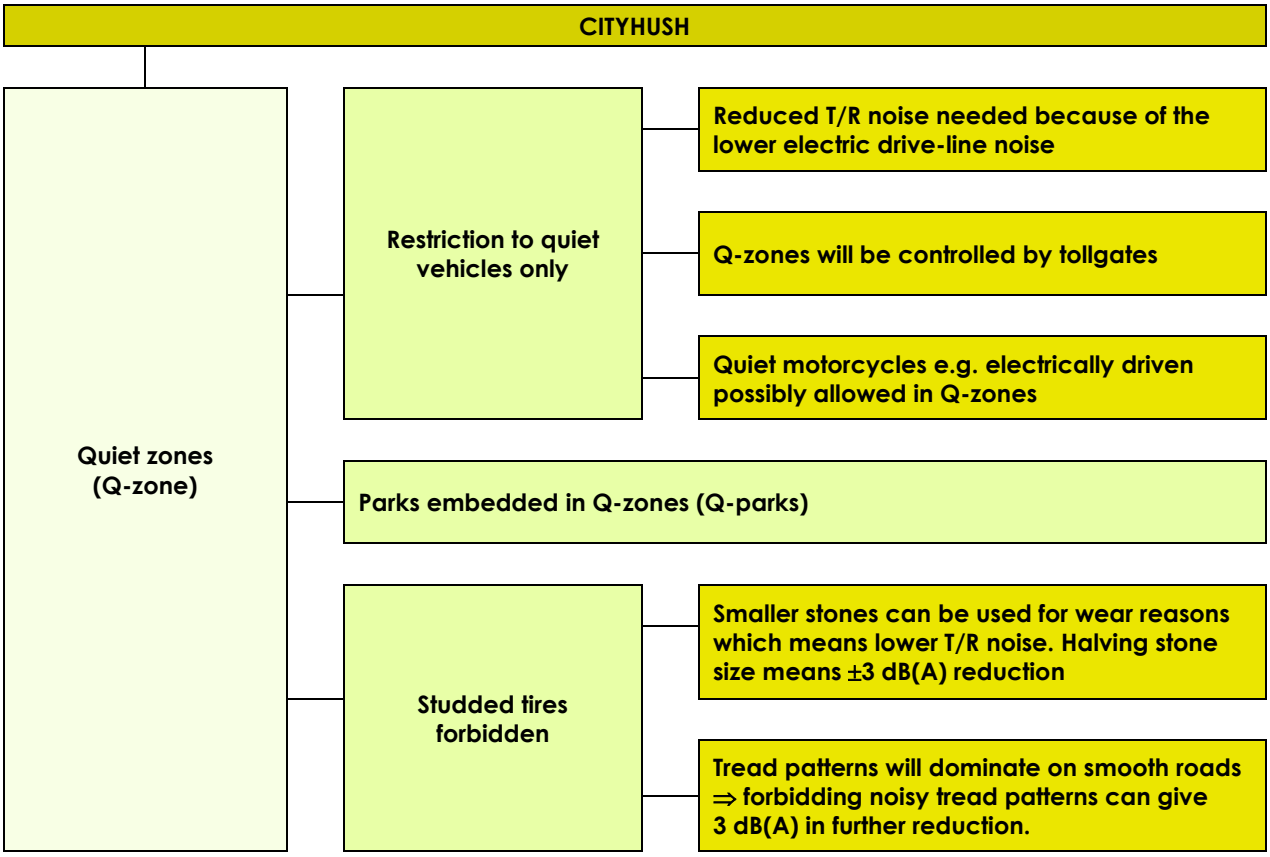

Figure 1. Project structure – Topic "Q-Zones"

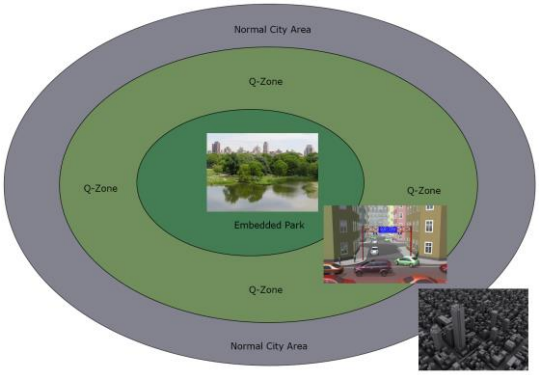

Figure 2. The "Q-Park" concept. Parks embedded in Q-Zones for ultra quiet park environment

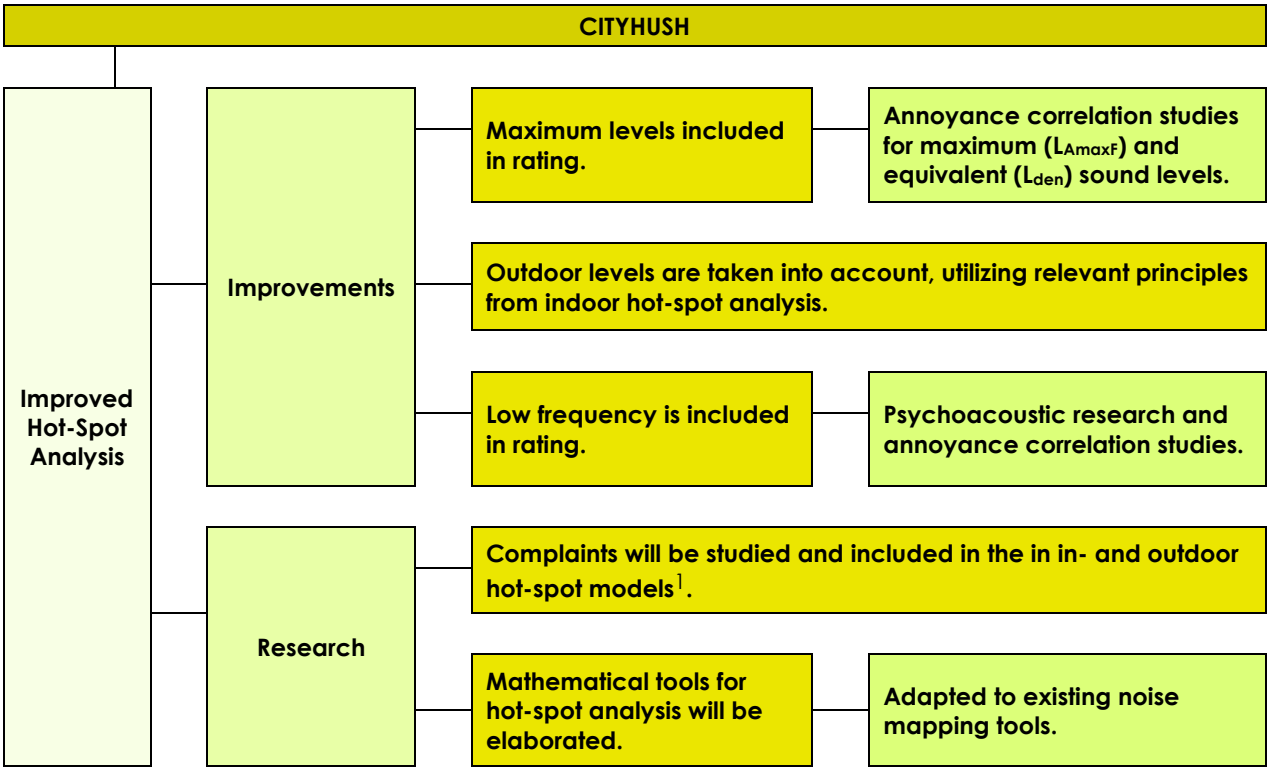

Figure 3. Improved hot spot analysis - Project structure

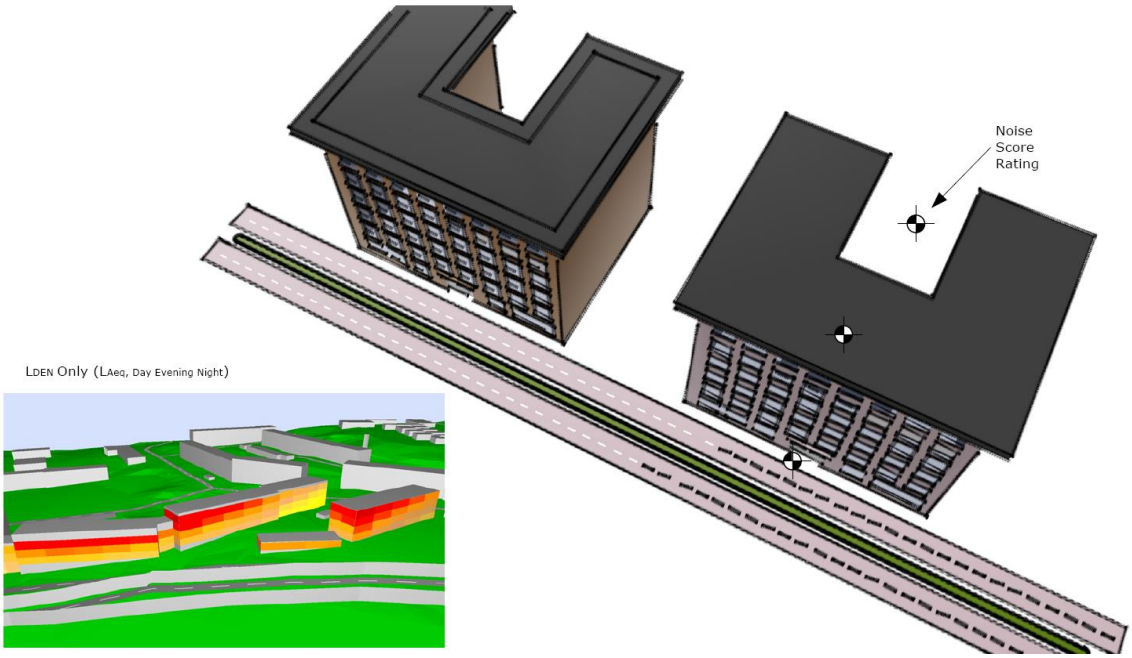

Figure 4. Improved indoor hot-spot analysis. Hot-spot analysis means that indoor and outdoor noise data are weighted together to a total noise score value. More factors will also be considered in the improved noise score model.

[1] Methods both for outdoor and indoor hot-spot analysis will be elaborated

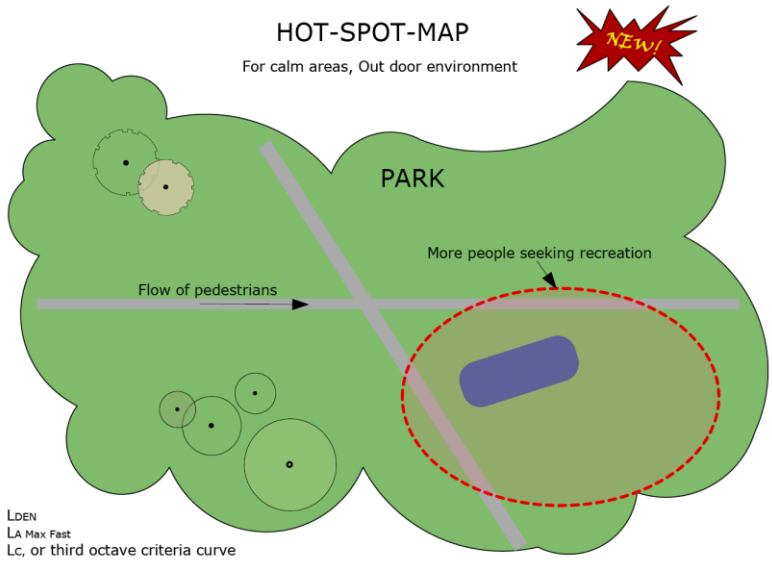

Figure 5. Hot-Spot analysis for the outdoor environment, e.g. in parks. Outdoors, the population density, equivalent and maximum sound levels as well as the low frequency content will be considered in the noise score value

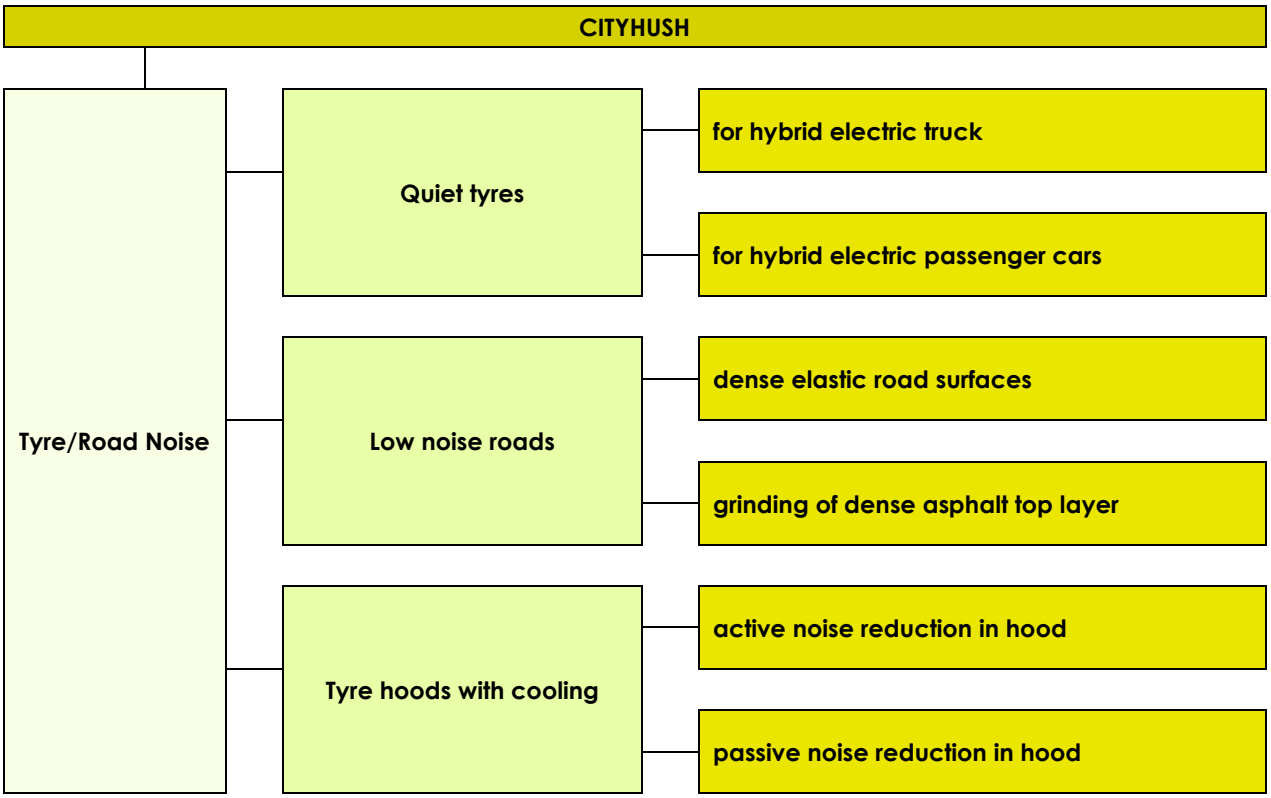

Figure 6. Tyre-Road noise research - Project structure.

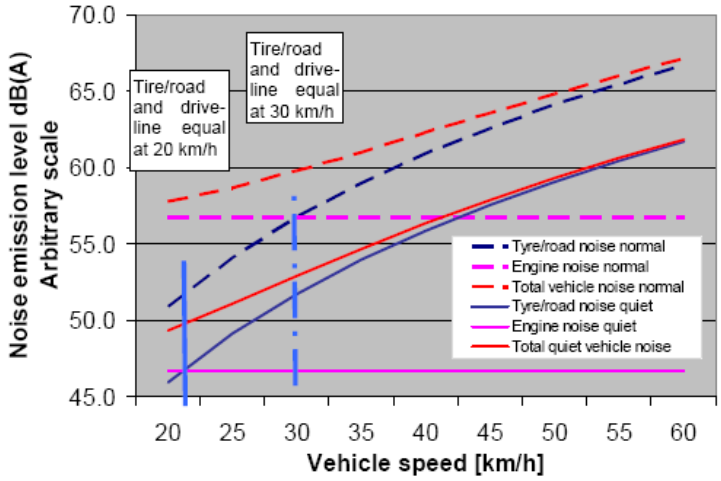

Figure 7. Reasons why tyre/road noise must be reduced for vehicles with electric driving. Driveline noise is reduced by 10 dB(A) for electric driving. This leads to a need for tyre/road noise reduction in order to take full benefit from the low driveline noise. The two red curves describe the difference in total noise emission between a normal gasoline fuelled passenger car (Volvo V70) and a hybrid electric car (Toyota Prius) during electric driving. Note that tyre/road noise dominates from 20 km/h and upwards for electric driving.

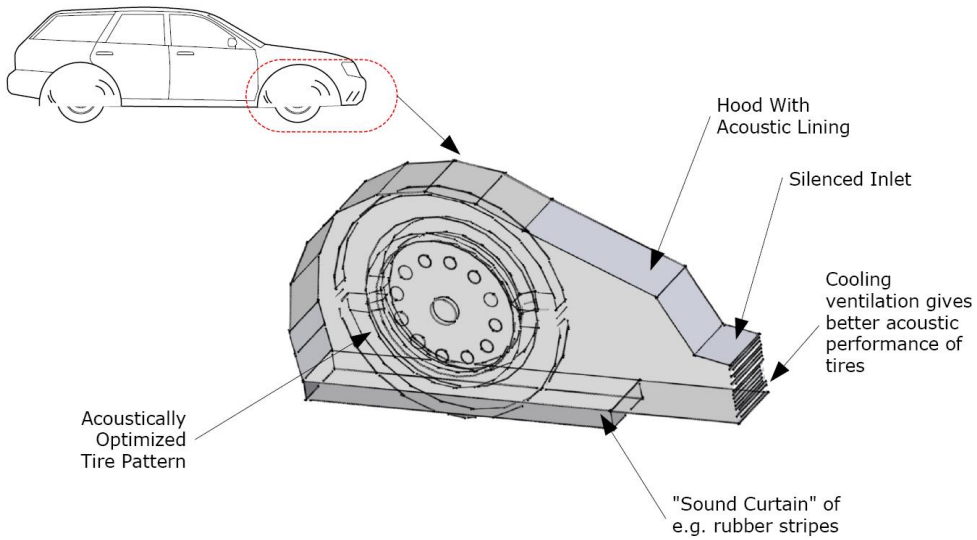

Figure 8. The concept of tyre hoods for reduction of tyre/road noise. Note: The silenced cooling air intake to keep tyre temperature down. The rubber stripes reduce the air gap to the road surface.

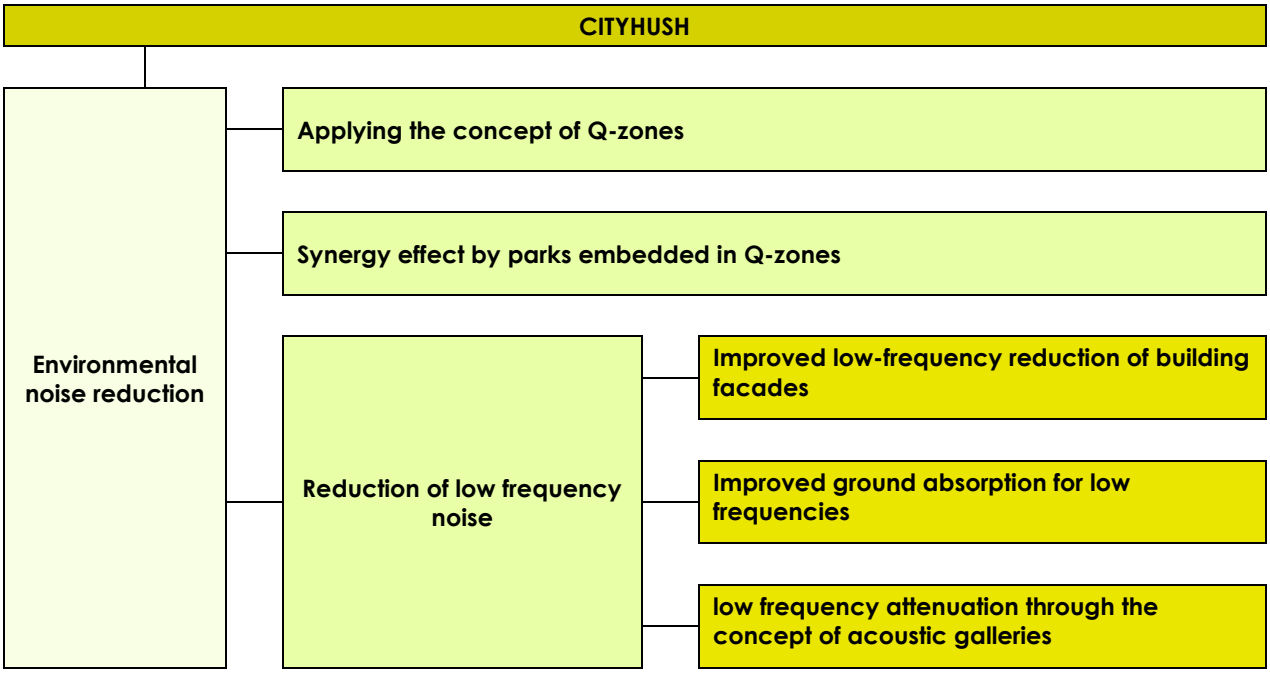

Figure 9. Partial project structure. Environmental noise reduction. Note: Treatment of the low frequency aspects of environmental noise will be addressed.

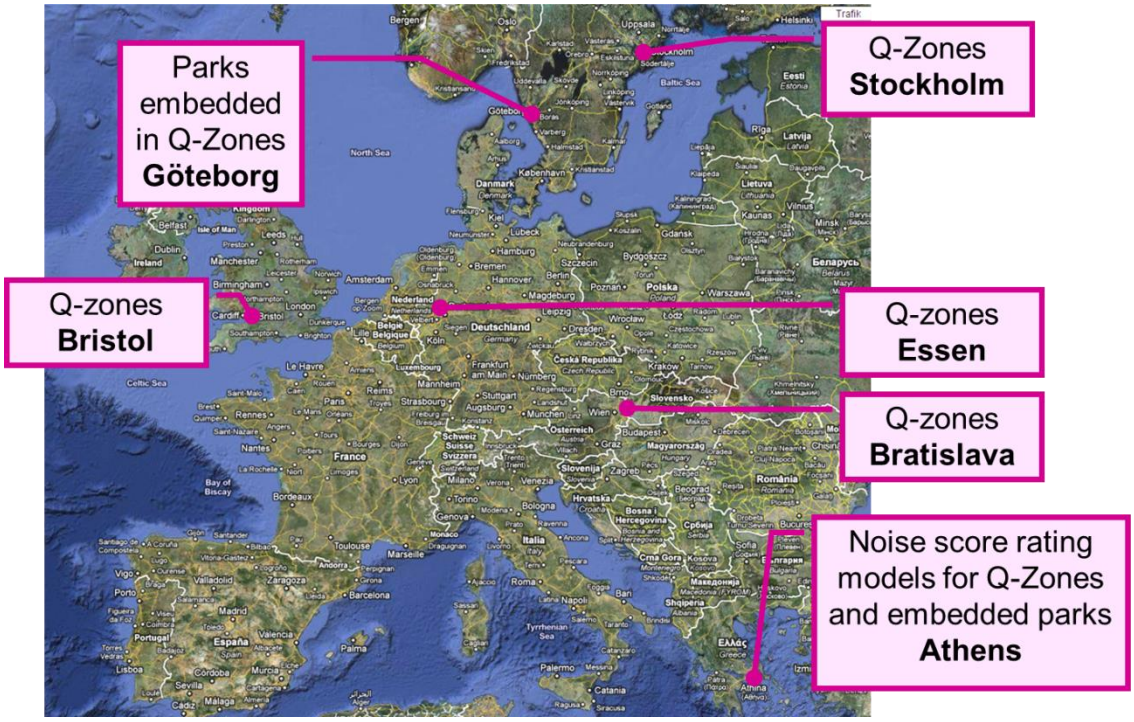

Figure 10. Cities chosen for evaluation of Q-zones

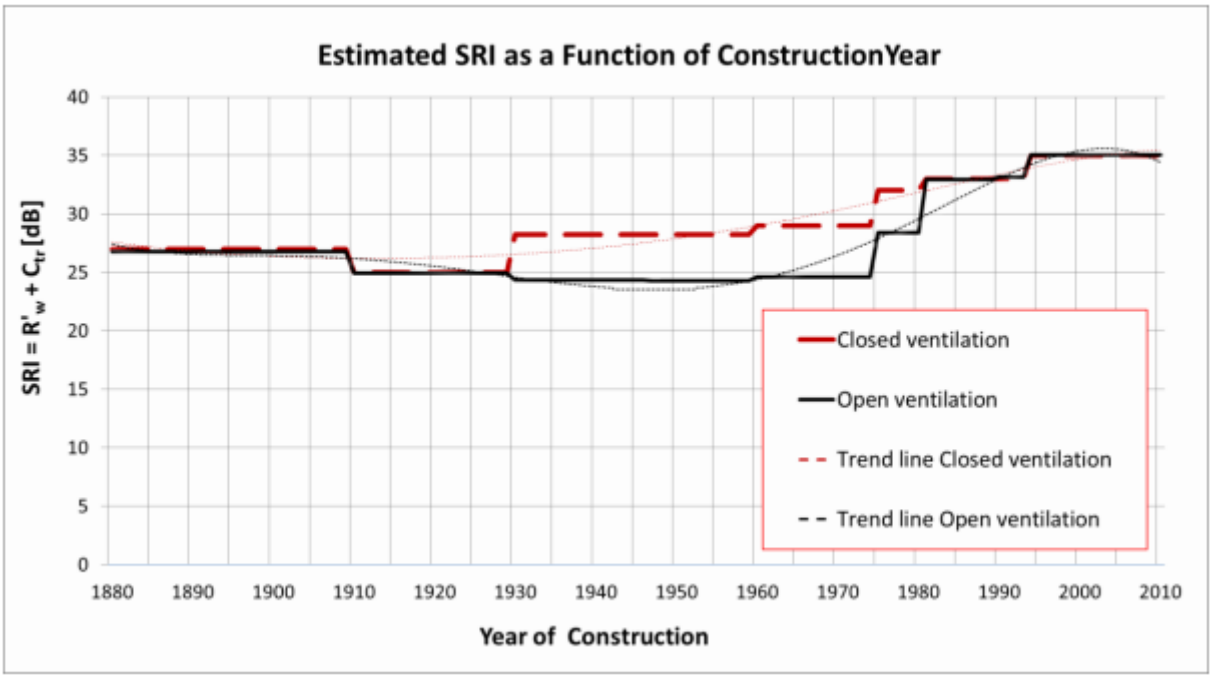

Figure 11. Estimated SRI as a function of construction year for Stockholm test site.

	Type	Unit	Stockholm		
			Base-Case	S 3	S 12
Costs	Noise Costs	[€ / a]	6 680 812	6 472 338	5 915 540
	Q-Zone Fees	[€ / a]	0	0	0
	Traffic Work (Q-Zone)	[No. Veh. km]	19 442	9 809	4 811
	Traffic Work (Test site - Q-Zone)	[No. Veh. km]	86 969	73 046	62 940
	Traffic Work (Summation)	[No. Veh. km]	106 411	82 856	67 751
	Traffic Costs (Q-Zone)	[€ / a]	3 548 235	1 790 225	878 027
	Traffic Costs (Test site - Q-Zone)	[€ / a]	15 871 817	13 330 918	11 486 496
	Traffic Costs (Summation)	[€ / a]	19 420 052	15 121 143	12 364 523
	Δ Noise Costs	[€ / a]	-	-208 474	-765 272
	Δ Q-Zone Fees	[€ / a]	-	0	0
	Δ Traffic Costs (Q-Zone)	[€ / a]	-	-1 758 009	-2 670 208
	Δ Traffic Costs (Test site - Q-Zone)	[€ / a]	-	-2 540 899	-4 385 321
	Δ Traffic Costs (Summation)	[€ / a]	-	-4 298 908	-7 055 529
Benefits	HAP (Testsite, complete)	[No. Persons]	5 098	4 996	4 708
	Annoyed Park Visitors	[No. Persons]	9 298	8 860	6 264
	Capacity	[m2]	802	2 806	6 914
	% Capacity related to park area	[%]	2,4	8,4	20,8
	LDEN (Q-Zone)	[dB (A)]	43,0	41,4	39,9
	LDEN (Park)	[dB (A)]	49,9	48,5	45,4
	Δ HAP (Testsite, complete)	[No. Persons]	-	-101	-389
	Δ Annoyed Park Visitors	[No. Persons]	-	-438	-3 033
	Δ LDEN (Q-Zone)	[dB (A)]	-	-1,6	-3,1
	Δ LDEN (Park)	[dB (A)]	-	-1,4	-4,5

Δ = Sx – Base Case

Figure 12. Cost benefit analysis for three scenarios for the Stockholm test-site.

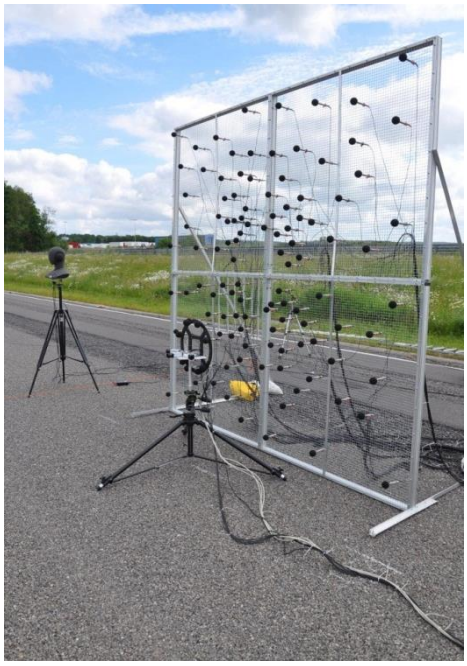

Figure 13. Grid structure (3 x 3 m) with 120 microphones in a random pattern

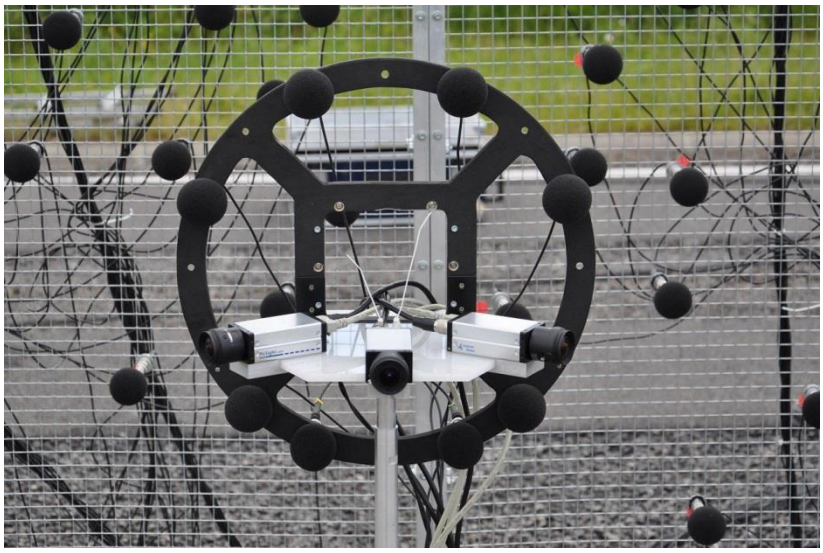

Figure 14. Panoramic camera module with three cameras at -60, 0, and 60 degree

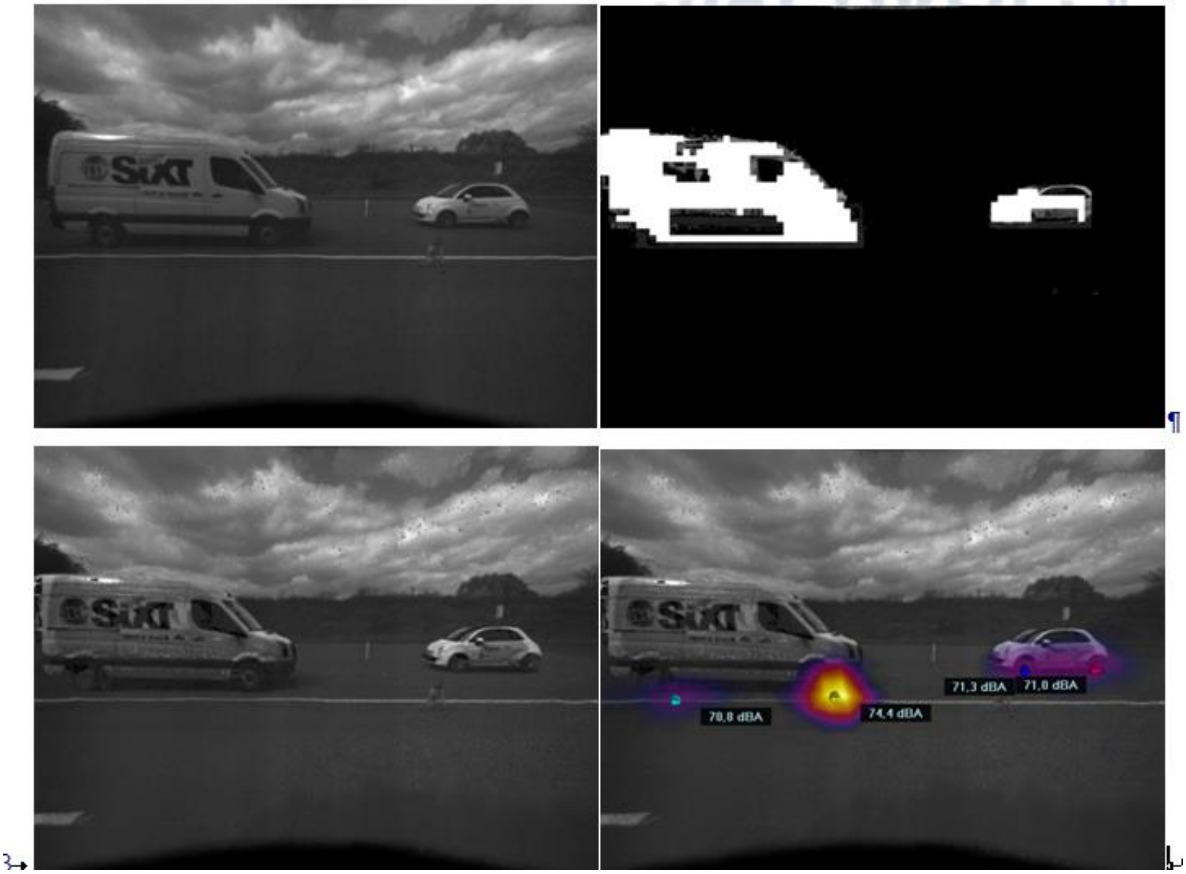

Figure 15. Object detection in real time: original video image showing two vehicles (upper left image), image analysis, foreground segmentation and object identification (upper right image), video morphing (lower left image), beamforming and calculation of source levels (lower right image)

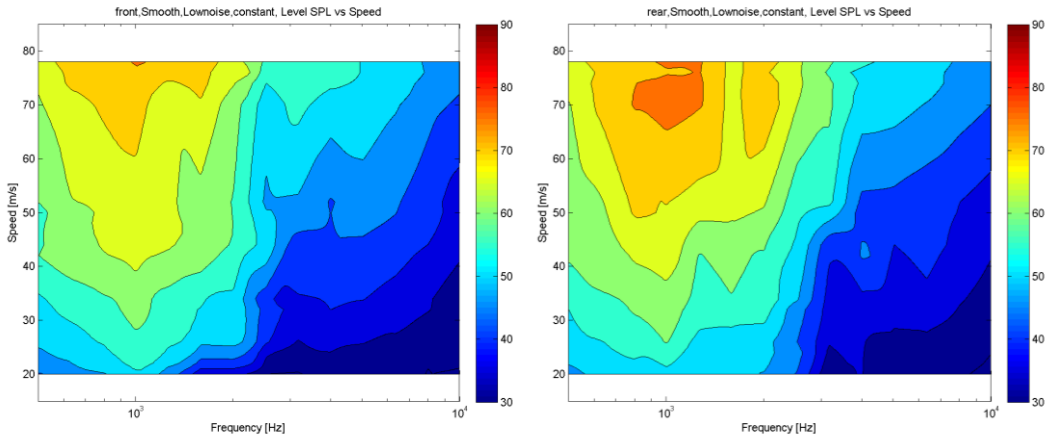

Figure 16. Example of an Acoustical Fingerprint; Left: Front tire, smooth surface, low noise tires, Level [dB(A)] vs. speed and frequency; Right: Rear tire, smooth surface, low noise tires, Level [dB(A)] vs. speed and frequency

Figure 17. Measurement campaign with 5 different passenger cars (2 electric vehicles, 3 ICE cars) on test track using the developed modified head visor microphone array

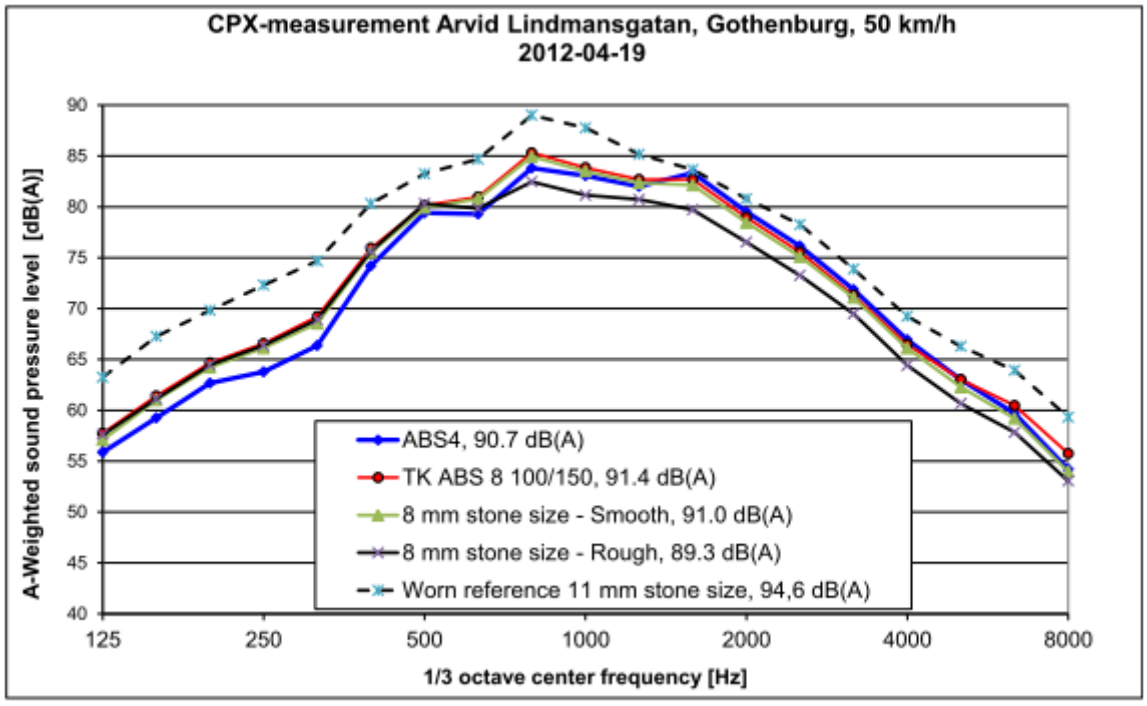

Figure 18. Results from CPX measurements on Arvid Lindmansgatan, Gothenburg.

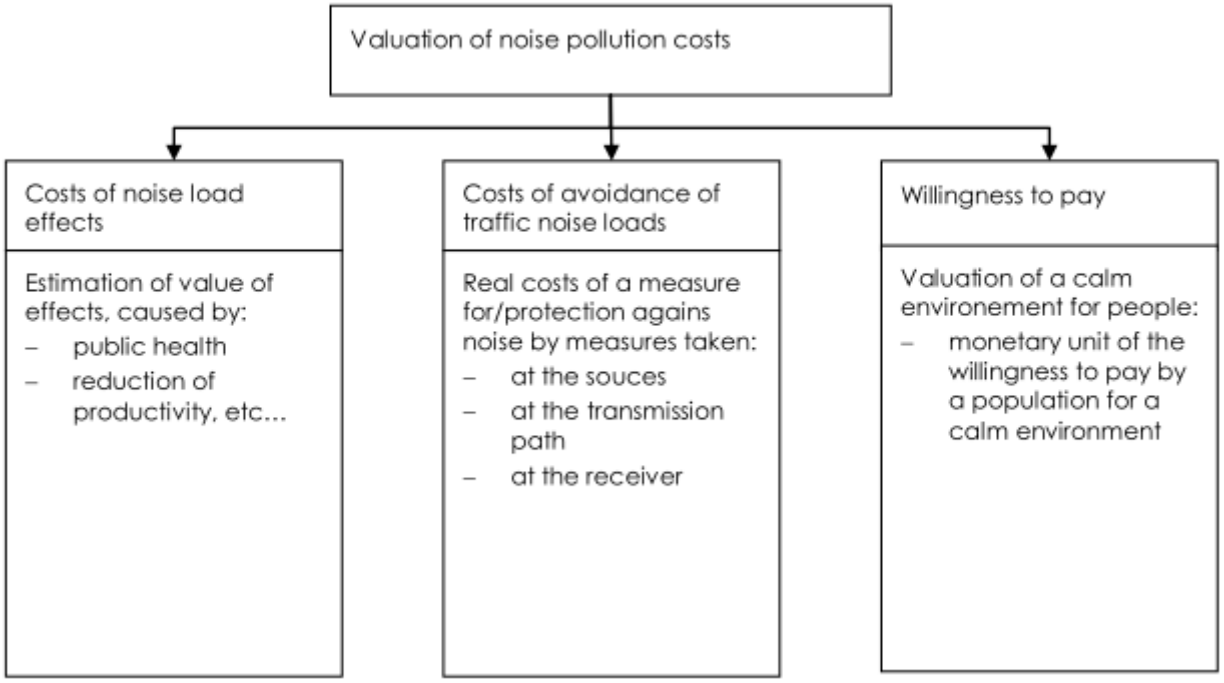

Figure 19. Evaluation of macro economical noise costs.

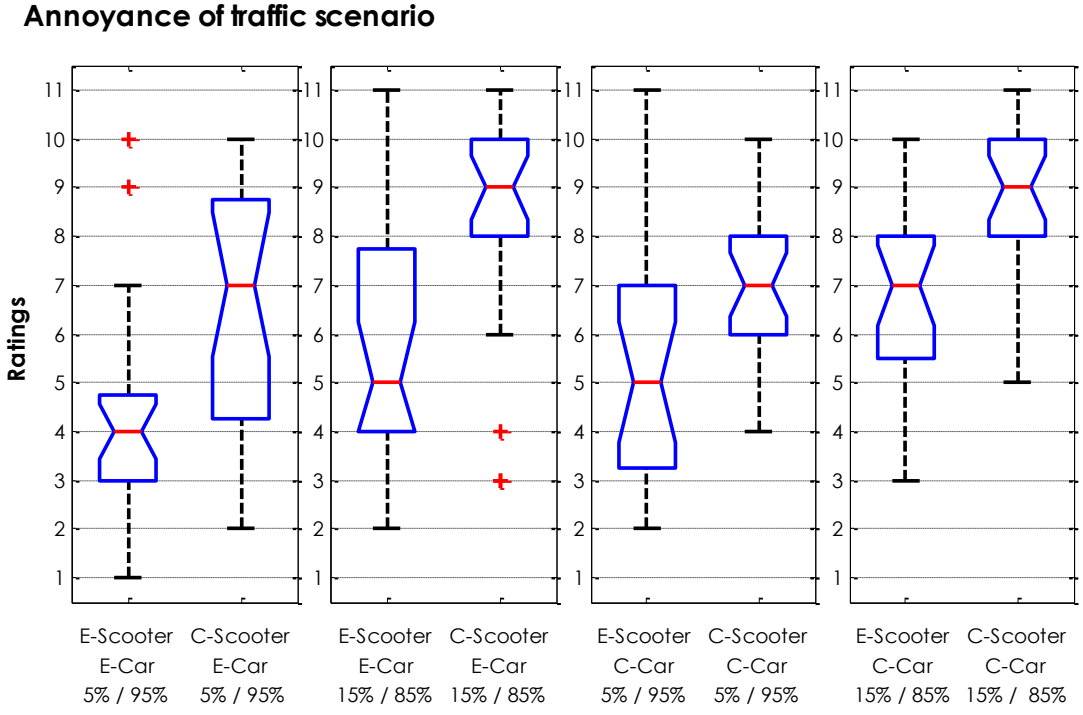

Figure 20. Ratings on the perceived annoyance of the presented traffic scenarios

Figure 21. Södermalm, Stockholm. Evaluation of the refined method for calculating number of HAP.

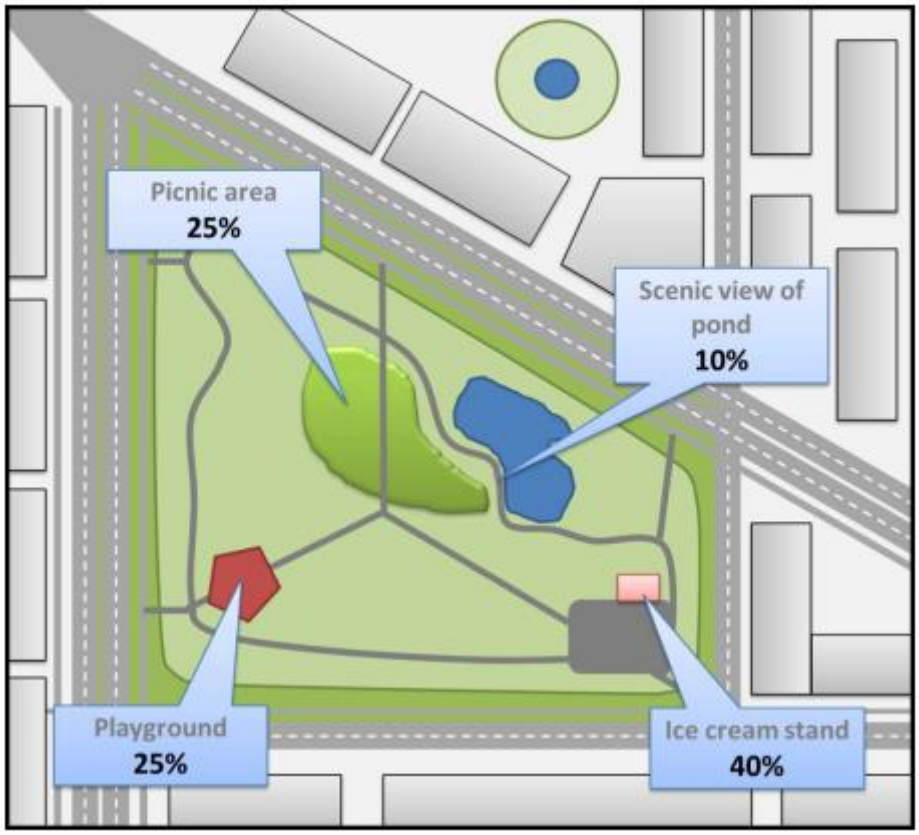

Figure 22. Distribution of visitors within the park

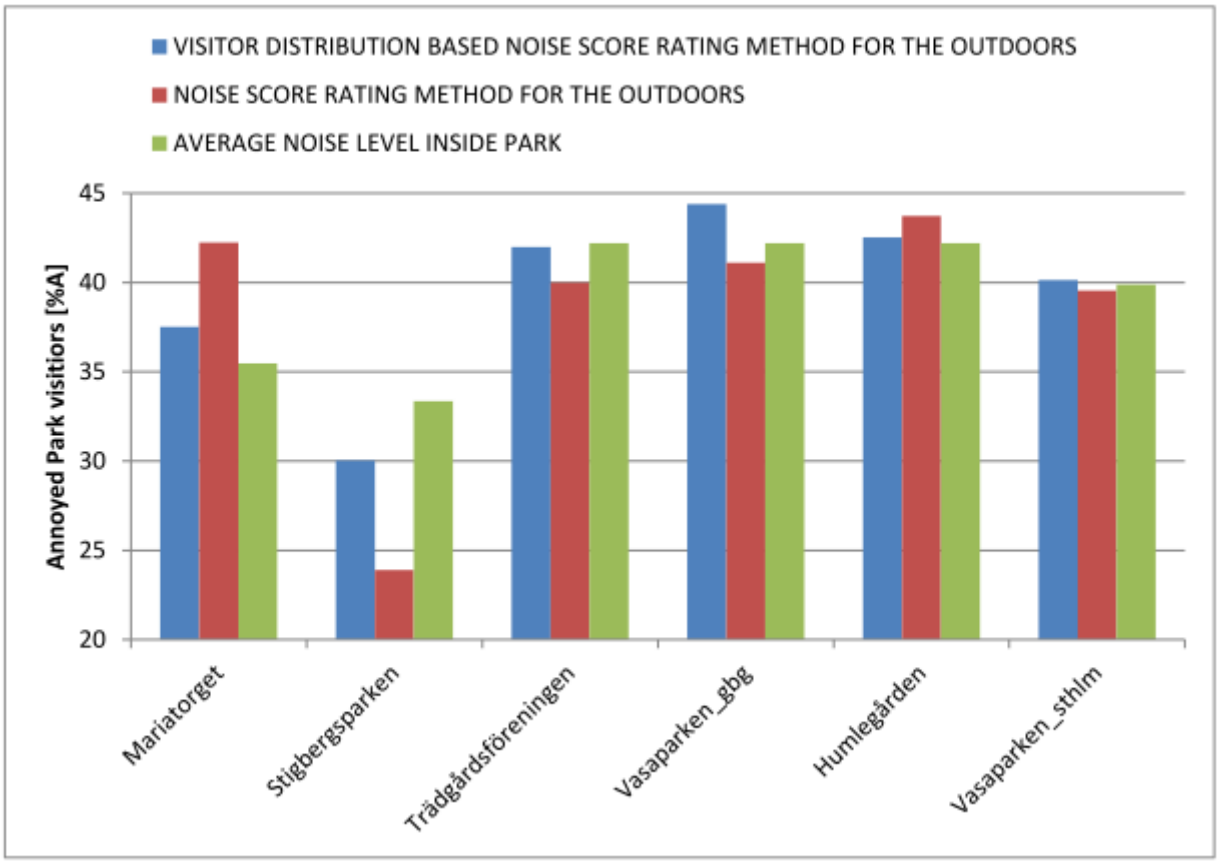

Figure 23. Distribution of % annoyed and % highly annoyed for the evaluated parks in Stockholm and Gothenburg.

Figure 24. Q-Zone (test site) and the investigated park in Athens. The park is divided into two sections for evaluation (Park left and Park right)

Figure 25. Test site for measurements on facade noise insulation.

Table 1. Dimensions for six different measurement setups.

Setup	Inner side (existing window)			Cavity [mm]	Outer side
	Glass pane 1 [mm]	Cavity [mm]	Glass pane 2 [mm]		Glass pane 3 [mm]
1	4	20	6	-	-
2	4	20	6	300	12
3	4	20	6	650	12
4	4	20	6	650MW[1]	12
5	4	20	6	1000	12
6	4	20	6	1300	12

Table 2. Noise reduction inside the building versus real frequency range.

Frequency range	Concrete barrier H_b = 6 [m]		Concrete-EPS-concrete barrier H_b = 6 [m]	
[Hz]	H_b/λ [-]	IL [dB]	H_b/λ [-]	IL [dB]
6.7 - 20	0.8	2	0.53	7
20 - 33.3	1.6	7	1.1	9
33.6 - 46.7	2.4	11	1.6	12
46.7 - 60	3.2	12	2.1	10

Figure 26. CityHush logo

Figure 27. Front page of CityHush template for PowerPoint presentations.

Figure 28. Homepage of the CityHush website.

Figure 29. Page providing presentations given at CityHush dissemination events for download.

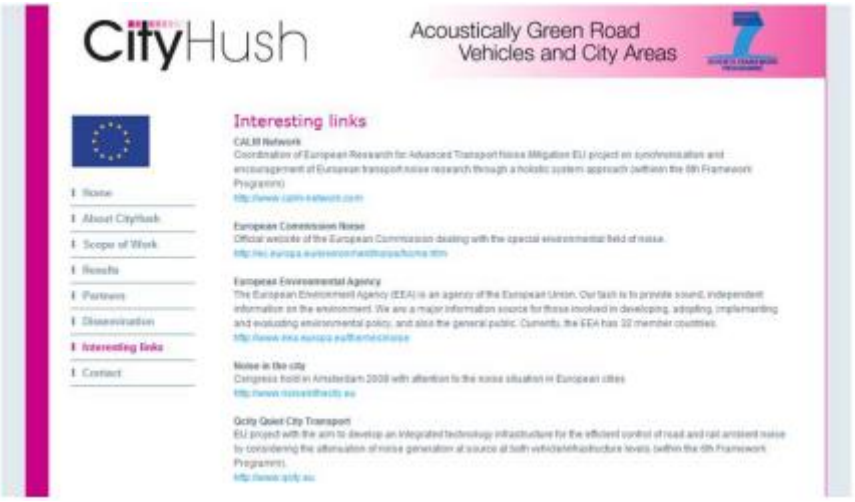

Figure 30. Page with links to related projects at the CityHush website.

Table 3. List of relevant publications to disseminate CityHush results

NAME OF MEDIA	TYPE OF MEDIA	COUNTRY	CONTACTS TO EDITORS?	WEBSITE
New Scientist	Magazine	UK	no	http://www.newscientist.com/
Acta Acoustica united with Acustica	Specialised scientific publication	EU	Yes	http://www.acta-acustica-united-with-acustica.com/
Le Strade	Specialised scientific publication	Italy	No	http://fiaccola.it/lestrade.htm
Applied Acoustics	Specialised scientific publication	-	No	http://www.sciencedirect.com/science/journal/0003682X
International Journal of Acoustics and Vibrations	Specialised scientific publication	UK	Yes	http://www.iiav.org
Plan	Publication of association of planners	Sweden	no	http://www.planering.org/plan.html
Ny Teknik	Engineers weekly newspaper	Sweden	no	http://www.nyteknik.se/
Journal of Sound and Vibration	Refereed journal	UK	No	http://ees.elsevier.com/jsv/
Journal of the Acoustical Society of America	Specialised scientific publication	US	Yes	http://asadl.org/jasa/

CityHush USB-Cards

CityHush earplugs