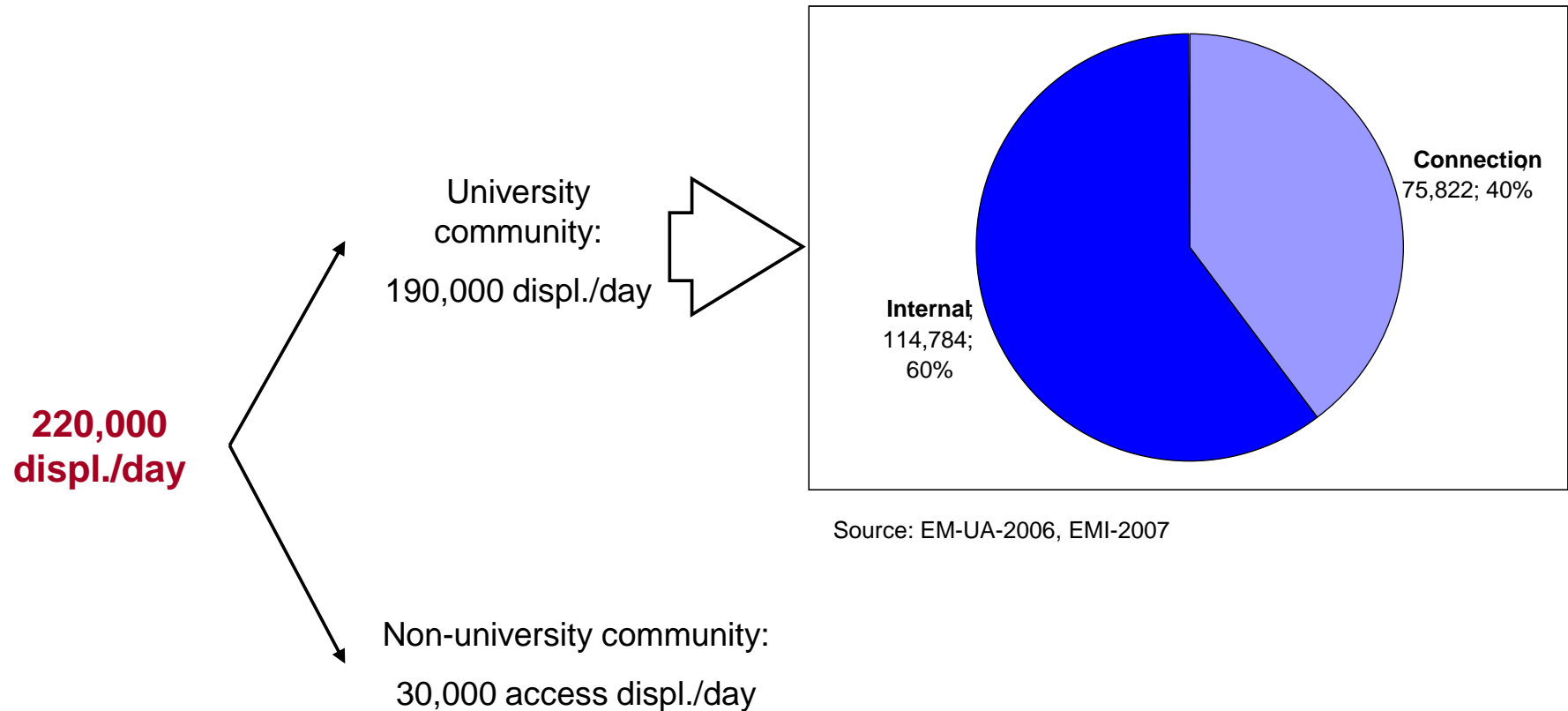
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ENVIRONMENTAL AND SOCIAL DIAGNOSIS OF THE PLAN



Environmental and social diagnosis of the plan

Diagnosis of displacements



Environmental and social diagnosis of the plan

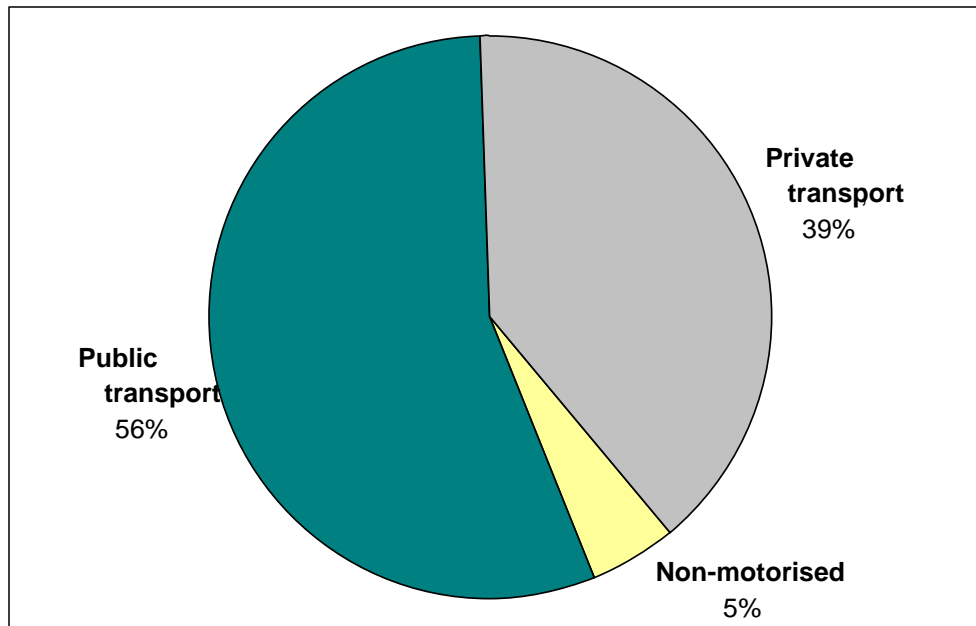
Kind of transports used

Connection displacements, university community:

75,800 displ./day

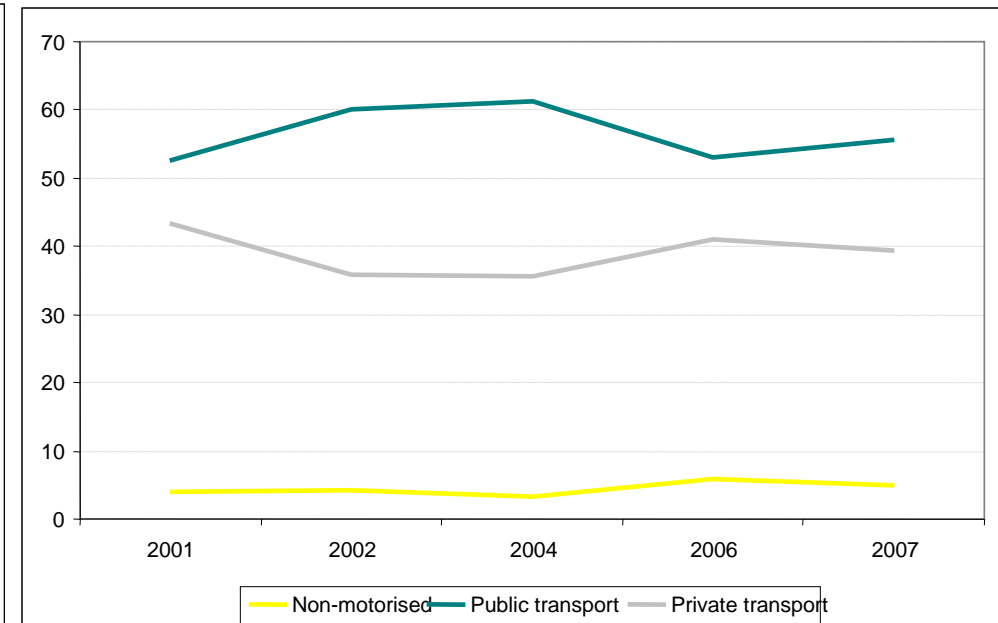
TOTAL DISPLACEMENTS 220,000	DISPLACEMENTS UNIVERSITY COMMUNITY 190,000	Connection 75,000
		Internal 114,000
	DISPLACEMENTS NON-UNIVERSITY COMMUNITY ?	Connection 30,000
		Internal ?

Kinds of transports used in access displacements by the university community. 2007.



Source: In-house based on GEMOTT 2001, 2002, 2004. IERMB 2006, 2007.

Evolution in kind of transports used in access displacements by the university community. 2001-2007



Diagnosis of the impacts of mobility

Air pollution

The effects of the displacements to the UAB Bellaterra campus on air pollution have been estimated at:

EMISSIONS 2006	Emissions NOx Kg	Emissions CO2 Kg	Emissions Partícules Kg	Cost percebut €	Cost total €	Consum Energètic tep	Accidentalitat Cost Total milers €
Cotxe	72.274	18.616.149	4.380	81.035.000	109.506.757	6.570	1.851.759.259
Moto	435	312.951	261	1.680.664	3.969.844	116	431.351.120
Autobús	20.175	1.888.689	722	741.427	1.014.585	624	52.114.535
Tren	654	8.413	136	368.891	446.552	116	6.866.549
Total	93.537	20.826.202	5.499	83.825.982	114.937.738	7.427	2.342.091.464

Noise pollution

North Axis. On this roadway, the levels were higher than 60 dBA during the busiest time bracket.

Central Axis: On this roadway the noise levels were also higher than 60 dBA during the busiest time bracket. On the Central Axis the noise particularly affects the Social Sciences Library and, to a lesser extent, the rest of the Sciences and Humanities building.

Medicine Axis – Vila Universitària: This zone showed noise problems all day long. The main causes were the non-asphalted pavement and vibrations and reverberations coming from under the bridges.

The Cases Sert homes closest to the FGC. This homes are affected by the noise caused by the trains passing by. The noise rates measured on the facades of the buildings closest to the railway was around 77 dBA as the trains passed by.

Appropriation of the space by roadway infrastructures

The roadways and parking zones account for 35% of the total land on campus.

Land uses	Area (ha)	%
Built area	25.0	34.2
Sports zone	2.3	3.1
Roadway	16.0	21.9
Car park	9.6	13.2
Train track	1.3	1.7
Urbanised, non-built area	18.9	25.9
Urbanised	73.1	100
Total area	262.6	

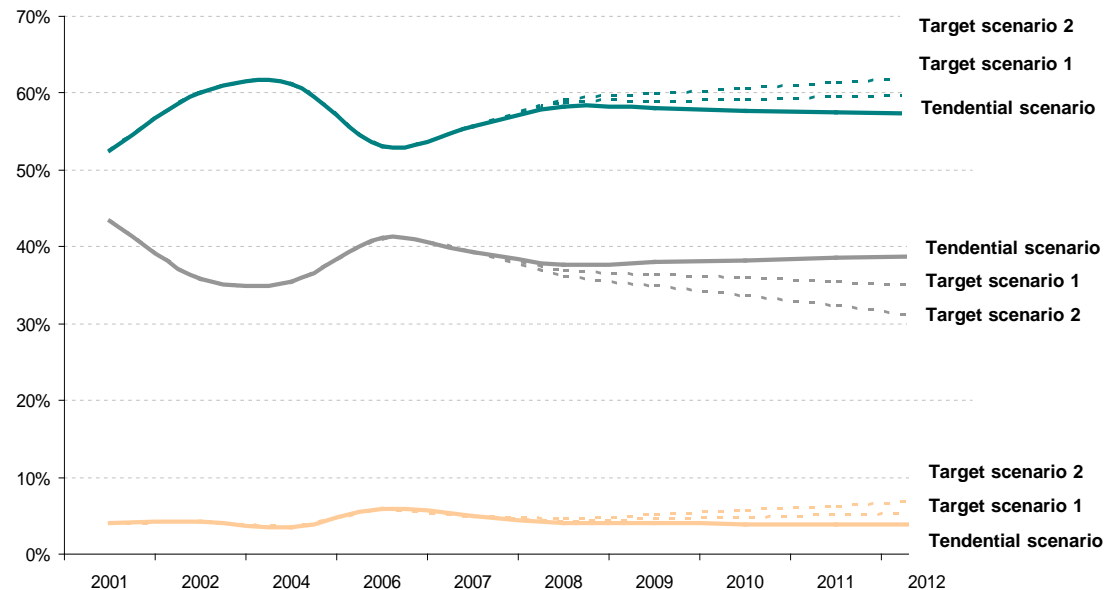
ENVIRONMENTAL AND SOCIAL EVALUATIONS OF THE PLAN'S TARGET SCENARIOS

Social and environmental evaluation of the plan

In the stage of mobility objectives and scenarios of the mobility plan, two future scenarios were devised according to their execution.

The environmental and social evaluation was performed for both scenarios.

	Tendential scenario	Target scenario 1	Target scenario 2
Non-motorised	3.9%	5.4%	6.9%
Public transport	57.2%	59.7%	62.1%
Private transport	38.1%	34.9%	30.9%
Total	100.0%	100.0%	100.0%



Target scenario 1. Emissions (NOx, CO2 and particles).

CÀLCUL ESTIMATIU DE LES EMISSIONS ANUALS SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

NOx	EMISSIONS Tendencial 2012	km anuals recorreguts (1)	emissions NOx (gNOx/veh-km)	coeficient corrector (2)	Emissions NOx Kg
	Cotxe	115.581.327	0,66	1	76.284
Moto	3.058.438	0,15	1	459	
Autobús*	2.347.010	10,34	1	24.268	
Tren**	778.490	1,01	1	786	
Tramvia**		1,01	1	0	
TOTAL					101.797

NOx	EMISSIONS 2012 Objectiu 1	km anuals recorreguts (1)	emissions NOx (gNOx/veh-km)	coeficient corrector (2)	Emissions NOx Kg
	Cotxe	103.745.598	0,66	0,62	42.285,1
Moto	2.745.249	0,15	1,00	411,8	
Autobús*	2.446.486	10,34	0,51	12.844,8	
Tren**	811.486	1,01	1,00	819,6	
Tramvia**		1,01		0,0	
TOTAL					56.361,3

Per motors i mobilitat tendencial
Reducció velocitat

NOx	ESTALVI Kg NOx
	33998,5
47,0	
11423,3	
-33,3	
0,0	
TOTAL	45435,5
% ESTALVIAT	-44,6%

CO2	EMISSIONS Tendencial 2012	km anuals recorreguts (1)	emissions CO2 (gCO2/veh-km)	coeficient corrector (2)	Emissions CO2 Kg
	Cotxe	115.581.327	170	1	19648825,6
Moto	3.058.438	108	1	330311,3	
Autobús*	2.347.010	968	1	2271905,5	
Tren**	778.490	13	1	10120,4	
Tramvia**		13	1	0,0	
TOTAL					22.261.163

CO2	EMISSIONS 2012 Objectiu 1	km anuals recorreguts (1)	emissions CO2 (gCO2/veh-km)	coeficient corrector (2)	Emissions CO2 Kg
	Cotxe	103.745.598	170	0,74	12.967.733
Moto	2.745.249	108	1,00	296.487	
Autobús*	2.446.486	968	0,74	1.741.259	
Tren**	811.486	13	1,00	10.549	
Tramvia**		13		0,0	
TOTAL					15.016.028,3

Per Biodiesel
Reducció velocitat
Eficiència motors

CO2	ESTALVI Kg CO2
	6681092,8
33824,5	
530646,1	
-428,9	
0,0	
TOTAL	7245134,4
% ESTALVIAT	-32,5%

Partícules	EMISSIONS Tendencial 2012	km anuals recorreguts (1)	emissions Partícules (gPM/veh-km)	coeficient corrector (2)	Emissions Partícules Kg
	Cotxe	115.581.327	0,04	1	4623,3
Moto	3.058.438	0,09	1	275,3	
Autobús*	2.347.010	0,37	1	868,4	
Tren**	778.490	0,21	1	163,5	
Tramvia**		0,21	1	0,0	
TOTAL					5.930

Partícules	EMISSIONS 2012 Objectiu 1	km anuals recorreguts (1)	emissions Partícules (gPM/veh-km)	coeficient corrector (2)	Emissions Partícules Kg
	Cotxe	103.745.598	0,04	0,65	2.677,4
Moto	2.745.249	0,09	1,00	247,1	
Autobús*	2.446.486	0,37	0,53	480,2	
Tren**	811.486	0,21	1,00	170,4	
Tramvia**		0,21	1	0,0	
TOTAL					3.575,0

Per motors i mobilitat tendencial
Reducció velocitat

Partícules	ESTALVI Kg Partícules
	1945,9
28,2	
388,2	
-6,9	
0,0	
TOTAL	2355,4
% ESTALVIAT	-39,7%

Social and environmental evaluation of the plan

Target scenario 2. Emissions (NOx, CO2 and particles).

CÀLCUL ESTIMATIU DE LES EMISSIONS ANUALS SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

NOx	EMISSIONS	km anuals recorreguts	emissions NOx	coeficient corrector (2)	Emissions NOx Kg
	Tendencial 2012	(1)	(gNOx/veh-km)		
	Cotxe	115.581.327	0,66	1	76.284
	Moto	3.058.438	0,15	1	459
	Autobús*	2.347.010	10,34	1	24.268
	Tren**	778.490	1,01	1	786
	Tramvia**		1,01	1	0
TOTAL					101.797

NOx	EMISSIONS	km anuals recorreguts	emissions NOx	coeficient corrector (2)	Emissions NOx Kg
	2012 Objectiu 2	(1)	(gNOx/veh-km)		
	Cotxe	91.909.870	0,66	0,62	37.461
	Moto	2.432.059	0,15	1,00	365
	Autobús*	2.545.961	10,34	0,51	13.367
	Tren**	844.481	1,01	1,00	853
	Tramvia**		1,01	1	0
TOTAL					52.046

Per motors i mobilitat tendencial
Reducció velocitat

NOx	ESTALVI Kg NOx
	38.823
	94
	10.901
	-67
	0
TOTAL	49.751
% ESTALVIAT	-48,9%

CO2	EMISSIONS	km anuals recorreguts	emissions CO2	coeficient corrector (2)	Emissions CO2 Kg
	Tendencial 2012	(1)	(gCO2/veh-km)		
	Cotxe	115.581.327	170	1	19.648.826
	Moto	3.058.438	108	1	330.311
	Autobús*	2.347.010	968	1	2.271.906
	Tren**	778.490	13	1	10.120
	Tramvia**		13	1	0
TOTAL					22.261.163

CO2	EMISSIONS	km anuals recorreguts	emissions CO2	coeficient corrector (2)	Emissions CO2 Kg
	2012 Objectiu 2	(1)	(gCO2/veh-km)		
	Cotxe	91.909.870	170	0,74	11.488.320
	Moto	2.432.059	108	1,00	262.662
	Autobús*	2.545.961	968	0,74	1.812.060
	Tren**	844.481	13	1,00	10.978
	Tramvia**		13	1	0
TOTAL					13.574.021

Per Biodiesel
Reducció velocitat
Eficiència motors

CO2	ESTALVI Kg CO2
	8.160.506
	67.649
	459.845
	-858
	0
TOTAL	8.687.142
% ESTALVIAT	-39,0%

Partícules	EMISSIONS	km anuals recorreguts	emissions Partícules	coeficient corrector (2)	Emissions Partícules Kg
	Tendencial 2012	(1)	(gPM/veh-km)		
	Cotxe	115.581.327	0,04	1	4.623
	Moto	3.058.438	0,09	1	275
	Autobús*	2.347.010	0,37	1	868
	Tren**	778.490	0,21	1	163
	Tramvia**		0,21	1	0
TOTAL					5.930

Partícules	EMISSIONS	km anuals recorreguts	emissions Partícules	coeficient corrector (2)	Emissions Partícules Kg
	2012 Objectiu 2	(1)	(gPM/veh-km)		
	Cotxe	91.909.870	0,04	0,65	2.372
	Moto	2.432.059	0,09	1,00	219
	Autobús*	2.545.961	0,37	0,53	500
	Tren**	844.481	0,21	1,00	177
	Tramvia**		0,21	1	0
TOTAL					3.268

Per motors i mobilitat tendencial
Reducció velocitat

Partícules	ESTALVI Kg Partícules
	2251,3
	56,4
	368,7
	-13,9
	0,0
TOTAL	2662,5
% ESTALVIAT	-44,9%

Target scenario 1. Costs.

CÀLCUL ESTIMATIU DELS COSTOS ANUALS SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

Costos	COSTOS Tendencial 2012	km anuals recorreguts (1)	cost unitari passatger-km percebut	cost unitari passatger-km total	coeficient corrector (2)	Cost percebut €	Cost total €
	Cotxe		115.581.327	0,74	1,00	1	85.530.182
Moto		3.058.438	0,58	1,37	1	1.773.894	4.190.060
Autobús*		2.347.010	0,38	0,52	1	891.864	1.220.445
Ferroviari**		778.490	0,57	0,69	1	443.739	537.158
TOTAL						88.639.679	121.528.990

Cost Percebut	ESTALVI €
	8.758.439
	181.650
	-37.801
-18.807	
TOTAL	8.883.481
% ESTALVIAT	-10,0%

Costos	COSTOS 2012 Objectiu 1	km anuals recorreguts (1)	cost unitari passatger-km percebut	cost unitari passatger-km total	coeficient corrector (2)	Cost percebut €	Cost total €
	Cotxe		103.745.598	0,74	1,00	1	76.771.743
Moto		2.745.249	0,58	1,37	1	1.592.244	3.760.991
Autobús*		2.446.486	0,38	0,52	1	929.665	1.272.173
Ferroviari**		811.486	0,57	0,69	1	462.547	559.925
TOTAL						79.756.198	109.338.686

Cost Total	ESTALVI €
	11.835.729
	429.069
	-51.727
-22.767	
TOTAL	12.190.304
% ESTALVIAT	-10,0%

Target scenario 2. Costs.

CÀLCUL ESTIMATIU DELS COSTOS ANUALS SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

Costos	COSTOS	km anuals recorreguts (1)	cost unitari passatger-km percebut	cost unitari passatger-km total	coeficient corrector (2)	Cost percebut €	Cost total €
	Tendencial 2012						
	Cotxe	115.581.327	0,74	1,00	1	85.530.182	115.581.327
	Moto	3.058.438	0,58	1,37	1	1.773.894	4.190.060
	Autobús*	2.347.010	0,38	0,52	1	891.864	1.220.445
	Ferrovitari**	778.490	0,57	0,69	1	443.739	537.158
	TOTAL					88.639.679	121.528.990

Cost Percebut	ESTALVI €
	363.300
	-75.602
	-37.615
TOTAL	17.766.961
% ESTALVIAT	-20,0%

Costos	COSTOS	km anuals recorreguts (1)	cost unitari passatger-km percebut	cost unitari passatger-km total	coeficient corrector (2)	Cost percebut €	Cost total €
	2012 Objectiu 2						
	Cotxe	91.909.870	0,74	1,00	1	68.013.304	91.909.870
	Moto	2.432.059	0,58	1,37	1	1.410.594	3.331.921
	Autobús*	2.545.961	0,38	0,52	1	967.465	1.323.900
	Ferrovitari**	844.481	0,57	0,69	1	481.354	582.692
	TOTAL					70.872.718	97.148.383

Cost Total	ESTALVI €
	858.139
	-103.455
	-45.534
TOTAL	24.380.607
% ESTALVIAT	-20,1%

Social and environmental evaluation of the plan

Target scenario 1. Energy consumption.

CÀLCUL ESTIMATIU DEL CONSUM ENERGÈTIC ANUAL SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

Consum Energètic	CONSUM ENERGÈTIC Tendencial 2012	km anuals recorreguts (1)	consum energètic (tep/1000-veh-h-km)	coeficient corrector (2)	Consum Energètic tep
	Cotxe	115.581.327	0,06	1	6.935
	Moto	3.058.438	0,04	1	122
	Autobús*	2.347.010	0,32	1	751
	Tren**	778.490	0,18	1	140
	Tramvia**		0,18	1	0
	TOTAL				7.948

Consum Energètic	CONSUM ENERGÈTIC 2012 Objectiu 1	km anuals recorreguts (1)	consum energètic (tep/1000-veh-h-km)	coeficient corrector (2)	Consum Energètic tep
	Cotxe	103.745.598	0,06	0,95	5.913
	Moto	2.745.249	0,04	1	110
	Autobús*	2.446.486	0,32	0,95	744
	Tren**	811.486	0,18	1	146
	Tramvia**		0,18	1	0
	TOTAL				6.913

Per eficiència motors

Consum Energètic	ESTALVI tep
	1021,38
	12,53
	7,31
	-5,94
	0,00
TOTAL	1035,28
% ESTALVIAT	-13,0%

Target scenario 2. Energy consumption.

CÀLCUL ESTIMATIU DEL CONSUM ENERGÈTIC ANUAL SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

Consum Energètic	CONSUM ENERGÈTIC Tendencial 2012	km anuals recorreguts (1)	consum energètic (tep/1000-veh-km)	coeficient corrector (2)	Consum Energètic tep
	Cotxe	115.581.327	0,06	1	6.935
	Moto	3.058.438	0,04	1	122
	Autobús*	2.347.010	0,32	1	751
	Tren**	778.490	0,18	1	140
	Tramvia**		0,18	1	0
	TOTAL				7.948

Consum Energètic	CONSUM ENERGÈTIC Any 2012 Objectiu 2	km anuals recorreguts (1)	consum energètic (tep/1000-veh-km)	coeficient corrector (2)	Consum Energètic tep
	Cotxe	91.909.870	0,06	0,95	5.239
	Moto	2.432.059	0,04	1	97
	Autobús*	2.545.961	0,32	0,95	774
	Tren**	844.481	0,18	1	152
	Tramvia**		0,18	1	0
	TOTAL				6.262

Per eficiència motors

Consum Energètic	ESTALVI tep
	1.696
	25
	-23
	-12
	0
TOTAL	1.686
% ESTALVIAT	-21,2%

Target scenario 1. Accident rate.

COSTOS EXTERNS ANUALS: ACCIDENT SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

Accidentalitat (costos externs)	COSTOS EXTERNS Tendencial 2012	km anuals recorreguts (1)	cost unitari (€/1000*veh-km)	coeficient corrector (2)	Cost Total milers €
	Cotxe	115.581.327	16,91	1	1.954.480.236
Moto	3.058.438	148,86	1	455.279.073	
Autobús*	2.347.010	26,71	1	62.688.633	
Ferrocarril**	778.490	10,61	1	8.259.780	
TOTAL				2.480.707.722	

Accidentalitat (costos externs)	COSTOS EXTERNS 2012 Objectiu 1	km anuals recorreguts (1)	cost unitari (€/1000*veh-km)	coeficient corrector (2)	Cost Total milers €
	Cotxe	103.745.598	16,91	1	1.754.338.067
Moto	2.745.249	148,86	1	408.657.706	
Autobús*	2.446.486	26,71	1	65.345.632	
Ferrocarril**	811.486	10,61	1	8.609.863	
TOTAL				2.236.951.267	

Accidentalitat	ESTALVI milers €
	200.142.170
	46.621.368
	-2.656.999
	-350.083
TOTAL	243.756.455
% ESTALVIAT	-9,8%

Target scenario 2. Accident rate.

COSTOS EXTERNS ANUALS: ACCIDENT SEGONS EL MODE DE TRANSPORT PEL PDE (segons dades 2006)

Accidentalitat (costos externs)	COSTOS EXTERNS Tendencial 2012	km anuals recorreguts (1)	cost unitari (€/1000*veh-km)	coeficient corrector (2)	Cost Total milers €
	Cotxe	115.581.327	16,91	1	1.954.480.236
Moto	3.058.438	148,86	1	455.279.073	
Autobús*	2.347.010	26,71	1	62.688.633	
Ferrocarril**	778.490	10,61	1	8.259.780	
TOTAL				2.480.707.722	

Accidentalitat (costos externs)	COSTOS EXTERNS 2012 Objectiu 2	km anuals recorreguts (1)	cost unitari (€/1000*veh-km)	coeficient corrector (2)	Cost Total milers €
	Cotxe	91.909.870	16,91	1	1.554.195.897
Moto	2.432.059	148,86	1	362.036.338	
Autobús*	2.545.961	26,71	1	68.002.631	
Ferrocarril**	844.481	10,61	1	8.959.946	
TOTAL				1.993.194.811	

Accidentalitat	ESTALVI milers €
	400.284.339
	93.242.735
	-5.313.998
	-700.166
TOTAL	487.512.910
% ESTALVIAT	-19,7%

Summary

	2006	Tendential scenario	Target scenario 1	Target scenario 2
NOX	93,537 kg	101,797 kg	56,361 kg	52,046 kg
CO2	20,826,202 kg	22,261,163 kg	15,016,028 kg	13,574,021 kg
Particles	5,499 kg	5,930 kg	3,575 kg	3,268 kg
Perceived costs	83,825,982 €	88,639,649 €	79,756,198 €	70,872,718 €
Total cost	114,937,738 €	121,528,990 €	109,338,686 €	97,148,383 €
Energy consumption	7,427 tep	7,948 tep	6,913 tep	6,262 tep
Accident rate	2,342,091,464 €	2,480,707,722 €	2,236,951,267 €	1,993,194,811€

	Variation with respect to the tendential scenario	
	Target scenario 1	Target scenario 2
NOX	-44.6%	-48.9%
CO2	-32.5%	-39.0%
Particles	-39.7%	-44.9%
Perceived costs	-10.0%	-20.0%
Total cost	-10.0%	-20.1%
Energy consumption	-13.0%	-21.2%
Accident rate	-9.8%	-19.7%

OTHER FORESEEN BENEFITS

•Noise pollution and appropriation of the space by roadway infrastructures

Reduction of the impacts through the execution of a variety of measures

Lowering of the noise on the Central Axis

Study of a new roadway to channel the traffic on the North Axis

Implementation of a comprehensive parking strategy