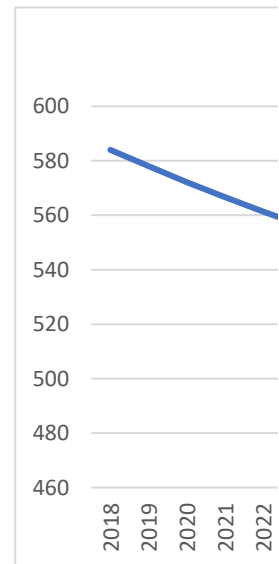
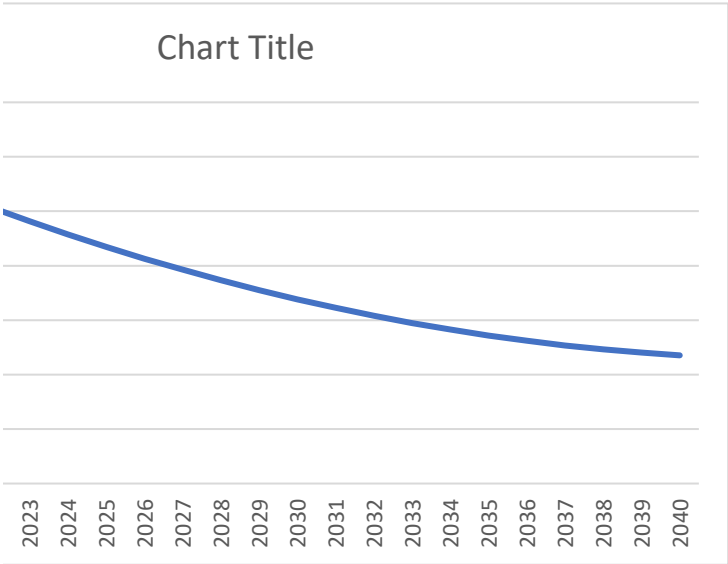


2018	584	
2019	578	-0.0103
2020	572	-0.00999
2021	567	-0.00968
2022	561	-0.00935
2023	556	-0.00901
2024	552	-0.00866
2025	547	-0.0083
2026	543	-0.00793
2027	538	-0.00755
2028	535	-0.00716

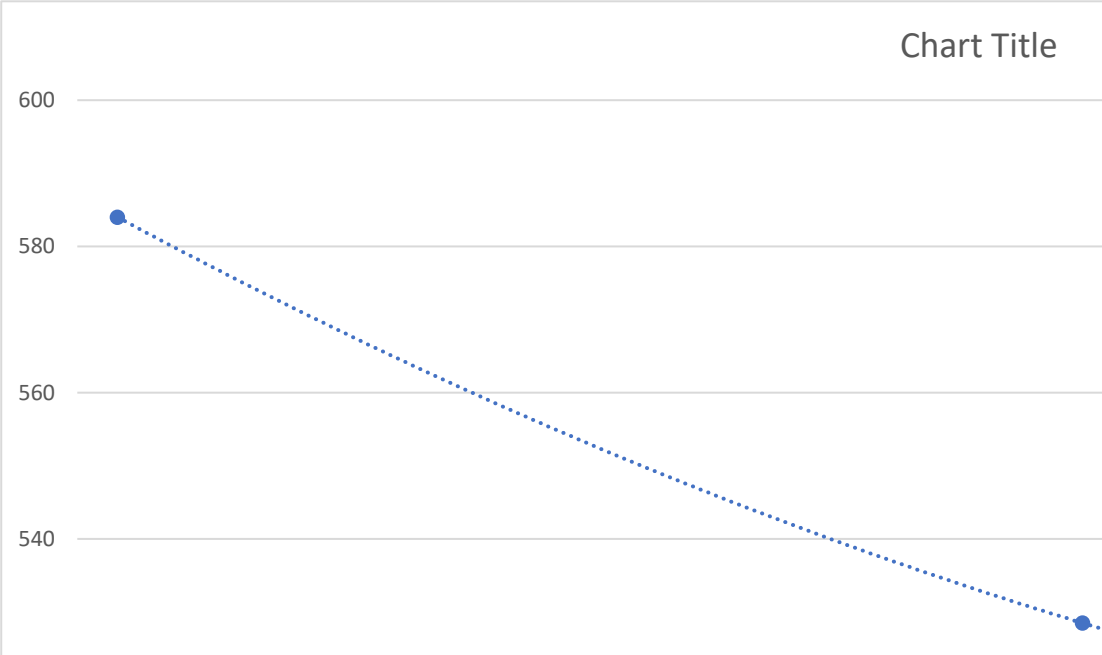


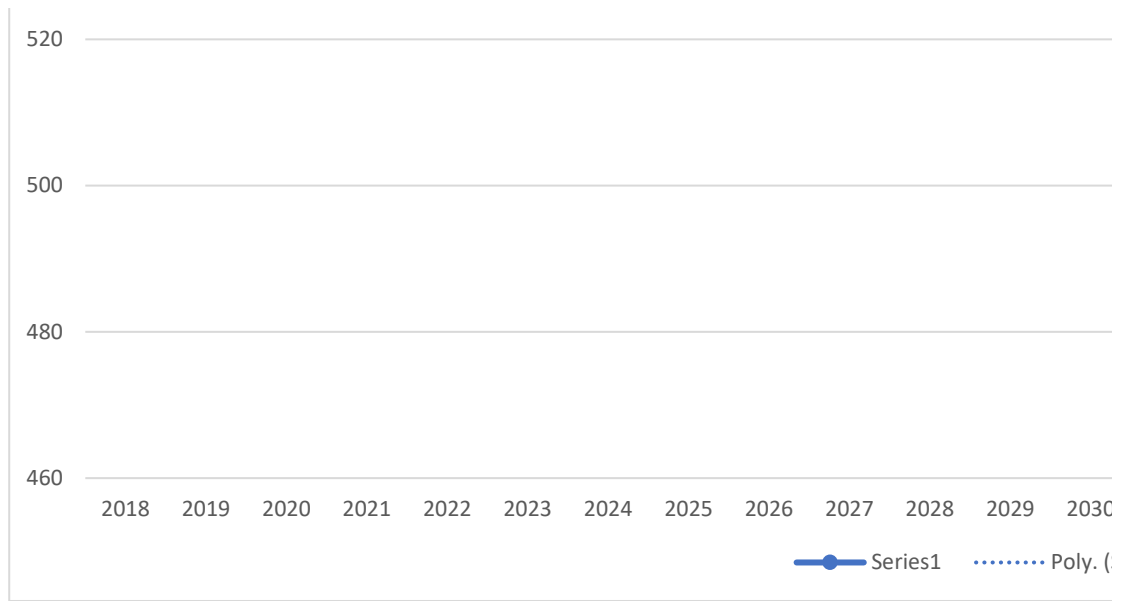
2029	531	-0.00676
2030	528	-0.00636
2031	525	-0.00594
2032	522	-0.00552
2033	519	-0.00509
2034	517	-0.00466
2035	514	-0.00421
2036	512	-0.00376
2037	511	-0.00331
2038	509	-0.00285
2039	508	-0.00239
2040	507	-0.00192

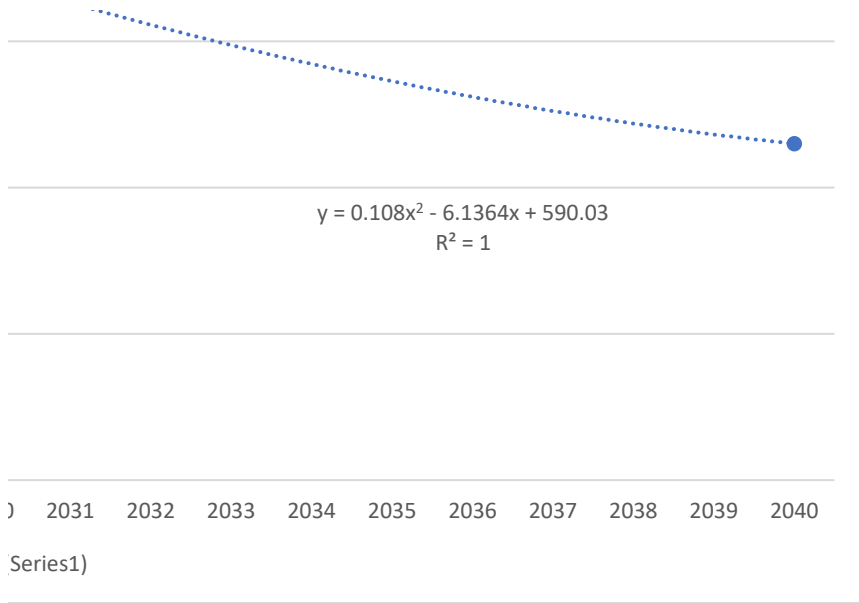


2018	584
2019	
2020	
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2028	
2029	
2030	528.5
2031	
2032	
2033	

2034	
2035	
2036	
2037	
2038	
2039	
2040	506



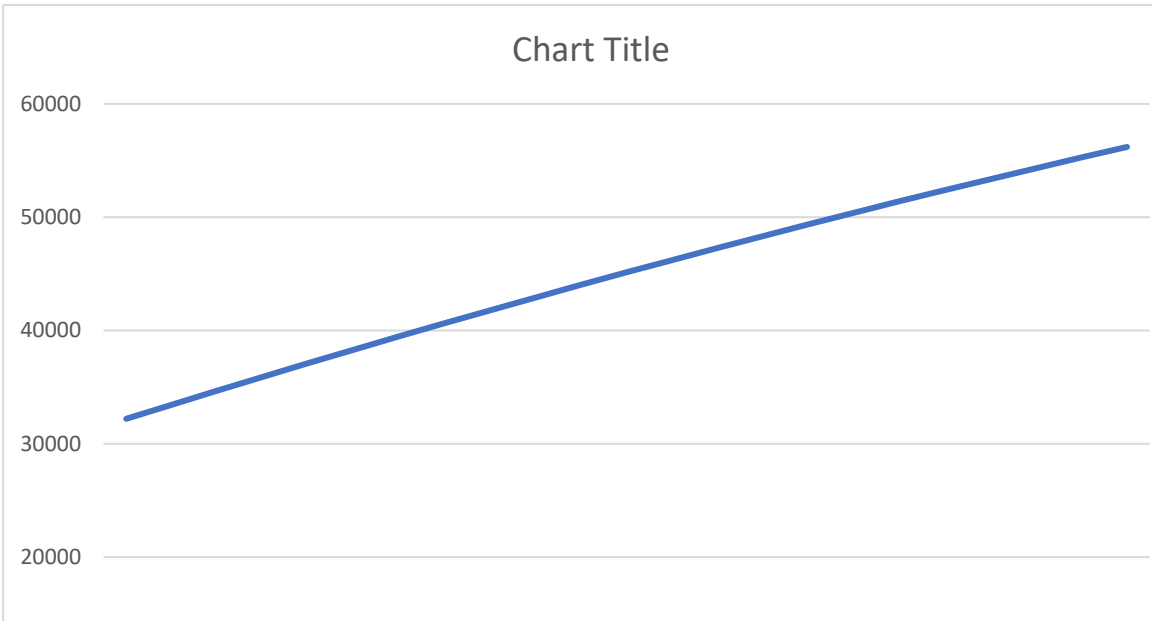
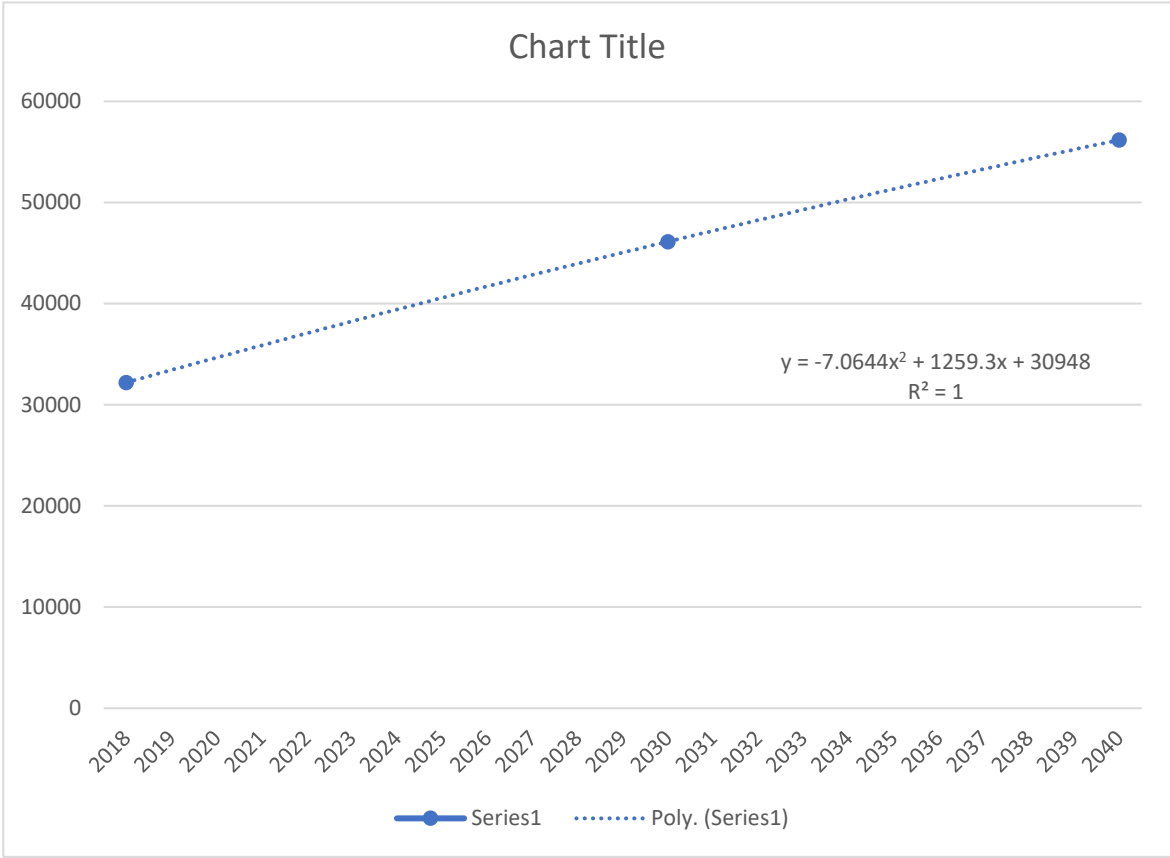


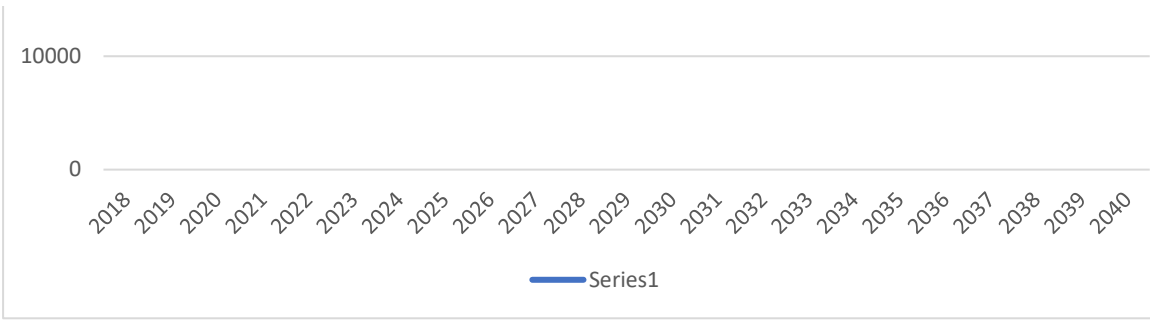


2018	32200
2019	
2020	
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2028	
2029	
2030	46125
2031	
2032	
2033	
2034	
2035	
2036	
2037	
2038	
2039	
2040	56175

2018	32200	
2019	33451.65	0.038871118
2020	34688	0.036959313
2021	35909.05	0.035200934
2022	37114.8	0.033577886
2023	38305.25	0.032074806
2024	39480.4	0.030678562
2025	40640.25	0.029377869
2026	41784.8	0.028162967
2027	42914.05	0.027025378
2028	44028	0.025957699
2029	45126.65	0.024953439
2030	46210	0.024006878
2031	47278.05	0.023112963
2032	48330.8	0.022267204

2033	49368.25	0.021465608
2034	50390.4	0.020704603
2035	51397.25	0.019980988
2036	52388.8	0.019291888
2037	53365.05	0.018634708
2038	54326	0.018007104
2039	55271.65	0.017406951
2040	56202	0.016832318





		Road deaths		
Year	BRON registered	%		Forecast
	1987	52		
	1988	34		
	1989	46		
1990	1990	41		
	1991	29		
	1992	29		
	1993	26		
	1994	28		
1995	1995	29		
	1996	24		
	1997	23		
	1998	20		
	1999	31		
2000	2000	37		
	2001	30		
	2002	23		
	2003	14		
	2004	14		
2005	2005	19		
	2006	20		
	2007	25		
	2008	12		
	2009	12		
2010	2010	11		
	2011	19		
	2012	15		
	2013	14		
	2014	18		
2015	2015	12		
	2016	10		
	2017	13		
	2018	17		
	2019	15	-0.010302055	
2020	2020	14	-0.009994055	14
	2021	14	-0.009675516	14
	2022	14	-0.00934652	14
	2023	14	-0.00900718	14
	2024	13	-0.008657638	13
2025	2025	13	-0.008298072	13
	2026	13	-0.007928689	13
	2027	13	-0.007549732	13
	2028	13	-0.007161475	13
	2029	13	-0.006764228	13

2030	2030	13	-0.006358334	13
	2031	13	-0.005944168	13
	2032	13	-0.00552214	13
	2033	13	-0.00509269	13
	2034	13	-0.004656289	13
2035	2035	13	-0.00421344	13
	2036	13	-0.00376467	13
	2037	12	-0.003310535	12
	2038	12	-0.002851613	12
	2039	12	-0.002388508	12
2040	2040	12	-0.001921837	12

Current situation (mostly frequency strategy)

	2020	2021	2022	2023
Deaths	14	14	14	14
Injuries	4371	4525	4677	4827
Damage	4174	4321	4466	4609

Base situation

	2020	2021	2022	2023
Deaths	19	19	19	18
Injuries	5907	6114	6320	6523
Damage	5641	5839	6035	6229
	312	326	340	355
	298	312	325	339

Base alternative = frequency strategy / 75% * 100%

It is assumed that in the current state of affairs mainly the frequency strategy is used. Research showed that this method is approximately 26% effective for serious accidents. <https://www.kennisnetwerkspv.nl/Aan-de-slag/Effectiviteitswijzer/24-Verkeersongevallen>
https://www.roadsafety-dss.eu/assets/data/pdf/synopses/High_risk_sites_t

Road injuries
 SWOV (2018) and estimation % Forecast

950	2850		
1070	3210	0.126315789	
1060	3180	-0.009345794	
1240	3720	0.169811321	
1370	4110	0.10483871	
1210	3630	-0.116788321	
1140	3420	-0.05785124	
1120	3360	-0.01754386	
1260	3780	0.125	
1270	3810	0.007936508	3810
	3951	0.036930346	3951
	4057	0.02699863	4057
	4215	0.038871118	4215
	4371	0.036959313	4371
	4525	0.035200934	4525
	4677	0.033577886	4677
	4827	0.032074806	4827
	4975	0.030678562	4975
	5121	0.029377869	5121
	5265	0.028162967	5265
	5407	0.027025378	5407
	5548	0.025957699	5548
	5686	0.024953439	5686

5823	0.024006878	5823
5957	0.023112963	5957
6090	0.022267204	6090
6221	0.021465608	6221
6349	0.020704603	6349
6476	0.019980988	6476
6601	0.019291888	6601
6724	0.018634708	6724
6845	0.018007104	6845
6965	0.017406951	6965
7082	0.016832318	7082

2024	2025	2026	2027
13	13	13	13
4975	5121	5265	5407
4751	4890	5028	5164

2024	2025	2026	2027
18	18	18	18
6723	6920	7115	7307
6420	6608	6795	6978
369	383	397	410
352	365	379	392

y is used.

s injuries.

ersonveilige-locaties-in-kaart-brengen

reatment_20102017.pdf

Source

<https://swov.nl>,

Material damage

BRON registered %

Forecast

11989

12074

12156

11501

9437

8935

8735

8610

8785

8093

8443

8877

8158

7349

6379

4998

4394

3996

3510

2972

3441

3414

2873

3012

3001

3267

3696

3231

4769

5350

5491

5940

6086 0.038871118

4174 0.036959313 4174

4321 0.035200934 4321

4466 0.033577886 4466

4609 0.032074806 4609

4751 0.030678562 4751

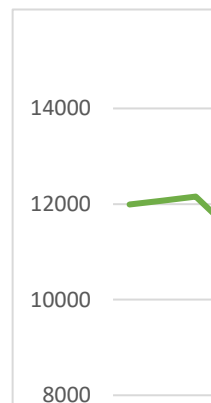
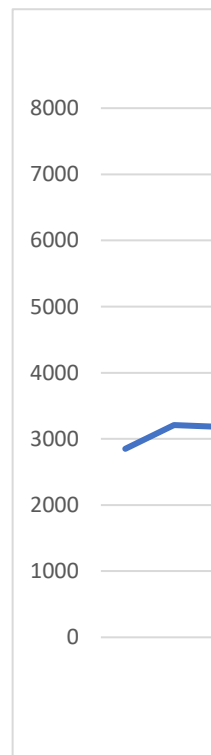
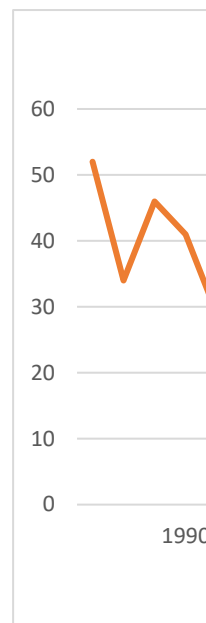
4890 0.029377869 4890

5028 0.028162967 5028

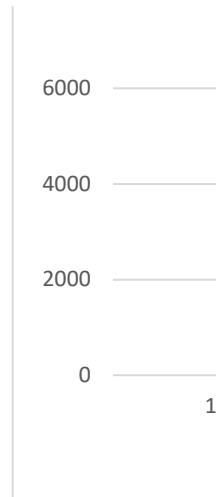
5164 0.027025378 5164

5298 0.025957699 5298

5430 0.024953439 5430



5560	0.024006878	5560
5689	0.023112963	5689
5816	0.022267204	5816
5940	0.021465608	5940
6063	0.020704603	6063
6185	0.019980988	6185
6304	0.019291888	6304
6421	0.018634708	6421
6537	0.018007104	6537
6651	0.017406951	6651
6763	0.016832318	6763

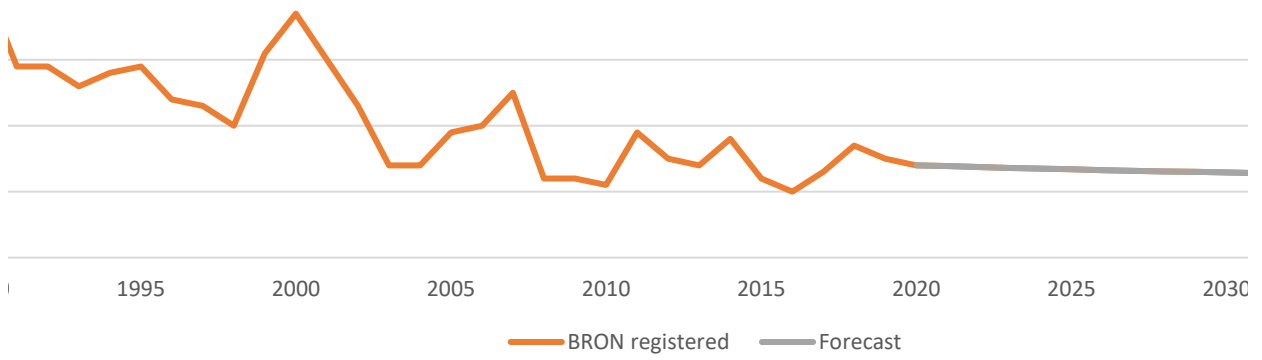


The forecast of material damage = road injuries forecast

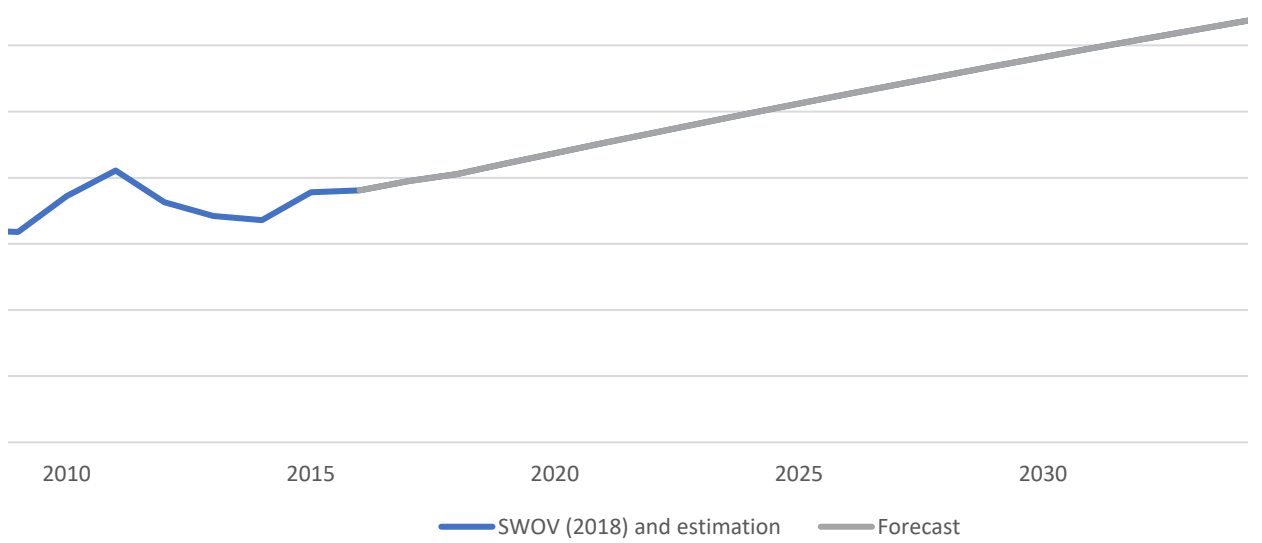
2028	2029	2030	2031	2032	2033
13	13	13	13	13	13
5548	5686	5823	5957	6090	6221
5298	5430	5560	5689	5816	5940

2028	2029	2030	2031	2032	2033
18	18	17	17	17	17
7497	7684	7869	8050	8230	8406
7159	7338	7514	7688	7859	8028
424	438	451	464	477	490
405	418	431	443	456	468

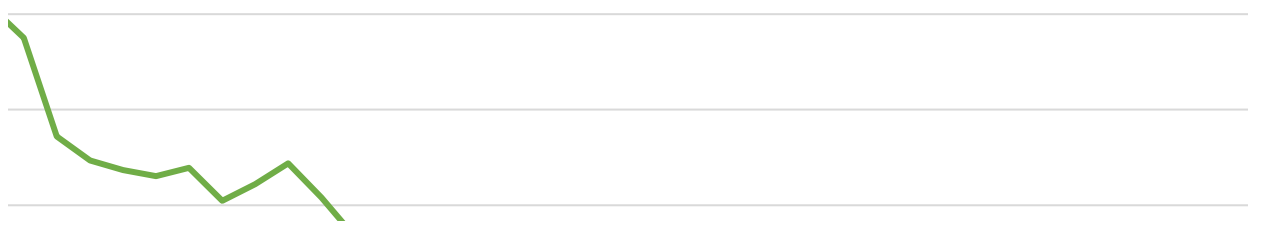
Road Deaths in Amsterdam

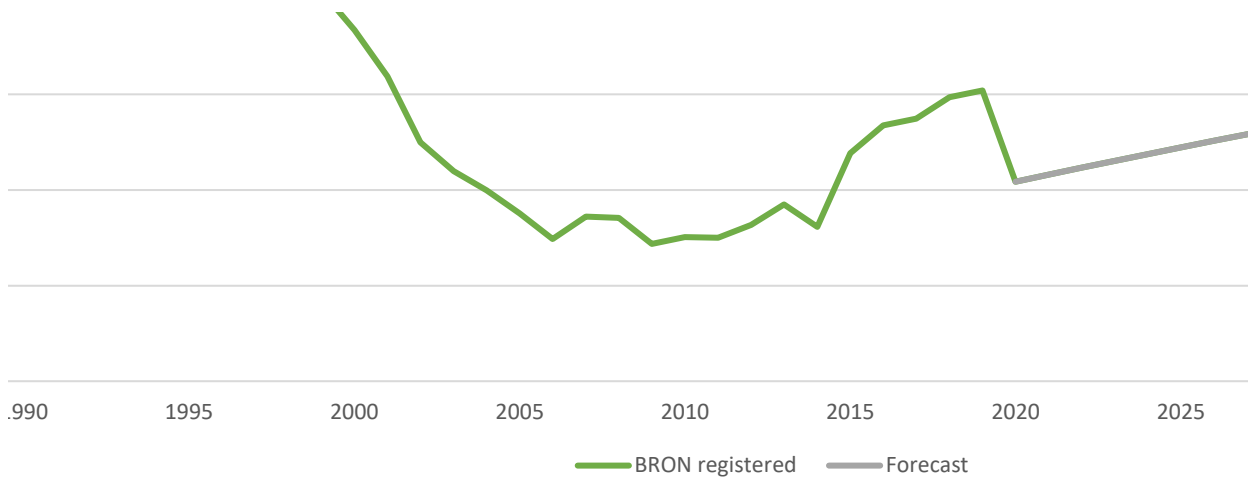


Road Injuries in Amsterdam



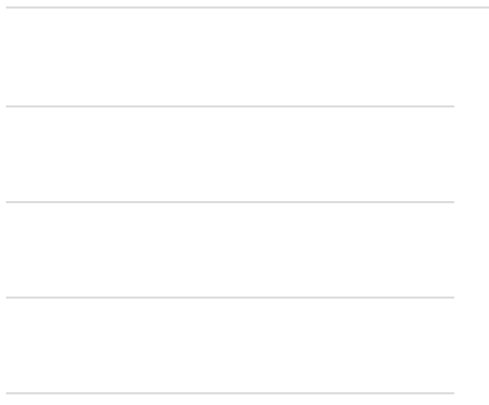
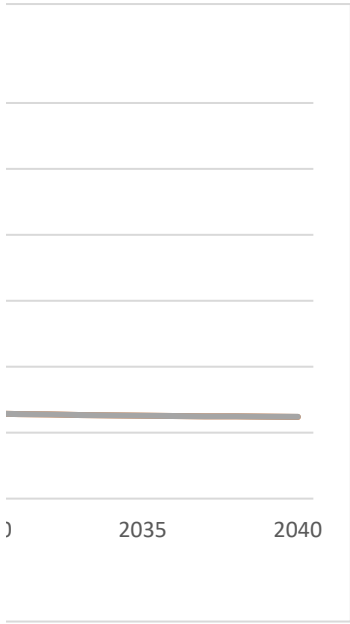
Material Damage in Amsterdam



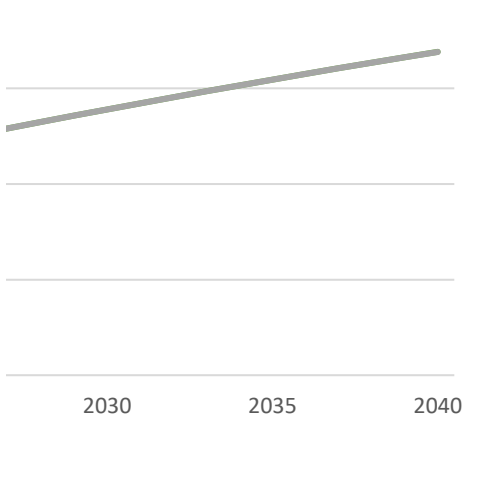


2034	2035	2036	2037	2038	2039
13	13	13	12	12	12
6349	6476	6601	6724	6845	6965
6063	6185	6304	6421	6537	6651

2034	2035	2036	2037	2038	2039
17	17	17	17	17	17
8580	8752	8921	9087	9250	9412
8194	8358	8519	8678	8834	8988
502	515	527	538	549	560
480	491	503	514	525	535



<https://swov.nl/sites/default/files/public>
Total number of traffic injuries = SWOV n
So, it is assumed that there are twice as r



Dip 2010-2015 te verklaren door de onde

2040
12
7082
6763

2040
17
9570
9139
571 448
545 427

Number of severe injuries + severe injuries x 2

Data	Costs
Costs traffic deaths	(2,758,112)
Costs serious traffic injuries	289,862
Costs light traffic injuries	86,175
Costs traffic injuries	(154,071)
Traffic deaths 2018	678
Serious traffic injuries 2018	21,700
Light traffic injuries 2018	43,400
Material damage 2018	130,746
Costs material damage	(31,206)

Present value	
€	(587,401,395.91) Costs of traffic deaths
€	(14,446,082,443.18) Costs of serious traffic injuries
€	(2,794,129,485.09) Costs of material damage
Total	€ (17,827,613,324.18)

Present value	
€	(1) Costs of traffic deaths
€	(14) Costs of serious traffic injuries
€	(3) Costs of material damage
Total	€ (18)

Discount rate 4,5% source: <https://www.mkba-informatie.nl/mkba-voc>

Unit	Source
€/person	https://swov.nl/nl/factsheet/kosten-van-verkeersongevallen
€/person	https://swov.nl/nl/factsheet/kosten-van-verkeersongevallen
€/person	https://swov.nl/nl/factsheet/kosten-van-verkeersongevallen
€/person	Calculated based on the other data
#persons	https://www.cbs.nl/nl-nl/nieuws/2021/15/610-verkeersdoden-in-2020
#persons	https://www.rijkswaterstaat.nl/wegen/wegbeheer/onderzoek/verkeersveiligheid-en
#persons	Estimation: twice as much light traffic injuries then serious injuries
#crash	https://theseus.swov.nl/single/?appid=d1569e91-8a56-4922-a336-2373764a6889&:
€/crash	https://swov.nl/nl/factsheet/kosten-van-verkeersongevallen

Discount rate 4.5%

Discount factor	1.00	0.96	0.92	0.88
Year	2022	2023	2024	2025
Year number	1	2	3	4
	€ (48,546,925.61)	€ (46,054,185.54)	€ (43,705,286.69)	
	€ (931,767,614.21)	€ (920,242,946.82)	€ (907,631,270.27)	
	€ (180,220,442.07)	€ (177,991,366.26)	€ (175,552,043.53)	

or-gevorderden/richtlijnen/rapport-werkgroep-discontovoet-2015/

[i-ongevallencijfers/actuele-verkeersongevallencijfers](#)

sheet=0ce1fd1f-761c-40ae-b54e-66823d116a34&opt=currsel%2Cctxmenu

0.84	0.80	0.77	0.73
2026	2027	2028	2029
5	6	7	8
€ (41,491,637.37)	€ (39,405,154.67)	€ (37,438,235.05)	€ (35,583,726.58)
€ (894,062,719.98)	€ (879,657,587.01)	€ (864,526,952.64)	€ (848,773,285.35)
€ (172,927,644.38)	€ (170,141,435.25)	€ (167,214,901.24)	€ (164,167,861.57)

	0.70		0.67		0.64		0.62
	2030		2031		2032		2033
	9		10		11		12
€	(33,834,902.74)	€	(32,185,437.69)	€	(30,629,382.96)	€	(29,161,145.46)
€	(832,491,002.41)	€	(815,766,997.79)	€	(798,681,138.63)	€	(781,306,731.81)
€	(161,018,578.22)	€	(157,783,858.04)	€	(154,479,148.75)	€	(151,118,629.21)

	0.59	0.56	0.54	0.52
	2034	2035	2036	2037
	13	14	15	16
€	(27,775,466.73)	€ (26,467,403.33)	€ (25,232,308.42)	€ (24,065,814.34)
€	(763,710,962.42)	€ (745,955,305.69)	€ (728,095,913.90)	€ (710,183,979.77)
€	(147,715,294.20)	€ (144,281,034.14)	€ (140,826,709.87)	€ (137,362,222.98)

	0.49	0.47	0.45
	2038	2039	2040
	17	18	19
€	(22,963,816.21)	€ (21,922,456.43)	€ (20,938,110.09)
€	(692,266,077.50)	€ (674,384,482.95)	€ (656,577,474.02)
€	(133,896,581.74)	€ (130,437,963.06)	€ (126,993,770.57)

Negative effects estimation

CO2 costs	100
Fuel consumption vehicles	150
Costs noise disturbance	75
People who experience noise disturbance	2000
Average noise disturbance	15
Hindrance during construction	0.161

CO2 costs	€	15,000.00
Noise disturbance costs	€	2,250,000.00
Hindrance during construction costs	€	434,642.43
Total	€	2,699,642.43

Sources

€/ton CO2	https://www.pbl.nl/sites/de pg. 70
ton CO2/year	https://www.rwseconomie . Average of efficiency high and low
€/person/dB/year	http://www.bos-kraanverhu pg. 13
#/year	https://www.rwseconomie . pg. 139
dB	Estimation
% of total external effects	https://www.rwseconomie . pg. 139
	https://www.pbl.nl/sites/de pg. 70

€/year

€/year

€/year

€/year

Data

Costs traffic deaths

Costs traffic injuries

Costs material damage

Effect frequency strategy

Expenses traffic safety Amsterdam

Percentages of expenses used for frequency strategy

Percentage of deaths on risky roads

Costs negative effects

Construction time

Saved costs divided by 20 (after 20 years the most risky)

Present value	
€	12,192,729.79
€	336,593,423.38
€	65,103,159.45
€	(84,197,627.56)
€	(35,527,272.27)
Balance of SCBA	€ 294,164,412.80
Benefits/costs ratio	3.5
	-119.7
	413.9

Costs	Unit	Source
2,758,112	€/person	https://swov.nl/nl/fa
154,071	€/person	https://swov.nl/nl/fa
31,206	€/crash	https://swov.nl/nl/fa
0.26	%	https://www.kennisr
(6,398,000)	€/year	https://assets.amste
1.00	%	
0.66	%	https://swov.nl/sites
(2,699,642)	€/year	See tab 'estimation n
20	years	Estimation

roads are improved)

Discount rate	4.5%
Discount factor	1.00
Year	2022
Year number	1
Saved costs of traffic deaths	
Saved costs of traffic injuries	
Saved costs of material damage	
Costs of improving the infrastructure	€ (6,398,000.00)
Costs negative effects	€ (2,699,642.43)

[ctsheet/kosten-van-verkeersongevallen](#)

[ctsheet/kosten-van-verkeersongevallen](#)

[ctsheet/kosten-van-verkeersongevallen](#)

<https://www.roadsafet> Mean of the three outcomes of the studies

Based on the budget of 2021 (source pg. 399)

blz. 36

Salary schale 10 is used as the labour costs of an average employee

	0.96		0.92		0.88		0.84
	2023		2024		2025		2026
	2		3		4		5
€	444,076.61	€	444,678.75	€	446,822.28	€	450,702.91
€	8,796,602.33	€	9,158,049.94	€	9,551,797.96	€	9,985,268.16
€	1,701,419.47	€	1,771,329.87	€	1,847,487.75	€	1,931,328.60
€	(6,122,488.04)	€	(5,858,840.23)	€	(5,606,545.67)	€	(5,365,115.48)
€	(2,583,389.89)	€	(2,472,143.43)	€	(2,365,687.49)	€	(2,263,815.78)

SENSITIVITY

ANALYSIS

Costs traffic injuries

	-20%		Base
Balance of SCBA	€ 226,845,728.12	€	294,164,412.80
Benefits/costs ratio		2.9	3.5
Delta		-16%	-

Expenses traffic safety Amsterdam

	-20%		Base
Balance of SCBA	€ 311,003,938.31	€	294,164,412.80
Benefits/costs ratio		4.0	3.5
Delta		16%	-

Costs negative effects

	-40%		Base
Balance of SCBA	€	308,375,321.71	€ 294,164,412.80
Benefits/costs ratio		3.9	3.5
Delta		13%	-

Scenario

	Positive		Base
Balance of SCBA	€	392,533,531.90	€ 294,164,412.80
Benefits/costs ratio		5.4	3.5
Delta		57%	-

	0.80		0.77		0.73		0.70
	2027		2028		2029		2030
	6		7		8		9
€	456,574.39	€	464,768.95	€	475,727.05	€	490,042.17
€	10,467,749.98	€	11,011,075.20	€	11,630,603.72	€	12,346,701.49
€	2,024,649.17	€	2,129,737.94	€	2,249,565.78	€	2,388,071.84
€	(5,134,081.80)	€	(4,912,996.93)	€	(4,701,432.47)	€	(4,498,978.44)
€	(2,166,330.89)	€	(2,073,043.92)	€	(1,983,774.08)	€	(1,898,348.41)

20%

€ 361,483,097.48

4.0

16%

20%

€ 277,324,887.29

3.0

-12%

40%

€ 279,953,503.89

3.1

-11%

Negative

€ 195,795,293.71

2.3

-34%

	0.67 2031		0.64 2032		0.62 2033		0.59 2034
	10		11		12		13
€	508,529.92	€	532,338.68	€	563,134.12	€	603,422.01
€	13,187,024.28	€	14,190,170.99	€	15,411,772.08	€	16,935,143.57
€	2,550,605.23	€	2,744,631.66	€	2,980,911.05	€	3,275,558.21
€	(4,305,242.53)	€	(4,119,849.31)	€	(3,942,439.53)	€	(3,772,669.41)
€	(1,816,601.35)	€	(1,738,374.49)	€	(1,663,516.26)	€	(1,591,881.59)

	0.56		0.54		0.52		0.49
	2035		2036		2037		2038
	14		15		16		17
€	657,147.81	€	730,895.87	€	836,527.71	€	997,777.81
€	18,891,072.57	€	21,497,387.43	€	25,146,011.45	€	30,620,596.04
€	3,653,869.70	€	4,157,977.38	€	4,863,686.21	€	5,922,568.32
€	(3,610,209.96)	€	(3,454,746.37)	€	(3,305,977.39)	€	(3,163,614.73)
€	(1,523,331.66)	€	(1,457,733.65)	€	(1,394,960.43)	€	(1,334,890.36)

0.47		0.45	
2039		2040	
18		19	
€	1,270,040.98	€	1,819,521.77
€	39,749,419.14	€	58,016,977.04
€	7,688,245.20	€	11,221,516.06
€	(3,027,382.51)	€	(2,897,016.76)
€	(1,277,407.05)	€	(1,222,399.09)

	Present value x 1.000.000	
	€	12
	€	337
	€	65
	€	(84)
	€	(36)
Balance of SCBA	€	294
Benefits/costs ratio		3.5

Saved costs of traffic deaths
Saved costs of traffic injuries
Saved costs of material damage
Costs of improving the infrastructure
Costs negative effects

Scenario	Positive
Balance of SCBA	€ 393
Benefits/costs ratio	5.43
Delta	57%

Base		Negative	
€	294	€	196
	3.46		2.30
-			-34%

Data

Costs traffic deaths

Costs traffic injuries

Costs material damage

Effect frequency strategy

Expenses traffic safety Amsterdam

Percentages of expenses used for combining strategy

Percentage of deaths on risky roads

Labor costs

Extra needed employees for this strategy

Costs negative effects

Construction time

Saved costs divided by 15 (after 15 years the most risky roads)

Present value	
€	6,945,225.83
€	191,730,431.04
€	37,084,078.17
€	(42,098,813.78)
€	(12,936,271.94)
€	(17,763,636.14)
	+
Balance of SCBA	€ 162,961,013.19
Benefits/costs ratio	3.2
€	235.76
€	(72.80)

Costs	Unit	Source
2,758,112	€/person	https://swov.nl/nl/fi
154,071	€/person	https://swov.nl/nl/fi
31,206	€/crash	https://swov.nl/nl/fi
0.15	%	Instead of 26% beca
(6,398,000)	€/year	https://assets.amst
0.50	%	Estimation
0.66	%	Estimation
(98,300)	€/employee/year	https://kennisopent
10	#	Estimation based on
(1,349,821)	€/year	See tab 'estimation i
20	years	Estimation

roads are improved) --> Shorter timespan than the frequency strategy, because w

Discount rate	4.5%
Discount factor	1.00
Year	2022
Year number	1
<hr/>	
Saved costs of traffic deaths	
Saved costs of traffic injuries	
Saved costs of material damage	
Costs of improving the infrastructure	€ (3,199,000.00)
Labor costs	€ (983,000.00)
Costs negative effects	€ (1,349,821.22)
Synergy impact	
<hr/>	
<hr/>	

SENSITIVITY
ANALYSIS

[actsheet/kosten-van-verkeersongevallen](#)

[actsheet/kosten-van-verkeersongevallen](#)

[actsheet/kosten-van-verkeersongevallen](#)

use not only the riskiest roads are improved, so the effect is less.

Based on the budget of 2021 (source pg. 399)

Salary schale 10 is used as the labour costs of an average employee

interviews

negative effects' Divided by 2 because there is less nuisance due to the integral project

with the same budget more roads can be improved

	0.96	0.92	0.88	0.84
	2023	2024	2025	2026
	2	3	4	5
€	252,955.03	€ 253,298.02	€ 254,519.02	€ 256,729.51
€	5,010,722.85	€ 5,216,610.73	€ 5,440,897.57	€ 5,687,810.98
€	969,162.99	€ 1,008,985.37	€ 1,052,366.44	€ 1,100,123.89
€	(3,061,244.02)	€ (2,929,420.11)	€ (2,803,272.84)	€ (2,682,557.74)
€	(940,669.86)	€ (900,162.54)	€ (861,399.56)	€ (824,305.80)
€	(1,291,694.94)	€ (1,236,071.72)	€ (1,182,843.75)	€ (1,131,907.89)

Costs traffic injuries

	-20%	Base	20%
Balance of SCBA	€ 124,614,926.98	€ 162,961,013.19	€ 201,307,099.39
Benefits/costs ratio		2.7	3.2
Delta		-16%	16%

Expenses traffic safety Amsterdam

	-20%	Base	20%
--	------	------	-----

Balance of SCBA	€	171,380,775.94	€	162,961,013.19	€	154,541,250.43
Benefits/costs ratio		3.7		3.2		2.9
Delta		13%		-		-10%

Costs negative effects

		-40%		Base		40%
Balance of SCBA	€	170,066,467.64	€	162,961,013.19	€	155,855,558.73
Benefits/costs ratio		3.6		3.2		3.0
Delta		11%		-		-9%

Scenario

		Positive		Base		Negative
Balance of SCBA	€	216,832,316.60	€	162,961,013.19	€	109,089,709.77
Benefits/costs ratio		4.8		3.2		2.2
Delta		48%		-		-31%

ects (roads are broken up once, instead of multiple times)

0.80		0.77		0.73		0.70		0.67	
2027		2028		2029		2030		2031	
6		7		8		9		10	
€	260,074.02	€	264,741.81	€	270,983.76	€	279,137.95	€	289,668.94
€	5,962,642.39	€	6,272,131.45	€	6,625,027.43	€	7,032,931.23	€	7,511,596.11
€	1,153,281.17	€	1,213,141.87	€	1,281,398.23	€	1,360,294.09	€	1,452,876.39
€	(2,567,040.90)	€	(2,456,498.47)	€	(2,350,716.24)	€	(2,249,489.22)	€	(2,152,621.26)
€	(788,809.38)	€	(754,841.51)	€	(722,336.37)	€	(691,230.98)	€	(661,465.05)
€	(1,083,165.45)	€	(1,036,521.96)	€	(991,887.04)	€	(949,174.20)	€	(908,300.67)

	0.64	0.62	0.59	0.56	0.54
	2032	2033	2034	2035	2036
	11	12	13	14	15
€	303,230.89	€ 320,772.60	€ 343,721.40	€ 374,324.70	€ 416,333.09
€	8,083,008.79	€ 8,778,857.51	€ 9,646,600.77	€ 10,760,737.54	€ 12,245,347.27
€	1,563,397.78	€ 1,697,987.31	€ 1,865,824.30	€ 2,081,318.18	€ 2,368,468.13
€	(2,059,924.65)	€ (1,971,219.77)	€ (1,886,334.70)	€ (1,805,104.98)	€ (1,727,373.19)
€	(632,980.91)	€ (605,723.36)	€ (579,639.58)	€ (554,679.02)	€ (530,793.32)
€	(869,187.25)	€ (831,758.13)	€ (795,940.79)	€ (761,665.83)	€ (728,866.83)

	0.52	0.49	0.47	0.45
	2037	2038	2039	2040
	16	17	18	19
€	476,503.12	€ 568,354.45	€ 723,441.06	€ 1,036,436.45
€	14,323,677.41	€ 17,442,111.67	€ 22,642,074.19	€ 33,047,645.15
€	2,770,454.17	€ 3,373,614.87	€ 4,379,380.18	€ 6,392,002.82
€	(1,652,988.69)	€ (1,581,807.36)	€ (1,513,691.26)	€ (1,448,508.38)
€	(507,936.19)	€ (486,063.34)	€ (465,132.39)	€ (445,102.76)
€	(697,480.22)	€ (667,445.18)	€ (638,703.52)	€ (611,199.54)

		Present value x 1.000.000
	€	7
	€	192
	€	37
	€	(42)
	€	(13)
	€	(18)
		+
Balance of SCBA	€	163
Benefits/costs ratio		3.2

Saved costs of traffic deaths
Saved costs of traffic injuries
Saved costs of material damage
Costs of improving the infrastructure
Labor costs
Costs negative effects
Synergy impact

Scenario	Positive
Balance of SCBA	217
Benefits/costs ratio	4.79
Delta	48%

Base	Negative
163	109
3.24	2.24
-	-31%

Data

Costs traffic deaths
Costs traffic injuries
Costs material damage
Costs material damage bicycle
Effects of speed reduction on injuries
Effects of speed reduction on damage
Percentage schoolzones of 30 km/h roads
Number of schools in Amsterdam
Costs construction school zone
Bicycle path length Amsterdam
Costs widening bicycle paths
Effects of widening bicycle paths
Costs applying edge and axle markings
Effects of edge and axle markings
Number bicycle poles in Amsterdam
Costs of removing bicycle poles
Effects of removing bicycle poles
Labor costs
Extra needed employees for this strategy
Costs negative effects
Construction time

Saved costs divided by 10 (after 10 years all bic

Present value	
€	9,915,847.89
€	9,920,083.51
€	(23,475,287.30)
€	8,064,328.53
€	470,021,425.64
€	8,541,924.77
€	(96,147,180.62)
€	(3,963,851.44)
€	(1,534,000.00)
€	(1,625,644.21)
€	(5,580,694.42)

Balance of SCBA	€	379,717,646.79
Benefits/costs ratio		3.8
	€	506.46
	€	(132.33)

Number injuries in Amsterdam 30km/h
Number of damages in Amsterdam 30km/h
Growth percentage injuries NL

Source

<https://theseus.swov.nl/single/?appid=d1569e>

Number of deaths bicycle paths Amsterdam
Number of injuries bicycle paths Amsterdam
Bron x SWOV factor Number of damages bicycle paths Amsterdam
Bron x SWOV factor Growth percentage injuries NL

Growth percentage deaths NL

BRON data

Number of injuries bicycle paths Amsterdam

Number of damages bicycle paths Amsterdam

<https://swov.nl/sites/> Factor difference BRON & SWOV data

Costs	Unit	Source
2,758,112	€/person	https://swov.nl/nl/fa
154,071	€/person	https://swov.nl/nl/fa
31,206	€/person	https://swov.nl/nl/fa
2,000	€/person	Estimation
0.30	%	https://pdf.sciencedi
0.40	%	https://pdf.sciencedi
0.10	%	Estimation
476	#	https://scholenopdel
(30,000.00)	€/10 years	Interview municipalit
767	km	https://www.iamster
(151,600)	€/km	https://investeringsir
0.26	%	https://www.kennisr
(6,250)	€/km	https://investeringsir
0.05	%	Estimation
2	#/km	Costs are nil'
(1,000)	€/pole	https://investeringsir
0.15	%	Estimation
-98300	€/employee/year	https://kennisopenb
2	#	Estimation based on i
(674,911)	€/year	See tab 'estimation n
10	years	Estimation

ycle paths are improved)

Discount rate	4.5%
Discount factor	1.00
Year	2022
Year number	1

Saved costs of traffic injuries school zone	
Saved costs of material damage school zone	
Costs construction school zone	€ (14,280,000.00)
Saved costs of traffic deaths cyclists	
Saved costs of traffic injuries cyclists	
Saved costs of material damage cyclists	
Costs widening bicycle paths	€ (11,627,720.00)
Costs applying edge and axle markings	€ (479,375.00)
Costs of removing bicycle poles	€ (1,534,000.00)
Labor costs	€ (196,600.00)
Costs negative effects	€ (674,910.61)

SENSITIVITY
ANALYSIS

2000	2001	2002
87	91	89
122	149	126

[91-8a56-4922-a336-2373764a6889&sheet=0ce1fd1f-761c-40ae-b54e-66823d116a34&o](#)

2000	2001	2002
0	0	0
165	33	66
0	33	0

5
0

1
1

2
0

33

Practically no reduction in road deaths when reducing a schoolzone from 30 to 15 km/h, beca

ctsheet/kosten-van-verkeersongevallen
 ctsheet/kosten-van-verkeersongevallen
 ctsheet/kosten-van-verkeersongevallen

pg. 858: approximately 30% reduction from 30 to 15 km/h
 pg. 859: approximately 40% reduction from 30 to 15 km/h

<https://allecijfers.nl/basisscholen/amsterdam/#:~:text=Bekijk%20het%20volledige%20uitstrooy of Amsterdam>

Every bicycle path is widened over a period of 10 years

mpulsspv.nl/wp-content/uploads/2020/06/Prijzenboek-Totaal-V-2.1.pdf

13% per 10% widening

The edge and axle markings are constructed over a period of 10 years

<https://www.kennisnetwerkspv.nl/Aan-de-slag/Effectiviteitswijzer/27-As-en-kantmarkering-o>

<https://www.kennisnetwerkspv.nl/Aan-de-slag/Effectiviteitswijzer/27-As-en-kantmarkering-o> 1500 bicycle poles in total

<https://data.amsterdam.nl/>

Based on interviews

<https://www.bnr.nl/nieuws/10023327/fietspaal-dodelijk-gevaarte>

Salary schale 10 is used as the labour costs of an average employee

interviews

negative effects'

Divided by 4 because the construction of bicycle paths gives less nuisance

	0.96 2023	0.92 2024	0.88 2025	0.84 2026
	2	3	4	5
€	644,730.00	€ 635,894.16	€ 626,387.91	€ 616,295.56
€	645,005.40	€ 636,165.78	€ 626,655.48	€ 616,558.81
€	131,153.76	€ 139,971.83	€ 151,808.98	€ 168,139.92
€	5,492,144.47	€ 6,093,985.65	€ 6,860,439.06	€ 7,874,887.66
€	99,811.38	€ 110,748.92	€ 124,678.05	€ 143,114.11
€	(11,127,004.78)	€ (10,647,851.47)	€ (10,189,331.55)	€ (9,750,556.51)
€	(458,732.06)	€ (438,978.05)	€ (420,074.68)	€ (401,985.34)
€	(188,133.97)	€ (180,032.51)	€ (172,279.91)	€ (164,861.16)
€	(645,847.47)	€ (618,035.86)	€ (591,421.87)	€ (565,953.95)

Costs traffic injuries

	-20%	Base	20%
Balance of SCBA	€ 283,730,192.08	€ 379,717,646.79	€ 475,705,101.50
Benefits/costs ratio	3.1	3.8	4.6
Delta	-25%	-	25%

Costs widening bicycle paths

	-20%	Base	20%
Balance of SCBA	€ 398,947,082.91	€ 379,717,646.79	€ 360,488,210.66
Benefits/costs ratio	4.5	3.8	3.3
Delta	5%	-	-5%

Effects of removing bicycle poles

	-40%	Base	40%
Balance of SCBA	€ 316,244,471.27	€ 379,717,646.79	€ 443,190,822.30
Benefits/costs ratio	3.3	3.8	4.3
Delta	-17%	-	17%

Scenario

	Positive	Base	Negative
Balance of SCBA	€ 570,669,141.63	€ 379,717,646.79	€ 213,289,008.94
Benefits/costs ratio	6.0	3.8	2.4
Delta	50%	-	-44%

2003	2004	2005	2006
91	61	71	97
145	173	156	103

[pt=cursel%2Cctxmenu](#)

2003	2004	2005	2006
0	1	0	0
66	0	33	66
0	0	33	0

2
0

0
0

1
1

2
0

use even at 30 km/h there are almost no road deaths.

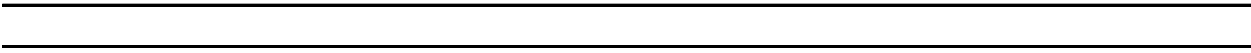
om%20overzicht,of%20het%20VWO%20is%20gegaan.

p-fietspaden-waarschijnlijk

n.nl/data/?center=52.3625291%2C4.8548572&lagen=vrkr-fiets%3A1&legenda=true&modus=ka

ance than the construction of car roads

	0.80	0.77	0.73	0.70	0.67
	2027	2028	2029	2030	2031
	6	7	8	9	10
€	605,694.91	€ 594,657.75	€ 583,250.25	€ 571,533.27	€ 559,562.77
€	605,953.63	€ 594,911.76	€ 583,499.39	€ 571,777.40	€ 559,801.79
€	191,621.64	€ 227,570.99	€ 288,397.63	€ 411,335.75	€ 782,565.93
€	9,287,321.88	€ 11,397,606.92	€ 14,905,284.09	€ 21,908,775.26	€ 42,899,812.37
€	168,782.95	€ 207,134.18	€ 270,880.88	€ 398,158.68	€ 779,638.86
€	(9,330,676.08)	€ (8,928,876.63)	€ (8,544,379.55)	€ (8,176,439.76)	€ (7,824,344.27)
€	(384,674.97)	€ (368,110.02)	€ (352,258.39)	€ (337,089.37)	€ (322,573.56)
€	(157,761.88)	€ (150,968.30)	€ (144,467.27)	€ (138,246.20)	€ (132,293.01)
€	(541,582.72)	€ (518,260.98)	€ (495,943.52)	€ (474,587.10)	€ (454,150.34)



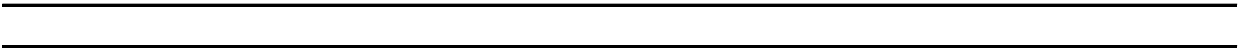
2007	2008	2009	2010	2011
101	121	104	31	36
150	185	169	63	15

2007	2008	2009	2010	2011
0	0	0	1	0
0	0	66	132	99
33	0	132	33	33

0	0	2	4	3
1	0	4	1	1

[part&zoom=8](#)

	0.64	0.62	0.59	0.56	0.54
	2032	2033	2034	2035	2036
	11	12	13	14	15
€	547,390.11	€ 535,062.37	€ 522,622.60	€ 510,110.16	€ 497,560.91
€	547,623.93	€ 535,290.92	€ 522,845.85	€ 510,328.06	€ 497,773.45
€	(9,195,287.30)				
€	744,731.57	€ 709,032.42	€ 675,340.63	€ 643,536.01	€ 613,505.56
€	41,966,575.37	€ 41,021,448.25	€ 40,067,733.05	€ 39,108,445.89	€ 38,146,336.51
€	762,678.70	€ 745,502.45	€ 728,170.13	€ 710,736.54	€ 693,251.67



2012	2013	2014	2015	2016
40	53	75	137	140
9	28	165	261	355

2012	2013	2014	2015	2016
1	1	0	0	0
33	66	66	231	330
33	0	0	99	264

1	2	2	7	10
1	0	0	3	8

	0.52	0.49	0.47	0.45
	2037	2038	2039	2040
	16	17	18	19
€	485,007.48	€ 472,479.48	€ 460,003.74	€ 447,604.47
€	485,214.65	€ 472,681.30	€ 460,200.23	€ 447,795.66
€	585,143.09	€ 558,348.79	€ 533,028.87	€ 509,095.19
€	37,183,906.57	€ 36,223,426.83	€ 35,266,953.33	€ 34,316,342.50
€	675,760.97	€ 658,305.71	€ 640,923.26	€ 623,647.35



2017	2018	2019	2020	2021
208	143	124	132	137
754	380	372	489	506
			0.036959313	0.035200934

2017	2018	2019	2020	2021
0	0	0	1	1
231	528	528	660	683
330	363	858	924	957
			0.036959313	0.035200934

-0.009994055 -0.00967552

7	16	16	20	21
10	11	26	28	29

Present value x 1.000.000	
€	10
€	10
€	(23)
€	8
€	470
€	9
€	(96)
€	(4)
€	(2)
€	(2)
€	(6)

Balance of SCBA	€	380
Benefits/costs ratio		3.8

2022	2023	2024	2025
141	146	150	155
523	540	557	573
0.033577886	0.032074806	0.030678562	0.029377869

2022	2023	2024	2025
1	1	1	1
706	729	751	773
989	1020	1052	1083
0.033577886	0.032074806	0.030678562	0.029377869

-0.00934652

-0.00900718

-0.008657638

-0.008298072

21

22

23

23

30

31

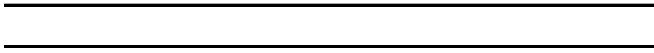
32

33

- Saved costs of traffic injuries school zone
- Saved costs of material damage school zone
- Costs construction school zone
- Saved costs of traffic deaths cyclists
- Saved costs of traffic injuries cyclists
- Saved costs of material damage cyclists
- Costs widening bicycle paths
- Costs applying edge and axle markings
- Costs of removing bicycle poles
- Labor costs
- Costs negative effects

Scenario

- Balance of SCBA
- Benefits/costs ratio
- Delta



2026	2027	2028
159	163	168
589	605	621
0.028162967	0.027025378	0.025957699

2026	2027	2028
1	1	1
795	817	838
1113	1143	1173
0.028162967	0.027025378	0.025957699

-0.007928689 -0.007549732 -0.007161475

24

25

25

34

35

36

Positive	Base	Negative
571	380	213
6.0	3.8	2.4
50% -		-44%

2029	2030	2031	2032	2033	2034
172	176	180	184	188	192
636	651	666	681	696	710
0.024953439	0.024006878	0.023112963	0.022267204	0.021465608	0.020704603

2029	2030	2031	2032	2033	2034
1	1	1	1	1	1
859	879	900	920	939	959
1202	1231	1259	1287	1315	1342
0.024953439	0.024006878	0.023112963	0.022267204	0.021465608	0.020704603

-0.006764228	-0.006358334	-0.005944168	-0.00552214	-0.00509269	-0.004656289
26	27	27	28	28	29
36	37	38	39	40	41

2035	2036	2037	2038	2039	2040
196	199	203	207	210	214
725	739	752	766	779	792
0.019980988	0.019291888	0.018634708	0.018007104	0.017406951	0.016832318

2035	2036	2037	2038	2039	2040
1	1	1	1	1	1
978	997	1015	1034	1052	1069
1369	1396	1422	1447	1472	1497
0.019980988	0.019291888	0.018634708	0.018007104	0.017406951	0.016832318

-0.00421344	-0.00376467	-0.003310535	-0.002851613	-0.002388508	-0.001921837
30	30	31	31	32	32
41	42	43	44	45	45

Data

Costs traffic deaths

Costs traffic injuries

Costs material damage

Expenses traffic safety Amsterdam

Effects of subjective safety strategy

Percentage budget spent on subjective safety

Percentage of deaths on complaint roads

Labor costs

Extra needed employees for this strategy

Construction time

Costs negative effects

Saved costs divided by 20 (after 20 years all roads)

Present value	
€	5,927,711.77
€	167,612,439.24
€	32,419,229.25
€	(84,197,627.56)
€	(6,468,135.97)
€	(35,527,272.27)
	+
Balance of SCBA	€ 115,293,616.73
Benefits/costs ratio	1.6
€	205.96
€	(126.19)

Costs	Unit	Source
2,758,112	€/person	https://swov.nl/nl/factsheet/kosten-van-ve
154,071	€/person	https://swov.nl/nl/factsheet/kosten-van-ve
31,206	€/crash	https://swov.nl/nl/factsheet/kosten-van-ve
(6,398,000)	€/year	https://assets.ams Based on the budget of :
0.15	%	https://www.kenn Not 26% but 15% becau:
1.00	%	
0.43	%	https://swov.nl/sit https://swov.nl/sites/de
-98300	€/employee/year	https://kennisope Salary schale 10 is used :
5	#	Estimation To handle all the comple
20	years	Estimation
(2,699,642.43)	€/year	See tab 'estimation negative effects'

ds where people complain about are improved)

	Discount rate	4.5%	
	Discount factor	1.00	0.96
	Year	2022	2023
	Year number	1	2
Saved costs of traffic deaths	€	173,959.82	
Saved costs of traffic injuries	€	3,445,926.40	
Saved costs of material damage	€	666,503.50	
Costs of improving the infrastructure	€ (6,398,000.00)	€ (6,122,488.04)	
Labor costs	€ (491,500.00)	€ (470,334.93)	
Costs negative effects	€ (2,699,642.43)	€ (2,583,389.89)	
Benefit of feeling safe			

SENSITIVITY ANALYSIS

Costs traffic injuries

Balance of SCBA
Benefits/costs ratio
Delta

Expenses traffic safety

Balance of SCBA
Benefits/costs ratio
Delta

Costs negative effects

Balance of SCBA
Benefits/costs ratio
Delta

Scenario

Balance of SCBA
Benefits/costs ratio
Delta

arbeidersongevallen

arbeidersongevallen

arbeidersongevallen

2021 (source pg. 399)

se people will be less cautious because they do not feel unsafe anymore

blz. 36

as the labour costs of an average employee

maintain and carry out the projects

	0.92		0.88		0.84		0.80
	2024		2025		2026		2027
	3		4		5		6
€	174,735.00	€	176,186.94	€	178,414.04	€	181,545.18
€	3,598,624.51	€	3,766,378.91	€	3,952,741.37	€	4,162,234.14
€	696,038.04	€	728,484.72	€	764,530.54	€	805,050.17
€	(5,858,840.23)	€	(5,606,545.67)	€	(5,365,115.48)	€	(5,134,081.80)
€	(450,081.27)	€	(430,699.78)	€	(412,152.90)	€	(394,404.69)
€	(2,472,143.43)	€	(2,365,687.49)	€	(2,263,815.78)	€	(2,166,330.89)

-20%	Base	20%
€ 81,771,128.89	€ 115,293,616.73	€ 148,816,104.58
1.4	1.6	1.9
-16%	-	16%

Amsterdam

-20%	Base	20%
------	------	-----

€ 132,133,142.25	€ 115,293,616.73	€ 98,454,091.22
1.9	1.6	1.4
15%	-	-12%

-40%	Base	40%
€ 115,293,616.73	€ 115,293,616.73	€ 115,293,616.73
1.8	1.6	1.5
13%	-	-10%

Positive	Base	Negative
€ 165,655,630.09	€ 115,293,616.73	€ 64,931,603.37
2.5	1.6	1.1
54%	-	-33%

	0.77	0.73	0.70	0.67	0.64
	2028	2029	2030	2031	2032
	7	8	9	10	11
€	185,751.24	€ 191,262.53	€ 198,395.57	€ 207,596.07	€ 219,510.58
€	4,400,726.26	€ 4,675,997.90	€ 4,998,612.28	€ 5,383,310.54	€ 5,851,336.33
€	851,178.79	€ 904,421.23	€ 966,820.59	€ 1,041,228.08	€ 1,131,752.60
€	(4,912,996.93)	€ (4,701,432.47)	€ (4,498,978.44)	€ (4,305,242.53)	€ (4,119,849.31)
€	(377,420.76)	€ (361,168.19)	€ (345,615.49)	€ (330,732.53)	€ (316,490.46)
€	(2,073,043.92)	€ (1,983,774.08)	€ (1,898,348.41)	€ (1,816,601.35)	€ (1,738,374.49)

	0.62	0.59	0.56	0.54	0.52
	2033	2034	2035	2036	2037
	12	13	14	15	16
€	235,111.74	€ 255,931.09	€ 284,524.59	€ 325,496.78	€ 388,061.26
€	6,434,503.52	€ 7,182,750.36	€ 8,179,247.47	€ 9,573,635.14	€ 11,665,116.07
€	1,244,547.51	€ 1,389,271.77	€ 1,582,012.05	€ 1,851,711.45	€ 2,256,241.09
€	(3,942,439.53)	€ (3,772,669.41)	€ (3,610,209.96)	€ (3,454,746.37)	€ (3,305,977.39)
€	(302,861.68)	€ (289,819.79)	€ (277,339.51)	€ (265,396.66)	€ (253,968.10)
€	(1,663,516.26)	€ (1,591,881.59)	€ (1,523,331.66)	€ (1,457,733.65)	€ (1,394,960.43)

0.49	0.47	0.45
2038	2039	2040
17	18	19
€ 493,722.05	€ 706,999.22	€ 1,350,508.10
€ 15,151,733.37	€ 22,127,481.60	€ 43,062,083.08
€ 2,930,614.94	€ 4,279,848.81	€ 8,328,973.37
€ (3,163,614.73)	€ (3,027,382.51)	€ (2,897,016.76)
€ (243,031.67)	€ (232,566.19)	€ (222,551.38)
€ (1,334,890.36)	€ (1,277,407.05)	€ (1,222,399.09)

Present value x 1.000.000		
€		6 Saved costs of traffic deaths
€		168 Saved costs of traffic injuries
€		32 Saved costs of material damage
€		(84) Costs of improving the infrastructure
€		(6) Labor costs
€		(36) Costs negative effects
	+	Benefit of feeling safe
Balance of SCBA	€	115
Benefits/costs ratio		1.6

Scenario	Positive	Base	Negative
Balance of SCBA	166	115	65
Benefits/costs ratio	2.5	1.6	1.1
Delta	54%	-	-33%