Technical University of Munich

Road Safety Workshop

Should we promote a 30km/hr speed limit in cities?

Munich, 6 July 2023

Why city-wide 30km/h speed limit?

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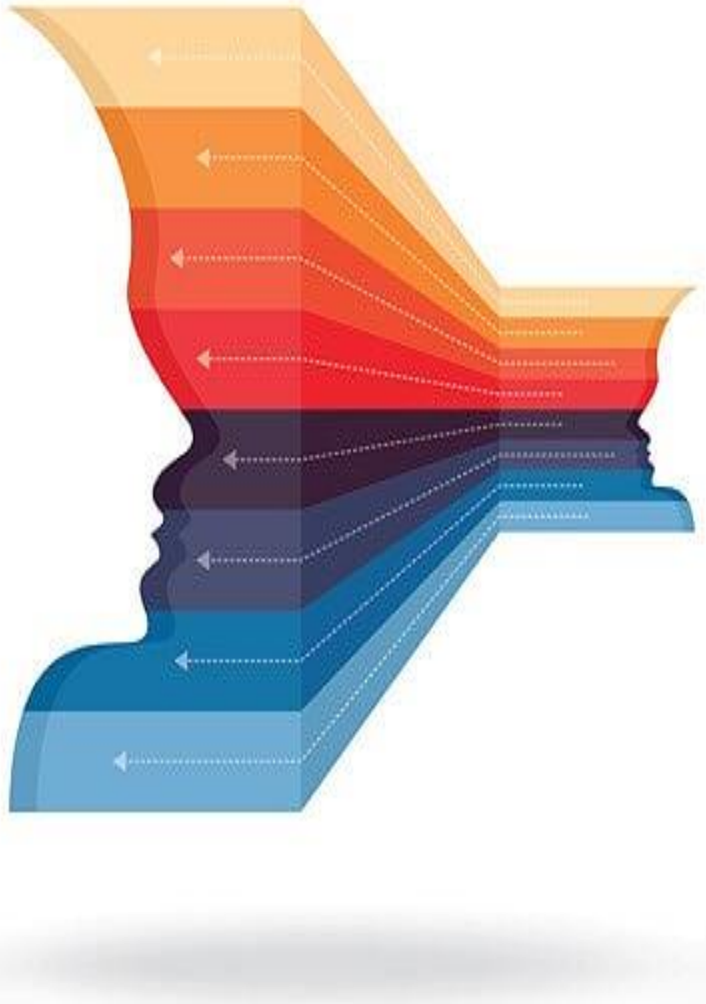
Outline

1. Key facts about speeding
2. Scientific evidence on 30km/h city-wide schemes
3. Cost benefit analysis example
4. Implementation modalities



Key Facts about Speeding

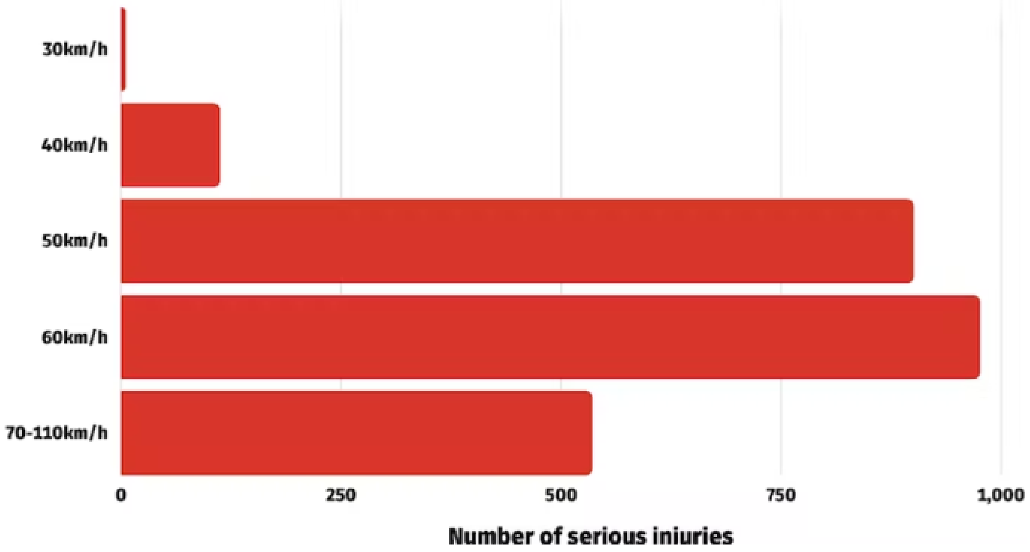
Speeding Kills (1/2)

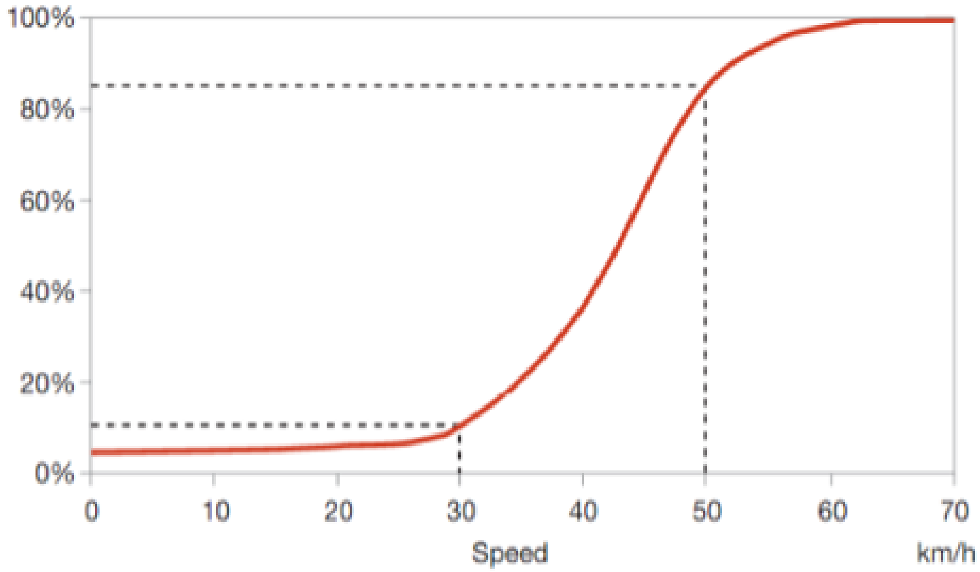
- Road crashes is a major societal problem worldwide, with 1,35 million road fatalities per year and more than 50 million of road injuries
- Speeding is the number one cause of road crashes worldwide, especially in cities where pedestrians, cyclists and motorcyclists are highly exposed and vulnerable in case of a collision.
- Speed has been found to be a major contributory factor in around 10-15% of total crashes and in around 30% of fatal crashes
- Both excessive speed (driving above the speed limit) and inappropriate speed (driving too fast for the conditions, but within the limits) are important crash causation factors
- Speed effects the quality of life of urban residents, especially the safe mobility of vulnerable road users

Speeding is the number one cause of road crashes worldwide and the main reason for pedestrian, cyclist and motorcycle casualties in cities

Speeding Kills (2/2)

- When speed increases, the risk of a crash and of its severity increases as well
- The increase in crash risk is usually attributed by the fact that when speed increases, the time to react to changes in the environment is shorter and manoeuvrability of a speeding car is smaller
- The relationship between speed and crash risk is a power function: With increasing speed, the crash risk increases more as the absolute speed is higher
- There is also a strong statistical relationship between speed and road crashes
- A 5% increase in average speed leads to approximately a 10% increase in all injury crashes and a 20% increase in fatal crashes





Scientific Evidence on 30km/h City-wide Schemes

Why 30km/h Speed Limit (1/2)

*Setting a speed limit of 30 km/h (20 mph) where people and traffic mix, make streets **safer, healthier, greener and more liveable***

Safer

- Reductions in speed limits are intended to improve road safety by decreasing travelling speed and thus reducing the risk of crashes occurring and the severity of crashes that do occur
- The risk of death is almost five times higher in collisions between a car and a pedestrian at 50 km/h compared to the same type of collisions at 30 km/h

Healthier

- Calm driving in lower speeds is a mean of healthier living for the drivers and all road users
- All road users and especially children and the elderly are more likely to walk and are more confident in venturing outside their homes, trying to cross the street

Why 30km/h Speed Limit (2/2)

Greener

- Streets that promote safe walking and cycling can reduce car dependency and harmful vehicle emissions that contribute to climate change
- More specifically, 30 km/h zones reduce carbon dioxide and nitrous oxide emissions from diesel cars, and particulate matter emission from both diesel and petrol cars, thus reducing air pollution

More liveable

- Motor traffic volumes decrease, since slower speeds encourage active, sustainable and shared travel. Reducing the speed limit at 30km/h improves traffic flow, reduces congestion and improves travel times as there is less stop/start traffic movement
- 30 km/h zones promote environmentally friendlier and more active modes of transport, freeing up more space for urban recreation, commerce, and outdoor activities, improving physical and mental health, and creating vibrant cities with better livability

Cities with 30 km/h Speed Limit

City	Implementation Started
Bologna	2023
Florence	2022
Copenhagen	2022
Lyon	2022
Paris	2021
Montpellier	2021
Brussels	2021
Leuven	2021
Vienna	2021
Zurich	2021

City	Implementation Started
Valencia	2021
Munster	2021
Den Haag	2021
Nantes	2020
Glasgow	2020
Antwerp	2020
Barcelona	2019
Madrid	2018
Bilbao	2018
Edinburgh	2016

30km/h Speed Limit in Cities (1/2)

- In January 2021, Brussels in Belgium, established a citywide 30 km/h limit. Maximum speed is 30 km/h on all roads in the Brussels Capital region, except of the major axes where the speed limit remains 50 or 70 km/h. Five months after installing the general speed limit of 30km there was an overall *10% decrease in the number of road crashes*, while one year later, a *50% reduction in road fatalities* was identified

- In August 2021, Paris in France, began reducing the speed limit to 30 km/h in most city streets, taking concrete steps to improve road safety and reduce pollution. The implementation of this measure led to a *25% decrease in the number of road crashes* and a *40% decrease in those considered serious and fatal*. The City has also argued that expanding the 30km/h limit cut noise pollution on the roads in half

- In July 2021, Munster in Germany, introduced 30 km/h speed limits. This measure has as result the drop of number of people *severely injured in road crashes by 72%*

30km/h Speed Limit in Cities (2/2)

- In June 2018, Bilbao in Spain, limited speed to 30 km/h with the triple aim of reducing noise, pollution and increasing road safety. One year after the implementation of the 30 km/h speed limit, the city had *reduced the road crashes by 23%*

- In July 2016, Edinburgh in UK, lowered the speed limit on almost all of its roads from 30 mph to 20 mph. One year later, the zones with a reduced speed limit saw a *38% decrease in the number of road crashes* (371 fewer crashes compared to the previous year), including fewer crashes involving cyclists and pedestrians

- In November 2021, Zurich in Switzerland, implemented 30km/h speed limit restrictions on parts of its street network to reduce noise levels and improve the health and quality of life of the city's residents. After the implementation of this measure, a *25% reduction in road fatalities* was identified. The incidence of car-pedestrian crashes was cut by 16% and the number of injured pedestrians by 20%

Cost Benefit Analysis Example

Financial CBA

- Financial Cost-Benefit Analysis (CBA) is carried out in order to:
  - assess the consolidated investment profitability for the project owner and key stakeholders
  - outline the cash flows which underpin the calculation of the socio-economic costs and benefits

- The financial CBA steps are:

Step 1 - Analysis of the amount and breakdown over the years of the total investment costs

Step 2 - Calculation of the total operating costs and revenues (if any)

Step 3 - Identification of the different sources of financing that cover the investment costs

Step 4 – Estimation of financial performance indicators
  - Financial net present value – FNPV
  - Financial rate of return – FRR

Costs(-)	Benefits(+)
C1 Initial Investment Cost	B1 Traffic
C1.1 Supply and installation of cameras	B1.1 Travel time
C1.2 Installation of speed humps	B1.2 Fuel consumption
C1.3 Supply and installation of signs and markings	
C1.4 Cost of study	
C2 Operating Cost	B2 External Factors
C2.1 Employment of additional human resources	B2.1 Road crashes
C2.2 Function-System Maintenance	B2.2 Environment
C2.3 Operation-Maintenance of mechanical equipment	B2.1.1 CO_2 emissions
C2.4 Media Campaigns	B2.1.2 NO_x Emissions
C2.5 Control of measure effectiveness every two years	B2.1.3 PM Emissions

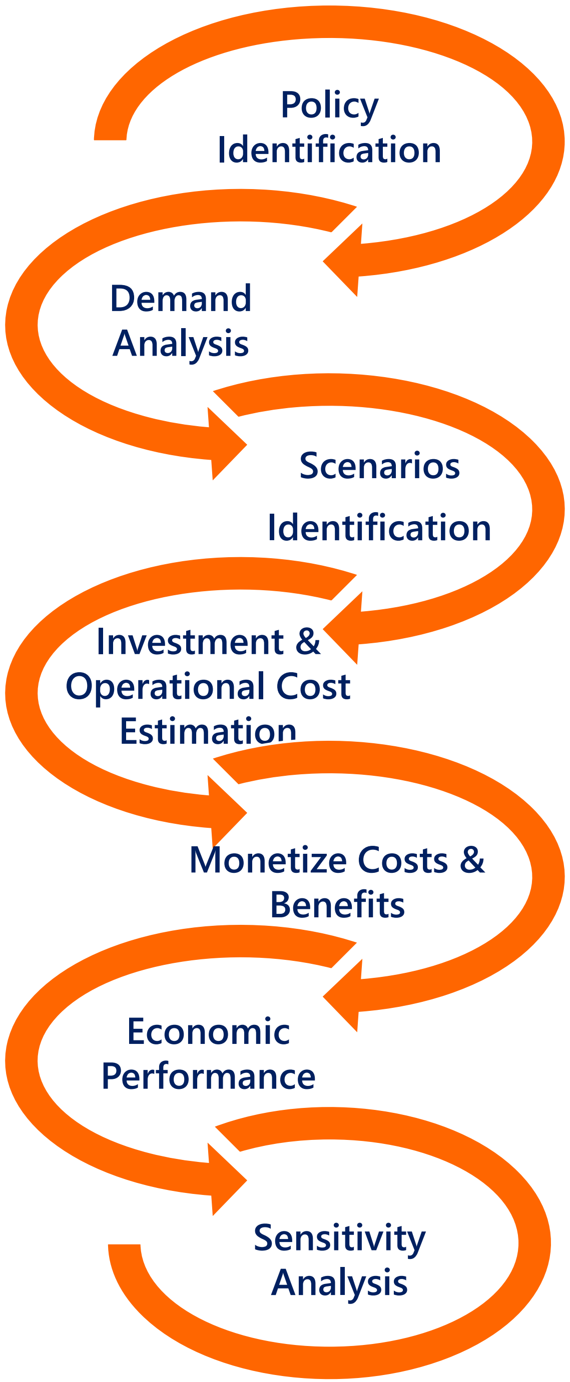
Social CBA

- Social Cost-Benefit Analysis (CBA) is a tool for evaluating the socio-economic impact of a public policy, including indirect impacts
- The following benefits (costs) must be considered in the social CBA to capture the impact on the society:
  - Travel time
  - Vehicle Operating Costs
  - Road casualties
  - Noise emissions
  - Air pollution
  - GHG emissions
- Costs and benefits at different times should be discounted using the Social Discount Rate, which reflects the long-term opportunity cost of resources to society as a whole
- The public policy economic performance is measured using indicators such as:
  - Economic Internal Rate of Return - ERR
  - Economic Net Present Value - ENPV

CBA Methodology

Conduct Social CBA until 2030 to measure the socio-economic feasibility of each policy investigating different Scenarios with and without implementation of the examined policy for the City of Athens

- Conduct stated preference survey to determine public acceptance of the examined urban mobility and safety policies
- Estimate investment and operational costs for each Scenario
- Estimate road user surplus, including travel time and Vehicle Operating Costs (i.e. fuel consumption, service etc.)
- Estimate externalities, including road safety and air pollution
- Monetize estimated costs and benefits for each Scenario
- Calculate Economic Internal Rate of Return (ERR) and Economic Net Present Value (ENPV) for each policy
- Conduct sensitivity analysis of ENPV as a function of critical parameters and assumptions



Multinomial Model - Acceptance Rate

- Based on the multinomial model for car drivers the produced utility function enables the calculation of the probability of choosing the reduction of speed throughout the whole urban network of Athens
- The acceptance rate of the speed limit reduction throughout the urban network was calculated with the respective function as 82%
- In the first two years the acceptance of this measure is reduced
- From the year 2025 and onwards, there is full compliance and acceptance by the drivers

Multinomial Model for cars

Deep Variable:	Choice	No. Observations:	2541
Model:	MNLogit	Df Residuals:	2535
Method:	MLE	Df Model:	4
Date:	Fri,28 Jan 2022	Pseudo R-squ:	0,668
Time:	11:19:10	Log-Likelihood:	-901.98
converged:	TRUE	LL-Null:	-2666.0
Covariance Type:	nonrobust	LLR p-value:	0.000

Choice= 1	coef	std err	z	P>|z|	[0.025	0.975]
const	16.791	1.022	16.422	0.000	14.786	18.794
TIME	4.446	0.898	4.951	0.000	2.686	6.206
FREQ	-20.290	1.233	-16.461	0.000	-22.705	-17.873

Choice= 2	coef	std err	z	P>|z|	[0.025	0.975]
const	11.507	1.097	10.492	0.000	9.357	13.656
TIME	13.488	1.052	12.820	0.000	11.426	15.550
FREQ	-22.730	1.253	-18.133	0.000	-25.181	-20.268

$$U(\text{Choice } 2) = 11.507 + 13.488 * \text{Time}_{\text{norm}} - 22.730 * \text{Fuel}_{\text{norm}} \ (1)$$

Impact on Road Safety

- An average reduction in road fatalities, serious injuries and slight injuries by 29%, 29% and 8% respectively, is found as compared to the baseline Scenario S0
- Based on the analysis of trends in Greece and Europe, the road casualties in Greece are estimated to decrease annually by 2.5%
- Future improvements in vehicle technology, driving behaviour and road infrastructure are also taken into consideration

Year	Slight Injuries/Year				Serious Injuries/Year				Serious Injuries/Year			
	S0	S1	S1-S0	Benefit	S0	S1	S1-S0	Benefit	S0	S1	S1-S0	Benefit
2022	1391	1309	-82	4,212,586 €	38	31	-7	1,915,018 €	17	13	-4	6,444,102 €
2023	1358	1278	-80	4,109,840 €	38	31	-7	1,915,018 €	17	13	-4	6,444,102 €
2024	1325	1235	-90	4,623,570 €	38	29	-9	2,462,166 €	17	13	-4	6,444,102 €
2025	1293	1191	-102	5,240,046 €	38	28	-10	2,735,740 €	17	13	-4	8,592,136 €
2026	1262	1162	-100	5,137,300 €	38	28	-10	2,735,740 €	17	13	-4	8,592,136 €
2027	1231	1133	-98	5,034,554 €	38	28	-10	2,735,740 €	17	13	-4	8,592,136 €
2028	1202	1107	-95	4,880,435 €	38	28	-10	2,735,740 €	17	13	-4	8,592,136 €
2029	1173	1080	-93	4,777,689 €	38	28	-10	2,735,740 €	17	13	-4	8,592,136 €
2030	1145	1055	-90	4,623,570 €	38	28	-10	2,735,740 €	17	13	-4	8,592,136 €
Total	**11380**	**10550**	**-830**		**342**	**259**	**-83**		**153**	**117**	**-36**	

Impact on Travel Time

- Travel time increases by 3% as compared to the baseline Scenario S0
- The cost of travel time is distinguished between travel for work and travel for other purposes
- In Greece, the cost of working time is 9€/hour, while the cost of non-working time is 4.10€/hour
- It is estimated that 44.3% of the distance travelled per commuter per day in urban areas is for work
- The weighted average for the costing of travel time is 6.26 €/hour

Year	Travel Time (h)		Increace of Travel Time (h)	Economic Benefit (€)
	S0	S1		
2022	47,116,800	48,276,709	1,159,909	-7,256,392 €
2023	48,073,177	49,256,630	1,183,453	-7,403,682 €
2024	49,048,966	50,373,288	1,324,322	-8,284,959 €
2025	50,044,562	51,545,899	1,501,337	-9,392,363 €
2026	51,060,367	52,592,178	1,531,811	-9,583,010 €
2027	52,096,790	53,659,694	1,562,904	-9,777,526 €
2028	53,154,251	54,748,878	1,594,628	-9,975,990 €
2029	54,233,176	55,860,171	1,626,995	-10,178,482 €
2030	55,334,001	56,994,021	1,660,020	-10,385,085 €

Impact on Fuel Consumption

- The petrol consumption in the zero emission baseline scenario S0 is derived from vehicle-km and consumption in litres/km
- The average fuel consumption reduction is equal to 11%
- At the beginning of 2022, the average price of petrol in Athens was 1.8€/litre. After deducting the energy regulator's fee, the state tax, customs fees and VAT, the price of petrol amounts to 0.8€/litre
- No forecast of the price of petrol is calculated due to various technical, political and economic factors

Year	Fuel Consumption (lt)		Reduction of Fuel Consumption (lt)	Economic Benefit (€)
	S0	S1		
2022	53,784,211	48,782,260	-5,001,951	4,130,700 €
2023	51,427,416	46,644,648	-4,782,768	3,949,695 €
2024	50,717,851	45,544,631	-5,173,221	4,272,138 €
2025	50,019,389	44,350,525	-5,668,864	4,681,449 €
2026	49,312,372	43,723,636	-5,588,735	4,615,277 €
2027	48,597,717	43,089,976	-5,507,741	4,548,391 €
2028	47,876,215	42,450,244	-5,425,971	4,480,864 €
2029	47,148,549	41,805,047	-5,343,502	4,412,759 €
2030	46,415,318	41,154,915	-5,260,403	4,344,134 €

Impact on Environment

- For the amount of pollutants emitted under the baseline scenario S0 for the year 2021, a 12%, 8.3% and 8% reduction in CO_2, NO_x, PM emissions, respectively is identified

- Calculation of annual cost and correlation with the cost of the baseline scenario S0, i.e. benefit of speed reduction to 30 km/h of scenario S1

Year	CO2 Emissions (tn)		Reduction of CO2 Emissions (tn)	Economic Benefit (€)
	S0	S1		
2022	134,284	127,672	-6,612	753,714 €
2023	132,563	126,036	-6,527	744,056 €
2024	130,870	123,803	-7,067	805,635 €
2025	129,202	121,450	-7,752	883,740 €
2026	127,517	119,866	-7,651	872,216 €
2027	125,817	118,268	-7,549	860,588 €
2028	124,103	116,656	-7,446	848,862 €
2029	122,375	115,033	-7,343	837,047 €
2030	120,636	113,398	-7,238	825,150 €

Year	PM Emissions (tn)		Reduction of PM Emissions (tn)	Economic Benefit (€)
	S0	S1		
2022	1.56	1.46	-0.10	9,075 €
2023	1.44	1.34	-0.10	8,378 €
2024	1.37	1.27	-0.10	8,739 €
2025	1.30	1.21	-0.10	8,299 €
2026	1.23	1.14	-0.09	7,867 €
2027	1.17	1.08	-0.09	7,443 €
2028	1.10	1.01	-0.09	7,808 €
2029	1.04	0.95	-0.08	7,355 €
2030	0.97	0.90	-0.08	6,911 €

Year	NOx Emissions (tn)		Reduction of NOx Emissions (tn)	Economic Benefit (€)
	S0	S1		
2022	459	428	-31	189,459 €
2023	434	404	-29	179,033 €
2024	422	391	-31	191,352 €
2025	412	378	-34	207,168 €
2026	401	368	-33	201,758 €
2027	390	358	-32	196,388 €
2028	380	348	-31	191,063 €
2029	369	339	-30	185,786 €
2030	359	329	-30	180,561 €

Social CBA Results

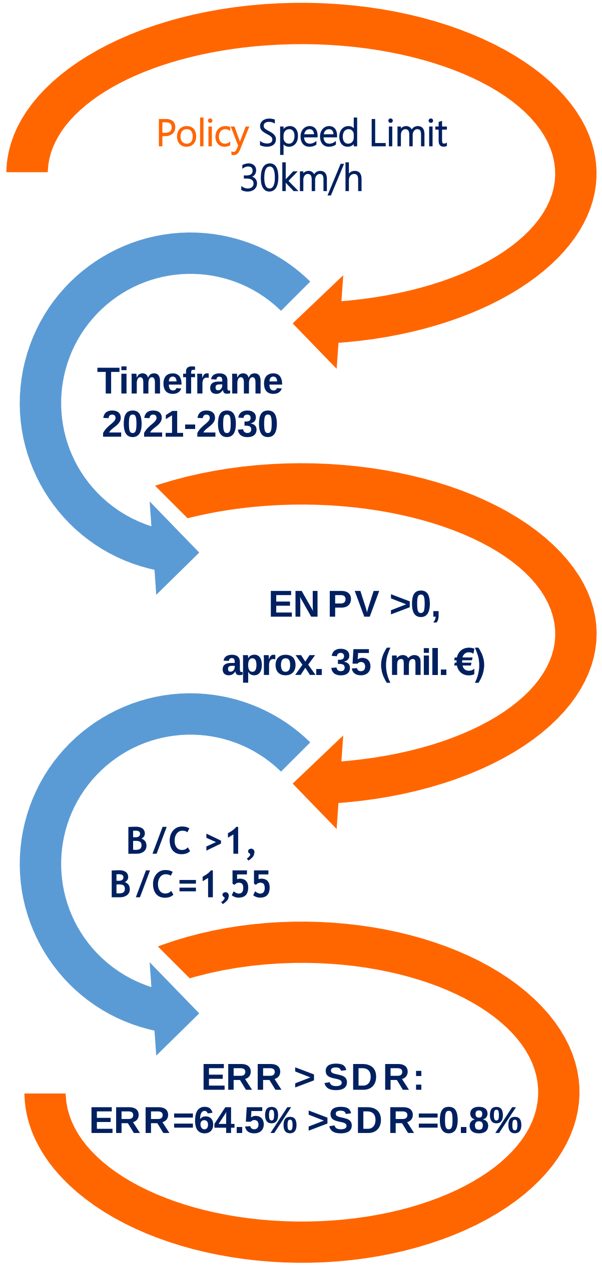
A Cost Benefit Analysis for the City of Athenswas implemented till the year 2030, by including all the Costs (Implementation and Operational) and all the Benefits (Road Crashes, Fuel Consumption, Emissions) which concludes to the following results:

- In the case of the reduction of the speed limit to 30 km/h in the city center, the society benefits from a reduction in road casualties amount to €130 million over a 10-year period

- All the examined policies present a positive ENPV and an ERR higher than the Social Discount Rate (0.8%), indicating their feasibility over time

- The most important economic benefit arises due to the improvement of road safety through the reduction of fatalities on road crashes

- The economic performance was assessed for each policy separately and not comparatively since the study area and the analysis timeframe do not coincide in all examined policies



Limitations

- Social CBA methodology depends on assumptions and estimates that can vary depending on policy implementation and context
- Social CBA results do not include intangible benefits like quality of life or cultural heritage preservation
- Stated preference survey responses may not accurately reflect the entire population's behavior and preferences
- Analysis of policies should account for potential unintended consequences or trade-offs that may arise in response to changing circumstances, particularly in the long-term

Implementation Modalities

Implementation Modalities (1/2)

Public Awareness Campaigns

- Emphasize the safety benefits and explain the rationale behind the 30km/h speed limit to gain public support
- Convince the society (citizens and politicians) to support large-scale interventions
- Launch public awareness through media campaigns, road signage, informational brochures and community outreach programs

Public Transportation and Active Mobility Promotion

- Encourage the use of public transportation and active mobility options, such as walking and cycling
- Enhance public transit services, developing cycling infrastructure, and creating pedestrian-friendly zones can help reduce the reliance on private vehicles and contribute to a safer and more sustainable urban environment

Traffic Calming Measures

- Implement physical changes to the road infrastructure, such as speed bumps, raised crosswalks, traffic circles and narrower lanes

Implementation Modalities (2/2)

Intelligent Transportation Systems

- Install electronic speed limit signs that display the current speed limit and use radar speed displays to alert drivers of their speeds
- Implement adaptive traffic signal systems that adjust signal timings based on prevailing speeds

Monitoring and Evaluation

- Collect data on traffic volumes, vehicle speeds, crash statistics and public feedback to assess the effectiveness of the implemented measures
- Use this information to make necessary adjustments and improvements over time

Enforcement and Police Cooperation

- Promote the collaboration between stakeholders and government levels to implement sustainable mobility and safety policies more effectively
- Collaborate with law enforcement agencies to ensure proper enforcement of the speed limit
- Educate and train police officers on the importance of the new speed limit and the increased presence of traffic patrols


George runs 30 Marathons in 30 Months
for 30km/h speed limit in all cities
Haspa
1682
George
REWE
30

George Runs 30 Marathons in 30 Months

- Scientific evidence from several cities so far, demonstrates more than 40% lives saved with the introduction of 30km/h zones; in parallel to significant environmental, energy and health impacts with less fuel consumption and more walking and cycling

- The discussion and introduction of 30 km/h city zones faces strong reactions and rigid inertia, whereas supporters' voices are weak and inefficient resulting in hesitant politicians and Authorities

- After more than 30 years of dedication to road safety science and several Marathon races, stepping beyond the continuous scientific pleas and promoting more actively the 30 km/h city through the challenge of 30 Marathons in 30 months

George

runs 30 Marathons in 30 Months
for 30km/h speed limit in all cities

30

Marathons

1. Zagori Mountain-23 July 2022
The Beyond the limits - 11:21:38

2. Helsinki, Finland–20 August 2022
The Summer - 3:45:04

3. Antwerp, Belgium-11 September 2022
The Slow-Fast - 3:33:40

4. London, UK-2 October 2022
The Noisy - 3:31:47

5. Athens, Greece – 13 November 2022
The Pain - 3:54:27

6. Valencia, Spain – 4 December 2022
The Fracture - 3:58:13

7. Malta – 26 February 2023
The Knights - 3:55:13

8. Rome, Italy – 19 March 2023
The Legendary - 3:55:55

9. Paris, France – 2 April 2023
The Beautiful - 3:52:02

10. Belgrade, Serbia – 23 April 2023
The Celebration - 3:55:27

11. Copenhagen, Denmark – 14 May 2023
The Cycling City - 3:53:16

12. Stockholm, Sweden – 3 June 2023
The 50th: 3:58:56

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