STREETMETER

2024

Concepts, Core Values and Formulas

DESCRIPTION OF STREETMETER'S PARAMETERS IN THE METRIC SYSTEM

SPACESCAPE placetoplan RISE STREETPLANS Miami New York street forum

Introduction

The analysis tool Streetmeter is the result of a Vinnova-funded research project carried out by the consulting company Spacescape, the dialogue company Placetoplan and the research institute RISE in collaboration with planners and experts in four Swedish municipalities. In addition, the American consulting company Streetplans and the European research project Street Forum have participated in the development of the English version of Streetmeter, adapted for international users. The purpose of Streetmeter is to calculate and visualize values created by street design. Analytical models and calculations are based on research and empirical studies. The following appendix presents the underlying calculations for all of Streetmeter's values. The formula collection is intended to function as an encyclopedia and is sorted in the same way as the tool for ease of use.

The first section presents all values based on the five categories health, social, economy, mobility and environment. Section two describes how the valuation based on the street's users was carried out. The last chapter describes how the overall grading of the street, its Streetmetric, is done.

If you have questions about the tool, or need help in a street project, please contact streetmeter@spacescape.se.

Streetmeter is a constantly evolving web platform. The screenshot is from April 2024.

Basic assumptions

Note! Since Streetmeter originates from Sweden, it utilizes the metric system for its formulas. In the English version, inputs and outputs are provided in the imperial system, but are automatically converted to metric by the tool during calculations. This eliminates the need to modify the formulas themselves. Therefore, only the concepts have been translated in this document. All the calculations and formulas are based on the metric system.

In order to limit the amount of input data and make Streetmeter user-friendly, calculations and assessments are in some cases based on assumptions. Among these are a number of recurring prerequisites:

- The diameter of a tree crown is seven meters.
- Cycling can take place in mixed traffic at the motor traffic flow up to 3000 vehicles/day and speed up to 30 km/h.
- A maximally tree-planted street has 20 trees per 100 meters.
- A fully activated street has 20 retail companies per 100 meters.
- Public transport vehicles are assumed to have a capacity of 70 passengers and an occupancy rate of 29 %.
- There are 1.4 road users in each car.
- Travel lanes have a maximum capacity of 9000 vehicles per day.

The assumption of tree diameter is based on a combination of several sources.

COWETT, F. & BASSUK, N. (2014). STATEWIDE ASSESSMENT OF STREET TREES IN NEW YORK STATE. URBAN FORESTRY & URBAN GREENING 13(2). 10.1016/J.UFUG.2014.02.001

NACTO (2017). URBAN STREET STORMWATER GUIDE. HTTPS://NACTO.ORG/PUBLICATION/URBAN-STREET-STORMWATER-GUIDE/

SPACESCAPE, KTH, CHALMERS, VTI, WHITE & SWECO (2022). DESIGNGUIDE FÖR SMARTA GATOR. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1670683/FULLTEXT01.PDF

The number of passengers in buses and cars has been taken from the following reports on Swedish public transport:

STOCKHOLM'S TRAFFIC ADMINISTRATION SLL (2018). RIKTLINJER PLANERING AV KOLLEKTIVTRAFIKEN I STOCKHOLMS LÄN. HTTPS://DOCPLAYER.SE/106331376-RIKTLINJER-PLANERING-AV-KOLLEKTIVTRAFIKEN-I-STOCKHOLMS-LAN.HTML

2030 THE ENVIRONMENTAL BAROMETER (2022). BELÄGGNINGSGRAD I KOLLEKTIVTRAFIKEN. HTTPS://2030.MILJOBAROMETERN.SE/KOMMUN/HELHET/BETEENDET/BELAGGNING-KOLLEKTIVTRAFIK-B3E-KH/ [2023-05-09]

2030 THE ENVIRONMENTAL BAROMETER (2022). GENOMSNITTLIGT ANTAL PERSONER I VARJE PERSONBIL. HTTPS://2030.MILJOBAROMETERN.SE/NATIONELLA-INDIKATORER/BETEENDET/GENOMSNITTLIGT-ANTAL-PERSONER-I-VARJE-FORDON-B3E/PERSONBIL/ [2023-10-19]

Streetmeter in Urban Planning

Streetmeter has built-in flexibility, making the tool applicable to all stages of urban planning. Since only basic knowledge about a street's dimensions is required to perform an initial assessment and compare alternatives, Streetmeter can be used early on during strategic planning. As planning progresses and more details become available, Streetmeter generates increasingly detailed data.

Strategic Planning

Strategic planning is done with broad strokes. Here, overarching decisions are made about the expansion and transformation of the city's streets and built environment. Participants represent a wide range of expertise, and the focus is on strategies and policy directions rather than details. Considering that public spaces largely consist of streets, it is crucial that their role in planning reflects their impact on the city and its inhabitants. Streetmeter can illustrate the value-creating effects and functions of streets beyond transportation, broadening discussions to include streets in contexts beyond traffic.

To initiate a calculation in Streetmeter, the length and width of the street need to be entered. During strategic planning, assumptions based on standard cross-sections can be used. This allows simple analyses of the prioritization of street space. By adding assumptions about speed limits and estimated motor traffic flow, often possible even at this stage, a more multifaceted picture of the street's value can be achieved.

Examples of use cases:

- Broaden the discussion about the role of streets in the city.
- Raise awareness among stakeholders about the potential of street design.
- Include street design in a wider range of planning forums.

Urban Planning

Detailed planning defines the parameters for potential future street designs. To achieve effective land use, it is essential to ensure that enough space is allocated to streets during this stage. Streetmeter aids in balancing competing interests and in evaluating the effects of alternative solutions on various stakeholders.

While detailed plans do not determine anything beyond the location and width of streets, this phase often includes more detailed sketches and traffic studies. This allows more comprehensive input into Streetmeter under the “Street Usage” category and ensures that data on street widths is more accurate.

Examples of use cases:

- Expand the discussion about the functions of streets.
- Provide a basis for fairer discussions about street design.
- Verify that allocated street space meets desired functional requirements.
- Compare the effects of different prioritizations.

Example

In 2024, the municipality of the Swedish city Gävle worked on a street development plan outlining a long-term vision for how the city's streets would evolve alongside urban life and other key functions. The plan proposed changes at a conceptual level and also focused on particularly problematic streets. Alternative designs were developed and analyzed using Streetmeter, with the results presented in tables that highlighted changes across the tool's five categories. The evaluation served as the basis for discussion. The clear presentation of the positive values associated with the proposed transformation ultimately led to a decision to test the suggested design for Södra Kungsgatan through a temporary transformation, enabling further evaluation in practice.

	Södra Kungsgatan		Norra Strandgatan		Brunnsgatan		
	Före	Efter	Före	Efter	Före	Efter	
HÄLSA							
Ljudnivå	58	58	56	49	53	35	dBA
Boende som ser grönska (i gatan)	34	51	30	31	3	22	%
Andel aktiva transporter	8	12	15	45	54	54	%
Risk för allvarlig trafikskada	22	22	22	9	22	0	%
Grönskans syreproduktion	4,8	7,2	2,0	2,0	0	0,6	ton/år
Utsläpp av luftpartiklar (PM10)	1,5	1,5	0,4	0,2	0	0	ton/år
Utsläpp av luftpartiklar (PM2,5)	1,8	1,8	0,9	0,5	0	0	ton/år
Utsläpp av kväveoxider (NOx)	26,4	26,4	6,9	3,5	0,2	0,2	ton/år
SOCIALT							
Besökstryck	4800	6600	1400	3400	500	500	pers/dygn
Nära grannkontakter	8	8	9	9	10	10	st/boende
Trygghetsskapande entréer	6	6	1	1	3	3	entréer/100 m
Trygghetsskapande belyst yta	79	79	86	86	40	40	%
Potentiell uteserveringsbredd	9,1	13,6	4,1	5,8	2,5	6,5	m
Sittmöjligheter	Saknas	60	75	19	Saknas	160	m mellan bänkar
Jämställdhet	54	54	51	54	52	52	% kvinnor
EKONOMI							
Bostadsvärdeskapande	10	10	7	11	0	10	%
Kontorsvärdeskapande	14	14	2	2	0	0	%
Omsättning serviceföretag	171000	237000	2600	7900	0	0	tkr/år
Bilparkeringsintäkt	400	120	0	20	23	11	tkr/år
Omsättning uteserveringar	8500	16250	0	3300	0	0	tkr/år
MOBILITET							
Trafiksäkert att gå från åldern	10	10	10	7	10	5	år
Trafiksäkert att cykla från åldern	8	8	Nej	8	Nej	5	år
Trafikkapacitet	7450	11100	7300	7600	6700	10900	pers/h
Bussars framkomlighet	18	18	18	12	Ingen buss	Ingen buss	km/h
Angöringsplatser	0,9	0,3	0	1	2,6	1,3	st/entré
Cykelparkeringsplatser	1,4	2,8	0	33	0	0	st/serviceföretag
Gående/rullstolar i bredd	1	3	2	3	2	5	st per sida
Cyklar i bredd	2	3	0	4	5	9	st totalt
Gångpassagetid	47	32	63	4	5	0	sek
Valfrihet i transportsätt	4	4	3	4	3	3	alternativ
MILJÖ							
Utsläpp av koldioxid	5900	5900	1600	800	47	46	ton/år
Dagvattenfördröjning	0	1	0	2	0	4	mm/h
Renat dagvatten	0	1	0	1	0	2	mm/h
Potentiell odlingsvolym	6	300	0	150	0	300	kg grödor/år
Temperatursänkning	0,9	1,3	1,3	1,4	0	0,5	°C
Grönytefaktor	0	0	0	0	0	0	

Evaluation of proposed street transformations from Gävle's Street Development Plan (Spacescape, 2024)

Project Design

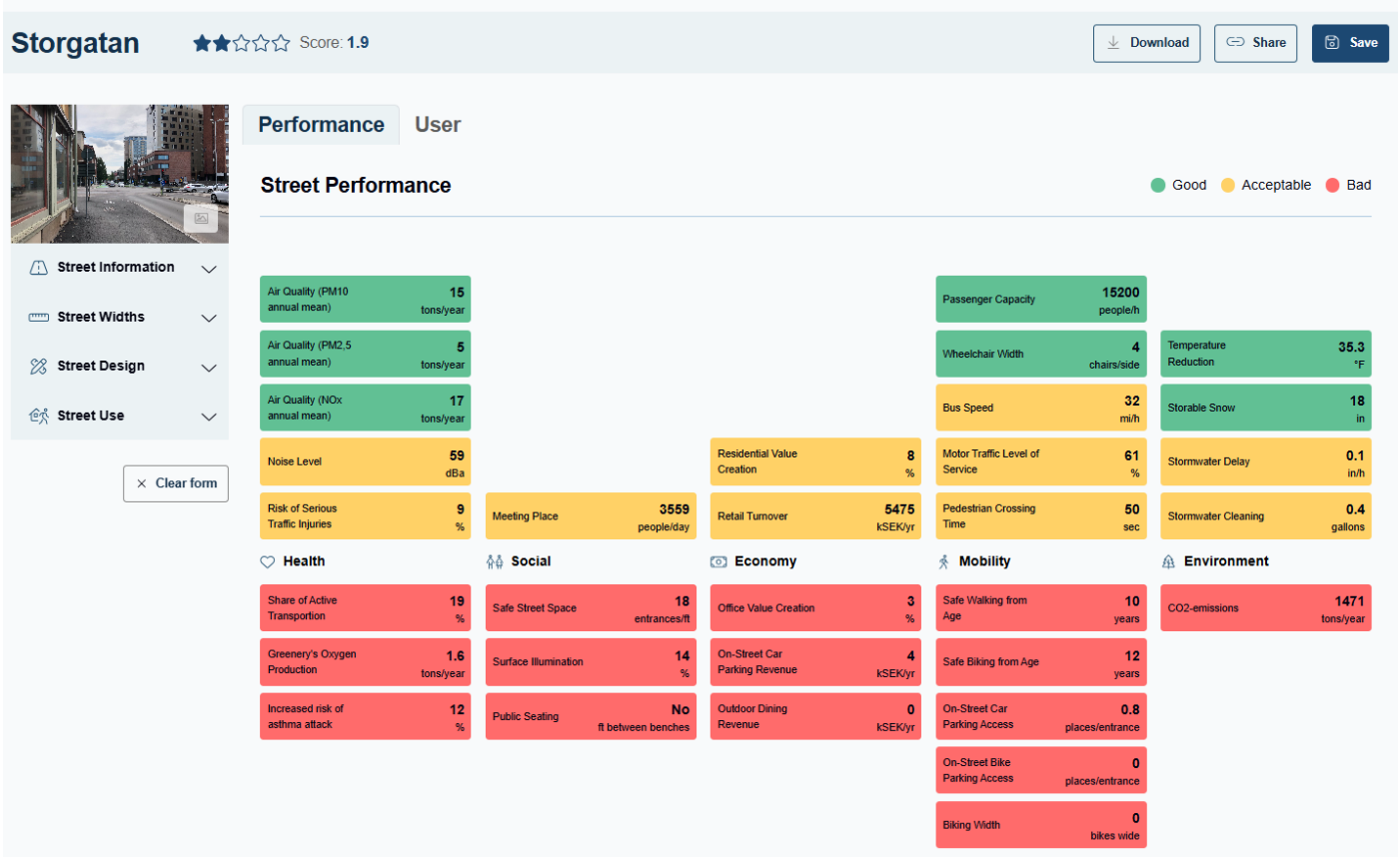
During the project design phase, final street designs are established, and detailed input related to “Street Design” can be added to Streetmeter. The tool can be used to support discussions and arguments when balancing different functions. Space constraints often necessitate prioritization, and Streetmeter provides an objective means of visualizing the effects of various decisions from a broad perspective.

Examples of Use Cases:

- Quantitatively compare alternative street cross-sections.
- Visualize the effects of prioritization decisions from multiple perspectives.

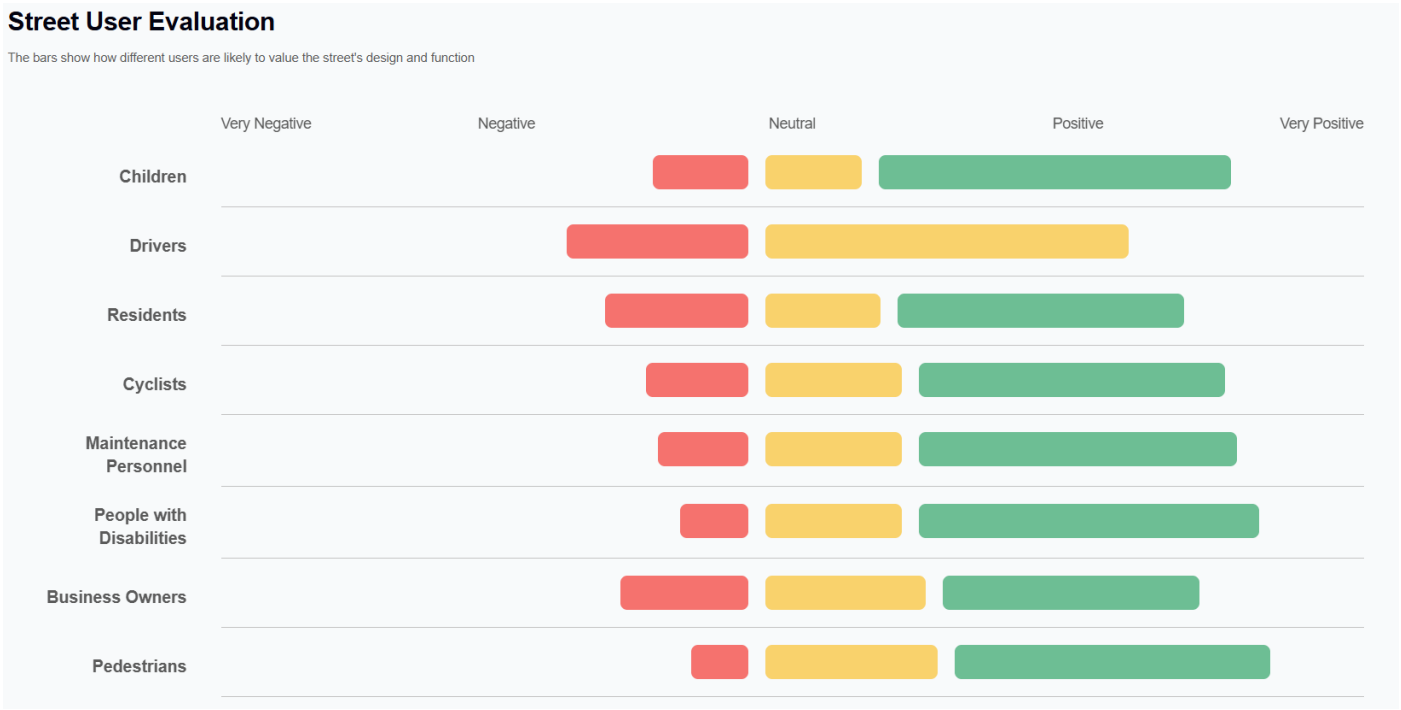
Example

As part of a research project, five Swedish city streets were redesigned using simple methods, avoiding major construction work. The aim was to explore temporary urbanism in Sweden, testing transformations of streets and public spaces more quickly and cost-effectively than traditional methods. During the design process, various alternatives for redistributing street space were developed, and Streetmeter was used as a comparison tool. The tool helped examine which design yielded the best results based on different criteria. The results served as a basis for discussion and debate on how bold the changes should be.



Storgatan's street performance in Umeå before the temporary transformation.

A large primary school was located on one of the included sections. Children were therefore a particularly prioritized target group in the transformation. The Streetmeter feature that evaluates street design from the perspective of different user groups proved practical in assessing which of the proposed designs best met the interests of children.



Evaluation of a design proposal for Roslagsgatan's transformation in Stockholm from the perspective of different street users.

On Herkulesgatan, the amount of street parking was a topic of discussion. Using Streetmeter, the effects of converting each asphalt surface from a parking space to a green area were quantified:

- Oxygen production: +13 kg/year
- Net CO2 emissions: -6 kg/year
- Stormwater retention: +0.1 mm/hour
- Potential harvest: +10 kg/year

The difference in Västra Esplanaden's street performance in Umeå today compared to a proposed transformation.

Environmental Impact Assessment

The quantitative features of Streetmeter make it a useful tool for environmental impact assessments. Although the calculations are generalized, they can serve as a starting point for evaluating the environmental effects of a plan.

Examples of Use Cases:

- Provide an overview of the environmental impact of streets and their traffic flows.

Social Impact Analysis

One of Streetmeter's main purposes is to provide a quantitative assessment of streets in areas not typically measured numerically, such as health and social values. This can be particularly helpful in social impact analyses, evaluating a plan from these perspectives. By quantifying "soft" values, Streetmeter makes it possible to compare them with traditionally analyzed aspects such as traffic flow and accessibility.

Examples of Use Cases:

- Inspire the inclusion of factors in the impact analysis.
- Concretely describe social differences between alternative street designs.
- Evaluate street design from the perspective of different user groups.

Child Impact Analysis

Streetmeter emphasizes both the child perspective (through values) and children's perspectives (as a separate user group). Since child impact analyses often involve traffic assessments, Streetmeter can help concretely describe and evaluate street design and usage.

Examples of Use Cases:

- Inspire the inclusion of factors in the analysis.
- Describe differences between alternative street designs from a child’s perspective.
- Compare children’s perspectives on street design with those of other user groups.

Street performance

The main function of Streetmeter is to account for the effects of a street by generating quantified values from a variety of angles. The selection of the values has been made on the basis of relevance and measurability. The results should not be seen as exact truths but are intended to be used as a basis for argumentation. The broad palette of numerical consequences can contribute to a more equal discussion between different views and technical areas regarding the design of the street.

The following chapters describe each of Streetmeter's values according to the layout below.

[Performance category]

[Performance name]

Motivation
[Description of why the value is interesting and what effects it has on people and society at large.]

Description
[Explanation of the effect measured by the value and its relationship with the design of the street, how the calculation is performed and what assumptions have been made.]

Unit
[Specification of which unit the value is measured in.]

Formula
[Presentation of the calculation in the form of mathematical formulas.]

Formula Reference
[Explanation of how the calculation of the value was obtained and the sources used. All formulas are based on one of the following three sources:

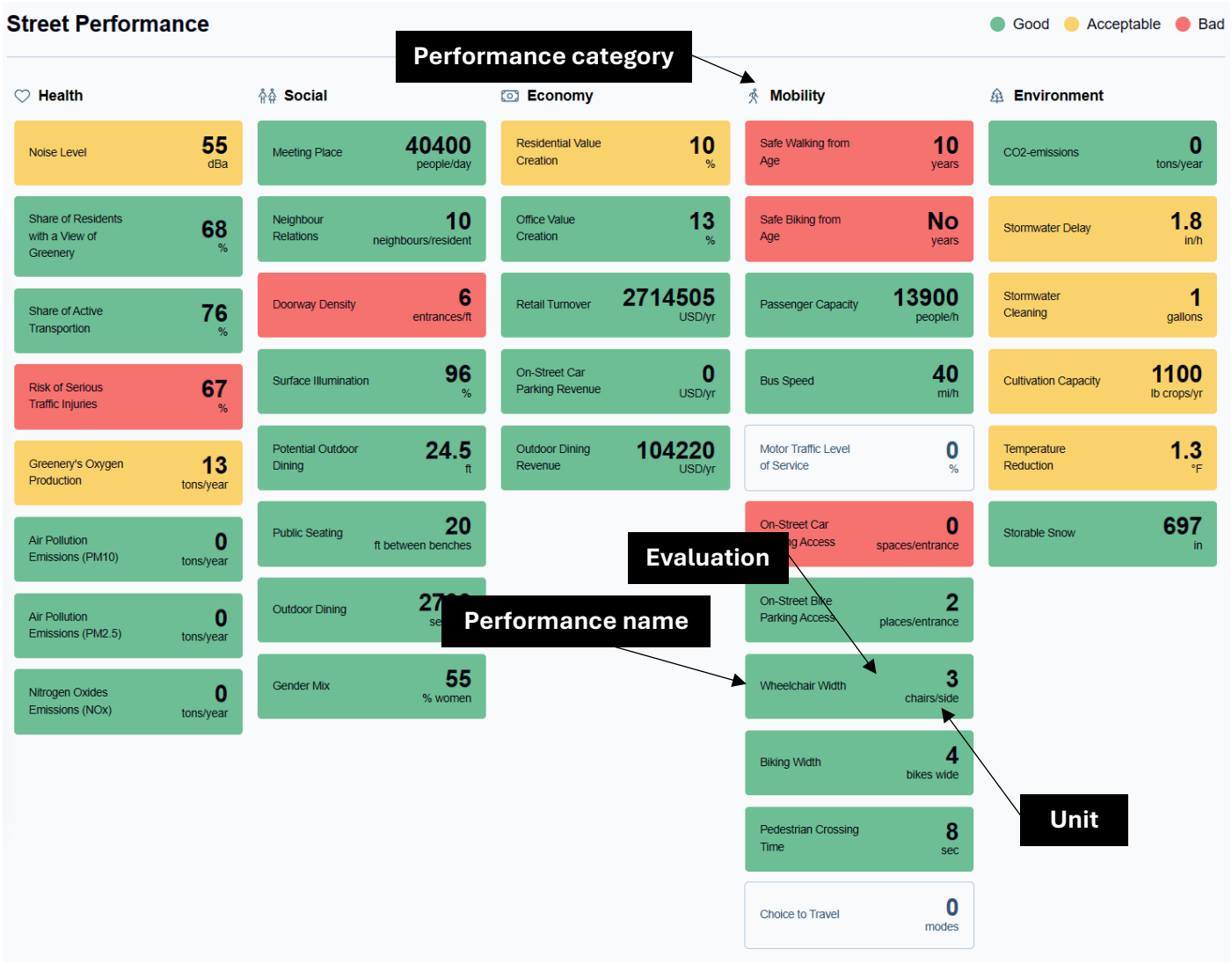
- Scientific - published, scientific articles with results from empirical studies
- Investigated - investigations of different scopes based on real conditions
- Rational – self-explanatory formula based on the street's geometry and constitution.]

Evaluation
[Description of the thresholds used to assess the performance based on the three levels good (green), acceptable (yellow) and bad (red). The evaluation is based on the contribution of value to sustainable development. The limits can be absolute or related to the geometry of the street.]

- 🟢 **Good:** [Threshold for a very positive performance with a significant contribution to sustainable development.]
- 🟡 **Acceptable:** [Threshold for an acceptable performance with a certain degree of contribution to sustainable development.]
- 🔴 **Bad:** [Threshold for a negative performance that does not contribute to sustainable development.]

Evaluation Reference
[Description of how the evaluation has been produced and the sources used, analogous to the formula reference above. All evaluations are based on one of the following three sources:

- Scientific - published, scientific articles with results from empirical studies
- Investigated - investigations of different scopes based on real conditions
- Rational – self-explanatory formula based on the street's geometry and constitution.]



Streetmeter is a constantly evolving web platform. The screenshot is from April 2024.

Health

Noise Level

Motivation

Low noise levels are positive for people's well-being. There are clear links between noise and both physical and mental health.

Description

Noise generated by motor traffic. The value corresponds to the noise level at a distance of ten meters from the center of the street.

Unit

Decibel A (dBA).

Formula

In the case of motor traffic up to 1,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 16.279$$

In the case of motor traffic between 1 001 and 2 000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 19.279$$

In the case of motor traffic between 2,001 and 3,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 21.279$$

In the case of motor traffic between 3,001 and 4,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 22.279$$

In the case of motor traffic between 4,001 and 5,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 23.279$$

In the case of motor traffic between 5,000 and 7,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 24.279$$

In the case of motor traffic between 7,001 and 8,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 25.279$$

In the case of motor traffic between 8,001 and 10,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 26.279$$

In the case of motor traffic between 10,001 and 20,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 29.279$$

In the case of motor traffic between 20,001 and 30,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 31.279$$

In the case of motor traffic between 30,001 and 40,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.9547 \times \ln \boldsymbol{Speed} + 32.279$$

In the case of motor traffic over 40,000 vehicles per day:

$$\boldsymbol{Noise\ Level} = 9.5608 \times \ln \boldsymbol{Speed} + 34.835$$

Formula Reference

The connections are taken from the Swedish National Board of Housing, Building and Planning.

THE SWEDISH NATIONAL BOARD OF HOUSING, BUILDING AND PLANNING (2016). HUR MYCKET BULLRAR VÄGTRAFIKEN? HTTPS://WWW.BOVERKET.SE/CONTENTASSETS/6B694ED0A7504182850BFF4528B4B28D/HUR-MYCKET-BULLRAR-VAGTRAFIKEN.PDF

Evaluation

1. **Good (green):** ≤50 dBA
2. **Acceptable (yellow):** 50–65 dBA
3. **Bad (red):** ≥65 dBA

Evaluation Reference

Rational. The evaluation is based on Swedish limit values for housing.

THE SWEDISH ENVIRONMENTAL PROTECTION AGENCY (2017). RIKTVÄRDEN FÖR BULLER FRÅN VÄG OCH SPÅRTRAFIK VID BEFINTLIGA BOSTÄDER. HTTPS://WWW.NATURVARDSVERKET.SE/4A4395/GLOBALASSETS/VAGLEDNING/BULLER/VAGLEDN-RIKTV-BULLER-VAG-SPAR-BEFINTLIGA-BOSTADER-REV-JUNI2017.PDF

Share of Active Transportation

Motivation

Choosing active modes of transport such as walking and biking has many positive effects on road users' health and in the long run reduces society's healthcare costs.

Description

The share of the street's total street user flow made up of pedestrians and cyclists. Public transport vehicles are assumed to have a capacity for 70 passengers and an occupancy rate of 29 %, giving a passenger load of 21. Cars are assumed to have an average of 1.4 people in them.

Unit

Percent (%).

Formula

$$\boldsymbol{Share\ of\ Active\ Transportation} = \frac{\boldsymbol{Pedestrian\ Traffic} + \boldsymbol{Bike\ Traffic}}{\boldsymbol{Pedestrian\ Traffic} + \boldsymbol{Bike\ Traffic} + \boldsymbol{Transit\ Traffic} \times 21 + \boldsymbol{Motor\ Traffic} \times 1.4}$$

Formula Reference

Rational.

The number of passengers in buses and cars has been taken from the following reports on Swedish public transport:

STOCKHOLM'S TRAFFIC ADMINISTRATION SLL (2018). RIKTLINJER PLANERING AV KOLLEKTIVTRAFIKEN I STOCKHOLMS LÄN. HTTPS://DOCPLAYER.SE/106331376-RIKTLINJER-PLANERING-AV-KOLLEKTIVTRAFIKEN-I-STOCKHOLMS-LAN.HTML

2030 THE ENVIRONMENTAL BAROMETER (2022). BELÄGGNINGSGRAD I KOLLEKTIVTRAFIKEN. HTTPS://2030.MILJOBAROMETERN.SE/KOMMUN/HELHET/BETEENDET/BELAGGNING-KOLLEKTIVTRAFIK-B3E-KH/ [2023-05-09]

2030 THE ENVIRONMENTAL BAROMETER (2022). GENOMSNITTLIGT ANTAL PERSONER I VARJE PERSONBIL. HTTPS://2030.MILJOBAROMETERN.SE/NATIONELLA-INDIKATORER/BETEENDET/GENOMSNITTLIGT-ANTAL-PERSONER-I-VARJE-FORDON-B3E/PERSONBIL/ [2023-10-19]

Evaluation

1. **Good (green):** >66 %
2. **Acceptable (yellow):** 33–66 %
3. **Bad (red):** ≤33 %

Evaluation Reference

Rational. The evaluation is based on commonly used modal allocation targets.

GÄVLE MUNICIPALITY (2014). TRAFIKSTRATEGI. HTTPS://OLD.GAVLE.SE/PAGEFILES/4462/TRAFIKSTRATEGI_DEL2_2014_WEB.PDF

Risk of Serious Traffic Injury

Motivation

Affects the health of road users and society's healthcare costs.

Description

The risk of being seriously injured at a certain speed. The calculation is based on the risk to the age group 60 years and older, society's most vulnerable road user group. The connection is derived from the Swedish Transport Administration's crash violence curves with modification based on international examples at speeds between 30 and 50 km/h when the Swedish Transport Administration states that "the flat slope of the new curves is partly due to deficiencies in the data base. Better data would likely result in a steeper curve in the speed range of 30 – 50 km/h." The value will be most accurate if the entered speeds are the street's measured, not posted, speed.

Unit

Percent (%).

Formula

$$\boldsymbol{Risk\ of\ Serious\ Traffic\ Injury} = 0.0302 \times \boldsymbol{Speed}^2 - 0.1904 \times \boldsymbol{Speed} + 0.5222$$

Formula Reference

Investigated.

ROAD SAFETY SWEDEN (2012). NYA KROCKVÅLDSKURVOR FÖR FOTGÄNGARES RISKER VID PÅKÖRNING AV BIL. HTTPS://WWW.LINKOPING.SE/CONTENTASSETS/3A5A0835389B48A5BCEC4D1EF2D4FAF2/NYA_KROCKVALDSKURVOR_FOR_FOTGANGARES_RISKER_VID_PAKORNING_AV_BIL.PDF?492C9F#:~:TEXT=NYA%20STUDIER%20OCH%20NY%20V%C3%A4RDERING,D%C3%B6DSOLYCKORNA%20SKER%20P%C3%A5%2050%2D%20V%C3%A4GN%C3%A4TET.

Evaluation:

1. **Good (green):** ≤2 %
2. **Acceptable (yellow):** 2–9 %
3. **Bad (red):** >9 %

Evaluation Reference

Rational. Based on the Swedish concept Vision Zero.

ROAD SAFETY SWEDEN (2019). VISION ZERO - NO FATALITIES OR SERIOUS INJURIES THROUGH ROAD ACCIDENTS. HTTPS://WWW.ROADSAFETYSWEDEN.COM/ABOUT-THE-CONFERENCE/VISION-ZERO---NO-FATALITIES-OR-SERIOUS-INJURIES-THROUGH-ROAD-ACCIDENTS/#:~:TEXT=IN%201997%2C%20THE%20SWEDISH%20PARLIAMENT,MISTAKES%20TO%20HAVE%20FATAL%20CONSEQUENCES [2024-04-10]

Greenery’s Oxygen Production

Motivation

Increased oxygen production is positive for the health of road users as well as residents and workers in the immediate area and in the long run lowers society's healthcare costs.

Description

Total, annual amount of oxygen produced by street trees thanks to photosynthesis. An average tree produces 120 kg of oxygen per year. Green spaces are assumed to function as grass lawns. They have been shown to be able to produce 13 kg of oxygen per year.

Unit

Tons per year (tons/year).

Formula

$$\textbf{\textit{Greenery's Oxygen Production}} = \frac{\textbf{\textit{Trees}} \times 120 + \textbf{\textit{Green Space}} \times 13}{1000}$$

Formula Reference

ROUQUETTE, J.R. AND HOLT, A.R. (2017). THE BENEFITS TO PEOPLE OF TREES OUTSIDE WOODS (TOWS). REPORT FOR THE WOODLAND TRUST. HTTPS://WWW.WOODLANDTRUST.ORG.UK/MEDIA/1702/BENEFITS-OF-TREES-OUTSIDE-WOODS.PDF

NOWAK, D. J., HOEHN, R., CRANE, D. E. OXYGEN PRODUCTION BY URBAN TREES IN THE UNITED STATES. ARBORICULTURE & URBAN FORESTRY 2007. 33(3):220–226. HTTPS://WWW.FS.USDA.GOV/RESEARCH/TREESEARCH/11485

Evaluation

1. **Good (green):** ≥0.9 kg/m^2 and year
2. **Acceptable (yellow):** 0.6–0.9 kg/m^2 and year
3. **Bad (red):** <0.6 kg/m^2 and year

Evaluation Reference

Scientific. All streets should have 30% canopy cover, which corresponds to an annual oxygen production of 0.9 kilograms per square meter.

KONIJNENDIJK, C. (2021). THE 3-30-300 RULE FOR URBAN FORESTRY AND GREENER CITIES. BIOPHILIC CITIES JOURNAL, 4(2), SS 821-830. HTTPS://DOI.ORG/10.1007/S11676-022-01523-Z

Air Quality (PM_{10} Annual Mean)

Motivation

Air quality affects both road users and local residents and workers. When inhaled, the airborne particles can cause harmful health effects and affect both the respiratory system and the cardiovascular system.

Description

Concentration of air pollutants with respect to coarse particulate matter, expressed as an annual average. The background grant is set at an average level. The emission factor is weighed together based on vehicle composition and the fact that the traffic flow is normally distributed as 95 per cent free flow and five per cent queues. Trees have been shown to reduce particle levels by up to five percent, which is assumed to be true for a fully tree-planted street with 20 trees per 100 meters. The reduction is assumed to decrease linearly with the number of trees down to zero.

Unit

Micrograms per cubicmeter (µg/cbm).

Formula

In order to calculate air quality, the composite emission factor of traffic must be calculated.

At speeds up to 30 km/h:

$$Emission\ Factor\ (mg/vkt) = (1 - 0.01 \times \boldsymbol{Heavy\ Traffic}) \times 27 + \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}} \times 130 + \left(0.01 \times \boldsymbol{Heavy\ Traffic} - \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}}\right) \times 130$$

At speeds above 30 km/h:

$$Emission\ Factor\ (mg/vkt) = (1 - 0{,}01 \times \boldsymbol{Heavy\ Traffic}) \times 27 + \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}} \times 376 + \left(0.01 \times \boldsymbol{Heavy\ Traffic} - \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}}\right) \times 130$$

With emission factor below 75 mg/vkt and street width up to 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} = (14 + 0.00014 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\dfrac{\boldsymbol{Trees}}{\boldsymbol{Analyzed\ Street\ Length}}}{0.2}\right)$$

With emission factor less than 75 mg/vkt and the street width is more than 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} = (14 + 0.00011 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\dfrac{\boldsymbol{Trees}}{\boldsymbol{Analyzed\ Street\ Length}}}{0.2}\right)$$

With emission factor below 125 mg/vkt and street width up to 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.00027 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor below 125 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.00023 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor below 200 mg/vkt and street width up to 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.00045 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor below 200 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.00034 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor below 300 mg/vkt and street width up to 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.0007 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor below 300 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.00056 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor from 300 mg/vkt and street width up to 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.001 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor from 300 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} =$$

$$(14 + 0.0008 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\frac{\boldsymbol{Trees}}{\boldsymbol{Analyzed\ Street\ Length}}}{0.2}\right)$$

Formula Reference

Investigated.

TOMAS WISELL, PROJECT MANAGER AND RESEARCHER AT THE SWEDISH ENVIRONMENTAL RESEARCH INSTITUTE IVL, PHONE CALL ON MARCH 7, 2023

FOLTESCU, V. L., GIDHAGEN, L. & OMSTEDT, G. (2004). NOMOGRAM FÖR UPPSKATTNING AV HALTER AV PM10 OCH NO2 - REVIDERAD VERSION (DECEMBER 2004). SMHI (NR. 102). HTTPS://WWW.SMHI.SE/POLOPOLY_FS/1.166757!/METEOROLOGI_102%20NOMOGRAM%20F%C3%B6R%20UPPSKATTNING%20AV%20HALTER%20AV%20PM10%20OCH%20NO2.PDF

TALLIS, M., TAYLOR, G. SINNETT, D. & FREER-SMITH, P. (2011). ESTIMATING THE REMOVAL OF ATMOSPHERIC PARTICULATE POLLUTION BY THE URBAN TREE CANOPY OF LONDON, UNDER CURRENT AND FUTURE ENVIRONMENTS. LANDSCAPE AND URBAN PLANNING, 103 (2), SS.129-138. DOI: 10.1016/J.LANDURBPLAN.2011.07.003

Evaluation

1. **Good (green):** ≤20 µg/m^3 and year
2. **Acceptable (yellow):** 20–40 µg/m^3 and year
3. **Bad (red):** ≥40 µg/m^3 and year

Evaluation Reference

Scientific. Based on EU-wide air quality standards.

EUROPEAN COMISSION (N.D.) EU AIR QUALITY STANDARDS. HTTPS://ENVIRONMENT.EC.EUROPA.EU/TOPICS/AIR/AIR-QUALITY/EU-AIR-QUALITY-STANDARDS_EN [2024-04-10]

Air Quality ($PM_{2,5}$ Annual Mean)

Motivation

Air quality affects both road users and local residents and workers. Lower levels of fine particles lead to fewer lung problems in both the short and long term, particularly for children in the latter case.

Description

Concentration of air pollutant with respect to fine particulate matter, expressed as an annual average. Fine particles have been found to make up about 30 percent of the coarse particles in the air.

Unit

Micrograms per cubicmeter (µg/cbm).

Formula

$$\boldsymbol{Air\ Quality\ (PM_{2.5}\ Annual\ Mean)} = 0.3 \times \boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)}$$

Formula Reference

Investigated.

ANDERSSON, S., BERGSTRÖM, R., OMSTEDT, G. & ENGARDT, M. (2008). DAGENS OCH FRAMTIDENS PARTIKELHALTER I SVERIGE - UTREDNING AV EXPONERINGSMINSKNINGSMÅL FÖR PM2.5 ENLIGT NYTT LUFTDIREKTIV. SMHI (NR. 133). HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:947535/FULLTEXT01.PDF

Evaluation

1. **Good (green):** ≤12 µg/m^3 och år
2. **Acceptable (yellow):** 12–25 µg/m^3 och år
3. **Bad (red):** ≥25 µg/m^3 och år

Evaluation Reference

Scientific. Based on EU-wide air quality standards.

EUROPEAN COMISSION (N.D.) EU AIR QUALITY STANDARDS. HTTPS://ENVIRONMENT.EC.EUROPA.EU/TOPICS/AIR/AIR-QUALITY/EU-AIR-QUALITY-STANDARDS_EN [2024-04-10]

Luftkvalitet (NO_x årsmedel)

Motivation

Air quality affects both road users and local residents and workers. Nitrogen oxides have negative health effects and impact the respiratory system, primarily in sensitive individuals, such as those with asthma. Nitrogen oxides also contribute to eutrophication and acidification of forests, soil, and water.

Description

Concentration of air pollutants with respect to oxides of nitrogen, expressed as an annual average. The urban concentration is set at an average level. The emission factor is weighed together based on vehicle composition and the fact that the traffic flow is normally distributed as 95 per cent free flow and five per cent queues. Trees have been shown to be able to reduce particle levels locally by up to 10 percent, which is assumed to apply to a fully tree-planted street with 20 trees per 100 meters. The reduction is assumed to decrease linearly with the number of trees down to zero.

Unit

Micrograms per cubicmeter (µg/cbm).

Formula

In order to calculate air quality, the composite emission factor of traffic must be calculated.

Emission factor at speeds up to 30 km/h:

$$Emission\ Factor\ (mg/vkt) = (1 - 0{,}01 \times \boldsymbol{Heavy\ Traffic}) \times 0{,}27 + \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}} \times 1.77 + \left(0.01 \times \boldsymbol{Heavy\ Traffic} - \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}}\right) \times 2.32$$

Emission factor at speed above 30 km/h:

$$Emission\ Factor\ (mg/vkt) = (1 - 0{,}01 \times \boldsymbol{Heavy\ Traffic}) \times 0{,}27 + \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}} \times 2.07 + \left(0.01 \times \boldsymbol{Heavy\ Traffic} - \frac{\boldsymbol{Transit\ Traffic}}{\boldsymbol{Motor\ Traffic}}\right) \times 1.91$$

With emission factor below 0.8 mg/vkt and street width up to 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} = (12 + 0.0005 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\dfrac{\boldsymbol{Trees}}{\boldsymbol{Analyzed\ Street\ Length}}}{0.2}\right)$$

With emission factor less than 0.8 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} = (12 + 0.0003 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\dfrac{\boldsymbol{Trees}}{\boldsymbol{Analyzed\ Street\ Length}}}{0.2}\right)2$$

With emission factor below 1.2 mg/vkt and street width up to 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00075 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor below 1.2 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00046 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor less than 1.6 mg/vkt and street width up to 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00105 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With the emission factor is less than 1.6 mg/vkt and the street width is more than 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00065 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factors below 2 mg/vkt and street width up to 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00135 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor less than 2 mg/vkt and street width greater than 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00083 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor from 2 mg/fkm and street width up to 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00164 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\boldsymbol{Trees}}{\frac{\boldsymbol{Analyzed\ Street\ Length}}{0.2}}\right)$$

With emission factor from 2 mg/fkm and street width greater than 30 m:

$$\boldsymbol{Luftkvalitet\ (PM_{10}\ årsmedel)} =$$

$$(12 + 0.00102 \times \boldsymbol{Motor\ Traffic}) \times \left(1 - 0.05 \times \frac{\frac{\boldsymbol{Trees}}{\boldsymbol{Analyzed\ Street\ Length}}}{0.2}\right)$$

Formula Reference

Investigated.

TOMAS WISELL, PROJECT MANAGER AND RESEARCHER AT THE SWEDISH ENVIRONMENTAL RESEARCH INSTITUTE IVL, PHONE CALL ON MARCH 7, 2023

FOLTESCU, V. L., GIDHAGEN, L. & OMSTEDT, G. (2004). NOMOGRAM FÖR UPPSKATTNING AV HALTER AV PM10 OCH NO2 - REVIDERAD VERSION (DECEMBER 2004). SMHI (NR. 102). HTTPS://WWW.SMHI.SE/POLOPOLY_FS/1.166757!/METEOROLOGI_102%20NOMOGRAM%20F%C3%B6R%20UPPSKATTNING%20AV%20HALTER%20AV%20PM10%20OCH%20NO2.PDF

BRYDOLF, M. & SJÖVALL, B. (2018). BAKGRUNDSHALTER AV PARTIKLAR (PM10, PM2,5) OCH KVÄVEOXIDER (NOX, NO2) VID ALVA MYRDALS GATA 5 I ESKILSTUNA. SLB (3:2019). HTTPS://WWW.SLBANALYS.SE/SLB/RAPPORTER/PDF8/SLB2019_003.PDF

SANTIAGO, J-L., RIVAS, E., SANCHEZ, B,, BUCCOLIERI, R. & MARTIN, F. (2017). THE IMPACT OF PLANTING TREES ON NOX CONCENTRATIONS: THE CASE OF THE PLAZA DE LA CRUZ NEIGHBORHOOD IN PAMPLONA (SPAIN). ATMOSPHERE, 8(131). HTTPS://DOI.ORG/10.3390/ATMOS8070131

Evaluation

1. **Good (green):** ≤26 µg/m^3 and year
2. **Acceptable (yellow):** 40–26 µg/m^3 and year
3. **Bad (red):** ≥40 µg/m^3 and year

Evaluation Reference

Scientific. Based on EU-wide air quality standards.

EUROPEAN COMISSION (N.D.) EU AIR QUALITY STANDARDS. HTTPS://ENVIRONMENT.EC.EUROPA.EU/TOPICS/AIR/AIR-QUALITY/EU-AIR-QUALITY-STANDARDS_EN [2024-04-10]

Increased Risk of Asthma Attack

Motivation

Asthmatics are a particularly vulnerable group when it comes to air pollution. Increased emissions have a direct impact on the number of hospital visits.

Description

Daily increase in the number of acute, asthma-related sick visits caused by particulate emissions from motor traffic on the street, compared to a street completely without motor traffic. Based on studies, visits can be assumed to increase by four per cent for every ten micrograms per cubic metre of increased daily average concentration of PM_{10}. The daily average level of coarse particles has been shown to be 1.95 of the annual average.

Unit

Percent (%).

Formula

$$\boldsymbol{Increased\ Risk\ of\ Asthma\ Attack} = 4 \times \frac{\boldsymbol{Air\ Quality\ (PM_{10}\ Annual\ Mean)} \times 1.95}{10}$$

Formula Reference

TORNEVI, A. & FORSBERG, B. (2020). SAMBAND MELLAN PARTIKELHALTEN I VISBY OCH AKUTA KONTAKTER FÖR ASTMA OCH SJUKDOMAR I ANDNINGSORGANEN. HÄMTAD FRÅN UMEÅ UNIVERSITET, INSTITUTIONEN FÖR FOLKHÄLSA OCH KLINISK MEDICIN, AVDELNINGEN FÖR HÅLLBAR HÄLSA. HTTPS://URN.KB.SE/RESOLVE?URN=URN:NBN:SE:UMU:DIVA-179225

Evaluation

1. **Good (green):** ≤16 %
2. **Acceptable (yellow):** 16–31 %
3. **Bad (red):** ≥31 %

Evaluation Reference

Scientific. Based on EU-wide air quality standards.

EUROPEAN COMISSION (N.D.) EU AIR QUALITY STANDARDS. HTTPS://ENVIRONMENT.EC.EUROPA.EU/TOPICS/AIR/AIR-QUALITY/EU-AIR-QUALITY-STANDARDS_EN [2024-04-10]

Social

Meeting Place

Motivation

Visitors form the customer base for services along the street and give rise to potential encounters between people.

Description

Pedestrians, cyclists and arriving motorists lay the foundation for the street's potential encounters. The turnover at the on-street car parking spaces is assumed to relate linearly to the street's motor traffic flow and vary from one arriving vehicle per hour and landing place on the largest of the inner city streets (corresponding to a motor traffic flow of 20,000 vehicles per day) down to zero if the street is completely car-free or has no docking places.

Unit

People per day (people/day).

Formula

$$\boldsymbol{Meeting\ Place} =$$

$$\boldsymbol{Pedestrian\ Traffic} + \boldsymbol{Bike\ Traffic} + 0.0006 \times \boldsymbol{On - Street\ Car\ Parking} \times \boldsymbol{Motor\ Traffic}$$

Formula Reference

Rational.

Evaluation

1. **Good (green):** >5000 people/day
2. **Acceptable (yellow):** 1000–5000 people/day
3. **Bad (red):** <1000 people/day

Evaluation Reference

Investigated. Good level corresponds to the lower limit for a place to be perceived as thriving.

SPACESCAPE (2019). LEVANDE STADSMILJÖER. HTTPS://ASSETS.CTFASSETS.NET/GHGQ5OOI403R/1KCIMDM7KOHXK9Y0JLDZFG/0CBC1732A49D46F696AB56CC4FD1A411/RAPPORT_LEVANDE_STADSMILJO_190629.PDF

Safe Street Space

Motivation

Entrances have a positive impact on safety on the street by increasing the actual and perceived presence of residents and workers, which in turn increases people's freedom of movement in general and women's in particular.

Description

Number of entrances per 100 meters. The calculation assumes that the two sides of the street are built and that the entrances are evenly spaced on both of them.

Unit

Entrances per 100 meter (entrances/100 m).

Formula

$$\boldsymbol{Doorway\ Density} = 100 \times \frac{\frac{\boldsymbol{Entrances}}{2}}{\boldsymbol{Analyzed\ Street\ Length}}$$

Formula Reference

Rational.

Evaluation

1. **Good (green):** ≥15 entrances/100 m
2. **Acceptable (yellow):** 10–15 entrances/100 m
3. **Bad (red):** <10 entrances/100 m

Evaluation Reference

Scientific.

GEHL, J., LOTTE JOHANSEN KAEFER, L. & REIGSTAD, S. (2006). CLOSE ENCOUNTERS WITH BUILDINGS. URBAN DESIGN INTERNATIONAL, 11, SS. 29-47. DOI:10.1057/PALGRAVE.UDI.9000162

Surface Illumination

Motivation

Well-lit streets are perceived as safer, which increases people's freedom of movement in general and women's in particular.

Description

Percentage of the total area of the street that is illuminated. The lighting fixtures are assumed to be mounted on poles with an average height of eight meters.

Unit

Percent (%).

Formula

$$\boldsymbol{Surface\ Illumination} = \frac{8 \times 1.5 \times 4 \times 8 \times \boldsymbol{Light\ Sources}}{\boldsymbol{Analyzed\ Street\ Length} \times \boldsymbol{Total\ Street\ Width}}$$

Formula Reference

Geometrisk.

GIDLUND, H. (2019). FYLLER MIN ANLÄGGNING DAGENS KRAV FÖR VÄGBELYSNING? VÄGBELYSNING – DEL 3. LJUSKULTUR, 27 NOVEMBER. HTTPS://LJUSKULTUR.SE/ARTIKLAR/FYLLER-MIN-ANLAGGNING-DAGENS-KRAV-FOR-VAGBELYSNING/

Evaluation

1. **Good (green):** >90 %
2. **Acceptable (yellow):** 70–90 %
3. **Bad (red):** <70 %

Evaluation Reference

Rational.

GDCI (2016) GLOBAL STREET DESIGN GUIDE. HTTPS://GLOBALDESIGNINGCITIES.ORG/PUBLICATION/GLOBAL-STREET-DESIGN-GUIDE/

Public Seating

Motivation

Benches make it possible to pause and rest when needed and are an important factor in accessibility for the elderly.

Description

Average distance between benches and other public seating. The benches are assumed to be evenly spaced on one side of the street.

Unit

Meters between benches (m between benches).

Formula

$$\textbf{Public Seating} = \frac{\textbf{Analyzed Street Length}}{\textbf{Benches}}$$

Formula Reference

Rational.

Evaluation

1. **Good (green):** ≤100 m
2. **Acceptable (yellow):** 100–200
3. **Bad (red):** >200 m

Evaluation Reference

Rational. Based on Swedish accessibility recommendations.

THE CITY OF STOCKHOLM (2008). STOCKHOLM – EN STAD FÖR ALLA. HTTPS://TILLSTAND.STOCKHOLM/GLOBALASSETS/FORETAG-OCH-ORGANISATIONER/TILLSTAND-OCH-REGLER/TILLSTAND-REGLER-OCH-TILLSYN/LOKAL-OCH-FASTIGHETER/HANDBOCKER-OCH-RIKTLINJER-VID-BYGGNATION-I-STOCKHOLM/STOCKHOLM_EN-STAD-FOR-ALLA.PDF

UPPSALA MUNICIPALITY (2019). RIKTLINJER FÖR SITTPLATSER PÅ ALLMÄN PLATS I UPPSALA KOMMUN. HTTPS://WWW.UPPSALA.SE/CONTENTASSETS/CB3097FB4184423CB1F1A45D18FE2AAA/RIKTLINJER-FOR-SITTPLATSER-PA-ALLMAN-PLATS-I-UPPSALA-KOMMUN.PDF

Outdoor Dining

Motivation

Outdoor dining populates the streetscape and contribute to the attractiveness of the urban environment.

Description

Total number of seats on outdoor dining areas. A seat is assumed to occupy one square meter.

Unit

Seatings (seatings).

Formula

$$\boldsymbol{Outdoor\ Dining} = \boldsymbol{Outdoor\ Dining} \times 1$$

Formula Reference

Rational.

Evaluation

1. **Good (green):** ≥0,02 seating/m^2
2. **Acceptable (yellow):** >0
3. **Bad (red):** 0

Evaluation Reference

Investigated. Good level corresponds to a limit on the number of seats per square meter that most thriving places are above. Acceptable level is achieved if the street has some form of outdoor seating.

SPACESCAPE (2019). LEVANDE STADSMILJÖER. HTTPS://ASSETS.CTFASSETS.NET/GHGQ5OOI403R/1KCIMDM7KOHXK9Y0JLDZFG/0CBC1732A49D46F696AB56CC4FD1A411/RAPPORT_LEVANDE_STADSMILJO_190629.PDF

Economy

Residential Value Creation

Motivation

Higher housing values have a positive effect on the economy and economic growth in general. Increased housing values can also bring with it an increased risk of gentrification, which can have negative social consequences.

Description

Percentage of the value of housing that can be attributed to the design and use of the street. The increase in value is assumed to be linear within a critical range. Changes outside the range are not expected to increase or decrease the value. A pedestrian street corresponds to a speed of five kilometers per hour and means maximum value creation of ten per cent. Above 30 kilometers per hour, the speed has no impact on the value of the home. A street with 20 trees per 100 meters is assumed to be maximally tree planted, corresponding to the maximum value creation of five percent. Similarly, a fully activated street is assumed to house 20 retail businesses per 100 meters, explaining five percent of the residential value.

Unit

Percent (%).

Formula

$$\boldsymbol{Residential\ Value\ Creating} = 100 \times (Speed\ Component + Tree\ Component + Retail\ Component)$$

With speed up to 5 km/h:

$$Speed\ Component = 0.1$$

With speed between 5 and 30 km/h:

$$Speed\ Component = 0.12 - 0.004 \times \boldsymbol{Speed}$$

With speed above 30 km/h:

$$Speed\ Component = 0$$

With up to 20 trees per 100 m of street:

$$Tree\ Component = 0.0025 \times \boldsymbol{Trees}$$

With more than 20 trees per 100 m of street:

$$Tree\ Component = 0.05$$

With up to 20 retail businesses on the ground floor per 100 meters of street:

$$Retail\ Component = 0.0025 \times \boldsymbol{Retail\ Along\ Street}$$

With more than 20 retail businesses on the ground floor per 100 meters of street:

$$Retail\ Component = 0.05$$

Formula Reference

Investigated.

SPACESCAPE, EVIDENS, THE CITY OF GOTHENBURG & THE GOTHENBURG REGION (2016). VÄRDESKAPANDE STADSUTVECKLING. HTTPS://GOTEBORGSREGIONEN.SE/DOWNLOAD/18.7C48537717DC24F2564176F4/1641811338050/V%C3%A4RDESKAPANDE%20STADSUTVECKLING_WEBB.PDF

Evaluation

1. **Good (green):** >10 %

2. **Acceptable (yellow):** 5–10 %
3. **Bad (red):** <5 %

Evaluation Reference

Investigated. The levels are based on probable fluctuations in housing prices in the Swedish housing market. A good level means that the street's contribution to the value of the home is likely to provide good compensation for depreciation in connection with a recession. Acceptable level takes into account statistical uncertainties and means that the street is likely to contribute to some extent to the value of the home.

SWEDISH BROKER STATISTICS (2024). PRISUTVECKLING RIKET. HTTPS://WWW.MAKLARSTATISTIK.SE/OMRADE/RIKET/#/BOSTADSRATTER/48M-PRISUTVECKLING [24-03-28]

Office Value Creation

Motivation

Higher office rents have a positive effect on the economy. Increased office rents can also lead to an increased risk of gentrification, which can have negative social consequences.

Description

Percentage of the value of office properties that can be attributed to the design and use of the street. The increase in value is assumed to be linear within a critical range. Changes outside the range are not expected to increase or decrease the value. A street with 20 retail companies per 100 meters is assumed to be fully activated, corresponding to a maximum value creation of five percent.

Unit

Percent (%).

Formula

With up to 20 retail companies on the ground floor per 100 m street:

$$\boldsymbol{Office\ Value\ Creation} = 0.015 \times \boldsymbol{Retail\ Along\ Street}$$

With more than 20 retail companies on the ground floor per 100 m of street:

$$\boldsymbol{Office\ Value\ Creation} = 0.3$$

Formula Reference

Investigated.

SPACESCAPE, EVIDENS, THE CITY OF GOTHENBURG & THE GOTHENBURG REGION (2016). VÄRDESKAPANDE STADSUTVECKLING. HTTPS://GOTEBORGSREGIONEN.SE/DOWNLOAD/18.7C48537717DC24F2564176F4/1641811338050/V%C3%A4RDESKAPANDE%20STADSUTVECKLING_WEBB.PDF

SPACESCAPE, RAMBOLL & REGION SKÅNE (2019). STADSKVALITETER I SKÅNE. HTTPS://UTVECKLING.SKANE.SE/SITEASSETS/PUBLIKATIONER/STADSKVALITETER-I-SKANE-KORTVERSION.PDF

Evaluation

1. **Good (green):** >10 %
2. **Acceptable (yellow):** 5–10 %
3. **Bad (red):** <5 %

Evaluation Reference

Investigated. The levels are based on likely fluctuations in office rents. A good level means that the street's contribution to the value of the office property is likely to provide good compensation for decreases in value in connection with a recession. Acceptable level takes into account statistical uncertainties and means that the street is likely to contribute to some extent to the value of the office property.

SWEDISH BROKER STATISTICS (2024). PRISUTVECKLING RIKET. HTTPS://WWW.MAKLARSTATISTIK.SE/OMRADE/RIKET/#/BOSTADSRATTER/48M-PRISUTVECKLING [24-03-28]

On-Street Car Parking Revenue

Motivation

Revenue from car parking contributes to the national economy and economic growth in general.

Description

Total annual revenue from the on-street car parking. The proportion of paying cars is assumed to relate linearly to the number of retail companies, from a base value of ten percent on a residential street without businesses up to a maximum activated street with 20 retail companies per 100 meters. The parking spaces are assumed to be subject to a fee for half the day and have an average occupancy rate of 50 percent.

Unit

Thousand kronor per year (tSEK/year).

Formula

With up to 20 retail companies per 100 m of street:

$$\boldsymbol{On-Street\ Car\ Parking\ Revenue} =$$

$$\left(0.10 + \frac{100 \times 0.045 \times \boldsymbol{Retail\ Along\ Street}}{\boldsymbol{Analysed\ Street\ Length}}\right) \times$$

$$\boldsymbol{On-Street\ Car\ Parking} \times \frac{\boldsymbol{On-Street\ Parking\ Fee}}{1000} \times 12 \times 365 \times 0.5$$

With more than 20 retail companies per 100 m of street:

$$\boldsymbol{On-Street\ Car\ Parking\ Revenue} =$$

$$\boldsymbol{On-Street\ Car\ Parking} \times \frac{\boldsymbol{On-Street\ Parking\ Fee}}{1000} \times 12 \times 365 \times 0.5$$

Formula Reference

Rational.

Evaluation

1. **Good (green):** On-Street Car Parking Fee≥20 SEK/h
2. **Acceptable (yellow):** On-Street Car Parking Fee 5–20 SEK/h
3. **Bad (red):** On-Street Car Parking Fee<5 SEK/h

Evaluation Reference

Investigated. Based on reasonable on-street parking fees.

THE CITY OF STOCKHOLM (2023) TAXEOMRÅDEN OCH PARKERINGSAVGIFTER. HTTPS://PARKERING.STOCKHOLM/BETALA-PARKERING/TAXEOMRADEN-AVGIFTER/ [2023-08-15]

Mobility

Safe Walking from Age

Motivation

Traffic safety affects the child-friendliness of the city and is a very important factor in children's chances of moving around independently.

Description

Minimum age of children who can walk and stay on the street in a safe manner. The calculations are based on limit values for when the traffic situation is to be assessed as safe based on motor traffic flow and speed.

Unit

Years (years).

Formula

With speed up to 10 km/h and motor traffic below 2,000 vehicles per day:

$$\boldsymbol{Safe\ Walking\ from\ Age} = 5\ years$$

With speed up to 10 km/h and motor traffic from 2000 vehicles per day:

$$\boldsymbol{Safe\ Walking\ from\ Age} = 8\ years$$

With speed between 10 and 20 km/h and motor traffic below 8 000 vehicles per day:

$$\boldsymbol{Safe\ Walking\ from\ Age} = 8\ years$$

With speed between 10 and 20 km/h and motor traffic from 8,000 vehicles per day:

$$\boldsymbol{Safe\ Walking\ from\ Age} = 10\ years$$

With speed above 20 km/h:

$$\boldsymbol{Safe\ Walking\ from\ Age} = 10\ years$$

Without pedestrian clear zone:

$$\boldsymbol{Safe\ Walking\ from\ Age} = 10\ years$$

Formula Reference

Investigated. Based on investigations and recommendations regarding traffic maturity from the Swedish non-governmental organization The National Federation for Road Safety.

THE NATIONAL FEDERATION FOR ROAD SAFETY (N.D). NÄR ÄR BARN TRAFIKMOGNA. HTTPS://NTF.SE/FRAGOR-OCH-SVAR/BARN-I-TRAFIKEN/PA-EGEN-HAND/NAR-AR-BARN-TRAFIKMOGNA/ [2023-02-21]

Evaluation

1. **Good (green):** 5 years
2. **Acceptable (yellow):** 8 years
3. **Bad (red):** 10 years

Evaluation Reference

Rational.

THE SWEDISH TRANSPORT ADMINISTRATION (2022). NOLLVISIONEN – TILLSAMMANS RÄDDAR VI LIV. HTTPS://BRANSCH.TRAFIKVERKET.SE/FOR-DIG-I-BRANSCHEN/SAMARBETE-MED-BRANSCHEN/SAMARBETEN-FOR-TRAFIKSAKERHET/TILLSAMMANS-FOR-NOLLVISIONEN/ [2023-02-21]

SPACESCAPE (2022). BARNS TRYGGHET I TRAFIKEN. HTTPS://WWW.SPACESCAPE.SE/WP-CONTENT/UPLOADS/2023/01/BARNS-TRAFIKTRYGGHET-I-MALMO_221221_LOWRES.PDF

Safe Biking from Age

Motivation

Traffic safety affects the child-friendliness of the city and is a very important factor in children's chances of moving around independently.

Description

Minimum age of children who can ride a bicycle on the street in a safe manner. The calculations are based on limit values for when mixed traffic and conventional bike lanes can be considered to be traffic-safe situations based on motor traffic flow and speed. The fact that Swedish law allows children to ride on the pavement until the age of 8 is used as a reference point.

Unit

Years (years).

Formula

With speed of up to 10 km/h and motor traffic below 2,000 vehicles per day:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 5\ years$$

With speed up to 10 km/h and motor traffic from 2000 vehicles per day:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 8\ years$$

With speed between 10 and 20 km/h and motor traffic below 2 000 vehicles per day:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 8\ years$$

With speed between 10 and 20 km/h and motor traffic between 2 000 and 5 000 vehicles per day, with conventional or protected bike lanes:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 8\ years$$

With speed between 10 and 20 km/h and motor traffic between 2,000 and 5,000 vehicles per day, without conventional or protected bike lanes:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 12\ years$$

With speed between 10 and 20 km/h and motor traffic from 5,000 vehicles per day, with protected bike lanes:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 8\ years$$

With speed between 10 and 20 km/h and motor traffic from 5,000 vehicles per day, without conventional or protected bike lanes:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 12\ years$$

With speed between 20 and 30 km/h and motor traffic below 5 000 vehicles per day:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 12\ years$$

With speed between 20 and 30 km/h and motor traffic over 5,000 vehicles per day, with protected bike lanes:

$$\boldsymbol{Safe\ Biking\ from\ Age} = 12\ years$$

With speed between 20 and 30 km/h and motor traffic over 5,000 vehicles per day, without conventional or protected bike lanes:

$$\boldsymbol{Safe\ Biking\ from\ Age} = No$$

With speed above 40 km/h:

$$\boldsymbol{Safe\ Biking\ from\ Age} = No$$

Formula Reference

Investigated.

THE NATIONAL FEDERATION FOR ROAD SAFETY (N.D). BARN SOM TRAFIKANTER. HTTPS://NTF.SE/NTF-ANSER/BARN-SOM-TRAFIKANTER/#:~:TEXT=I%20M%C3%A5TTLIGT%20TRAFIKERAD%20MILJ%C3%B6%20KAN,MAN%20V%C3%A4NTA%20YTTERLIGARE%20N%C3%A5GRA%20%C3%A5R.&TEXT=CYKELHJ%C3%A4LMSLAGEN%20G%C3%A4LLER%20UPP%20TILL%2015%20%C3%A5RS%20%C3%A5LDER [2023-10-19]

THE NATIONAL FEDERATION FOR ROAD SAFETY (N.D). NÄR ÄR BARN TRAFIKMOGNA. HTTPS://NTF.SE/FRAGOR-OCH-SVAR/BARN-I-TRAFIKEN/PA-EGEN-HAND/NAR-AR-BARN-TRAFIKMOGNA/ [2023-02-21]

SFS 1998:1276. TRAFIKFÖRORDNINGEN, 3 KAP. 12 A §.

Evaluation

1. **Good (green):** 5 years
2. **Acceptable (yellow):** 8 years
3. **Bad (red):** 12 years and No

Evaluation Reference

Rational. Based on the Swedish concept Vision Zero.

THE SWEDISH TRANSPORT ADMINISTRATION (2022). NOLLVISIONEN – TILLSAMMANS RÄDDAR VI LIV. HTTPS://BRANSCH.TRAFIKVERKET.SE/FOR-DIG-I-BRANSCHEN/SAMARBETE-MED-BRANSCHEN/SAMARBETEN-FOR-TRAFIKSAKERHET/TILLSAMMANS-FOR-NOLLVISIONEN/ [2023-02-21]

Passenger Capacity

Motivation

Capacity affects the transport efficiency and accessibility of the street network.

Description

Maximum number of road users theoretically able to travel along the street per hour. A pedestrian path is estimated to be able to transport 1000 people per meter of width and a cycle lane 700 people. The capacity per public transport lane is estimated at 1700 people and for vehicle lanes 900.

Unit

People per hour (people/h).

Formula

$$\boldsymbol{Passenger\ Capacity} =$$

$$\boldsymbol{Pedestrian\ Clear\ Zone} \times 1000 + (\boldsymbol{Conventional\ Bike\ Lanes} + \boldsymbol{Protected\ Bike\ Lanes}) \times 700 +$$

$$\boldsymbol{Number\ of\ Transit\ Lanes} \times 1700 + \boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes} \times 900$$

Formula Reference

GDCI (2016). Global Street Design Guide. https://globaldesigningcities.org/publication/global-street-design-guide/

Spacescape, KTH, Chalmers, VTI, White & Sweco (2022). Designguide för smarta gator. https://www.diva-portal.org/smash/get/diva2:1670683/FULLTEXT01.pdf

Evaluation

1. **Good (green):** >10 000 people/h
2. **Acceptable (yellow):** 5 000–10 000 people/h
3. **Bad (red):** <5 000 people/h

Evaluation Reference

Investigated.

Spacescape, KTH, Chalmers, VTI, White & Sweco (2022). Designguide för smarta gator. https://www.diva-portal.org/smash/get/diva2:1670683/FULLTEXT01.pdf

Bus Speed

Motivation

The accessibility of bus traffic is crucial for its competitiveness in relation to the car.

Description

Average speed of bus traffic along the route, including bus stop time. Based on studies, it can be assumed that that free flow, and thus maximum bus speed, prevails up to motor traffic flow of 2000 motor vehicles per day, after which the bus speed drops down to zero with the maximum occupancy level of 9000 motor vehicles per day and lane. Transit lanes correspond to a situation with free flow and maximum average bus speed. The latter is based on Swedish target values for bus traffic and related to the street's posted speed.

Unit

Kilometers per hour (km/h).

Formula

Without transit lanes and speed up to 30 km/h:

$$\boldsymbol{Bus\ Speed} = 19.6 - 4 \times 10^{-11} \times \left(\frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}\right)^3 + 1 \times 10^{-7} \times \left(\frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}\right)^2 + 7 \times 10^{-5} \times \frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}$$

Without transit lanes and speed between 30 and 40 km/h:

$$\boldsymbol{Bus\ Speed} = 24.5 - 5 \times 10^{-11} \times \left(\frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}\right)^3 + 1 \times 10^{-7} \times \left(\frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}\right)^2 + 9 \times 10^{-5} \times \frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}$$

Without transit lanes and speed above 40 km/h:

$$\boldsymbol{Bus\ Speed} = 29.4 - 6 \times 10^{-11} \times \left(\frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}\right)^3 + 2 \times 10^{-7} \times \left(\frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}\right)^2 + 1 \times 10^{-4} \times \frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes}}$$

With two transit lanes and speed up to 30 km/h:

$$\boldsymbol{Bus\ Speed} = 20$$

With two transit lanes and speed between 30 and 40 km/h:

$$\boldsymbol{Bus\ Speed} = 25$$

With two transit lanes and speed from 40 km/h:

$$\boldsymbol{Bus\ Speed} = 30$$

With transit lanes in one direction:

$$\boldsymbol{Bus\ Speed} = \textit{Mean value of speed without and with two transit lanes}$$

Formula Reference

Investigated.

THE SWEDISH TRANSPORT ADMINISTRATION (2013). TRVMB KAPACITET OCH FRAMKOMLIGHETSEFFEKTER (TRV 2013:64343). HTTPS://BRANSCH.TRAFIKVERKET.SE/CONTENTASSETS/32CE05ECC3AC458BB8ECB802E8E2DA54/TRVMB_KAPACITET_OCH_FRAMKOMLIGHETSEFFEKTER.PDF

Evaluation

1. **Good (green):** ≥30 km/h
2. **Acceptable (yellow):** 20–30 km/h
3. **Bad (red):** <20 km/h

Evaluation Reference

Rational. Based on Swedish target standards for bus traffic.

REGION STOCKHOLM. (2022). KOLLEKTIVTRAFIKPLAN 2050. HTTPS://WWW.REGIONSTOCKHOLM.SE/490684/SITEASSETS/8.-OM-REGION-STOCKHOLM/OM-REGION-STOCKHOLM/STYRANDE-DOKUMENT/8.-KOLLEKTIVTRAFIK/KOLLEKTIVTRAFIKPLAN-2050.PDF

Motor Traffic Level of Service

Motivation

Accessibility and queues affect the car's competitiveness in relation to other modes of transport.

Description

The occupancy rate of the travel lanes based on maximum traffic capacity. A lower occupancy rate means better accessibility. Based on studies, one lane can be assumed to have a capacity of 9000 vehicles per day.

Unit

Percent (%).

Formula

$$\boldsymbol{Motor\ Traffic\ Level\ of\ Service} = 100 \times \frac{\boldsymbol{Motor\ Traffic}}{\boldsymbol{Number\ of\ Vehicle\ Travel\ Lanes} \times 9000}$$

Formula Reference

GDCI (2016). Global Street Design Guide. https://globaldesigningcities.org/publication/global-street-design-guide/

Spacescape, KTH, Chalmers, VTI, White & Sweco (2022). Designguide för smarta gator. https://www.diva-portal.org/smash/get/diva2:1670683/FULLTEXT01.pdf

Evaluation

1. **Good (green):** ≤60 %
2. **Acceptable (yellow):** 60–80 %
3. **Bad (red):** >80 %

Evaluation Reference

Investigated. The occupancy rate should not exceed 0.6 at junctions and 0.8 at stretch according to Swedish standards.

The Swedish Transport Administration (2022). VGU Krav. http://trafikverket.diva-portal.org/smash/get/diva2:1621296/FULLTEXT02.pdf

On-Street Car Parking Access

Motivation

Affects the accessibility of people with disabilities and deliveries as well as the proportion of flex zone used for stationary vehicles.

Description

Describes the amount of car access in relation to how active the street is and the extent to which different types of access (goods deliveries, disabled parking and regular visitor parking) are shared. Entrances are assumed to be evenly spaced along both sides of the street. Parking spaces are assumed to be evenly spaced along one side of the street. On shared streets without marked parking spaces, it is assumed that it will be possible to stop everywhere, and that each space is 6 meters long. A line means that the street has parking but no entrances.

Unit

Spaces per entrance (spaces/entrance).

Formula

Without transit lanes, vehicle travel lanes or on-street car parking:

$$\boldsymbol{On-Street\ Car\ Parking\ Access} = \frac{\frac{\boldsymbol{Analyzed\ Street\ Length}}{6}}{\boldsymbol{Entrances}}$$

På övriga gator:

$$\boldsymbol{On-Street\ Car\ Parking\ Access} = \frac{\boldsymbol{On-Street\ Car\ Parking}}{\boldsymbol{Entrances}}$$

Formula Reference

Rational.

Evaluation

1. **Good (green)**:
    a. If distance between entrances≥25 m: 1 space/entrance
    b. If distance between entrances <25 m: 25 m between entrances
    c. If there are no entrances: 0 pcs/entrance
    d. If there are no transit lanes, vehicle travel lanes or on-street car parking
2. **Acceptable (yellow):**
    a. If distance between entrances≥25 m: 0.8–1 or 1–1.2 spaces/entrance
    b. If distance between entrances<25 m: 20-25 or 25-30 m between spaces
3. **Bad (red):**
    a. If distance between entrances≥25 m: <0.8 or >1.2 pcs/entrance
    b. If distance between entrances<25 m: 0 spaces/entrance or <20 m between places or >30 m between spaces
    c. If there are no entrances: >0 spaces/entrance

Evaluation Reference

Rational. Based on Swedish accessibility regulations that require the ability to stop with a car on the street within 25 meters from an entrance to every building.

THE SWEDISH NATIONAL BOARD OF HOUSING, BUILDING AND PLANNING (N.D.). VAD GÄLLER FÖR ANGÖRINGSPLATS OCH PARKERINGSPLATS VID BOSTÄDER? HTTPS://WWW.BOVERKET.SE/SV/OM-BOVERKET/PUBLICERAT-AV-BOVERKET/FRAGOR--SVAR/BBR-BOVERKETS-BYGGREGLER/AVSNITT-3-TILLGANGLIGHET-MED-

MERA/TILLGANGLIGHET/10/#:~:TEXT=VID%20UPPF%C3%B6RANDE%20AV%20BYGGNAD%20SKA,REGLERNA%20G%C3%A4LLER%20%C3%A4VEN%20F%C3%B6R%20SM%C3%A5HUS. [2023-02-21]

On-Street Bike Parking Access

Motivation

Affects accessibility, the attractiveness of the bicycle as a means of transport and the risk of incorrectly parked bicycles.

Description

Demonstrate accessibility by bike in the same way as by car. A dash means that the street has no entrances.

Unit

Places per entrance (places/entrance).

Formula

$$\boldsymbol{On-Street\ Bike\ Parking\ Access} = \frac{\boldsymbol{On-Street\ Bike\ Parking}}{\boldsymbol{Entrances}}$$

Formula Reference

Rational.

Evaluation

1. **Good (green):**
    a. Without entrances: Number of on-street bike parking≥0
    1. If there are entrances: ≥2 places/entrance
1. **Acceptable (yellow):** 1–2 places/entered
2. **Bad (red):** <1 place/entrance

Evaluation Reference

Rational. Based on bicycle parking standards for retail companies, it is estimated that each entrance needs two bicycle parking spaces.

SJÖBO MUNICIPALITY. (2021). MOBILITETSNORM FÖR SJÖBO TÄTORT. HTTPS://WWW.SJOBO.SE/DOWNLOAD/18.5C545E7717842D07A559E98A/1617011644319/MOBILITETSNORM.PDF

GÄVLE MUNICIPALITY. (2021). MOBILITETSNORM FÖR GÄVLE KOMMUN. HTTPS://MEETINGSPLUS.GAVLE.SE/WELCOME-SV/NAMNDER-STYRELSER/KOMMUNFULLMAKTIGE/MOTE-2021-06-21/AGENDA/MOBILITETSNORM-FOR-GAVLE-KOMMUN-RIKTLINJER-FOR-PARKERING-OCH-ANDRA-MOBILITETSLOSNINGAR-I-DETALJPLANER-OCH-BYGGLOV-UPPDATERAD-VERSION-2021-02-16PDF?DOWNLOADMODE=OPEN

Wheelchair Width

Motivation

Affects accessibility, mobility and city life through the opportunity to walk and talk in groups.

Description

Number of pedestrians and wheelchairs that can meet or travel parallel per pedestrian zone. The pedestrian clear zone is assumed to be divided into two equally wide walkways on each side of the street, except on shared spaces. Each pedestrian or wheelchair is estimated to need a width of one meter.

Unit

Chairs per side (chairs/side).

Formula

$$\boldsymbol{Wheelchair\ Width} = \frac{\boldsymbol{Pedestrian\ Clear\ Zone}}{\frac{2}{1}}$$

Formula Reference

Rational.

SPACESCAPE, KTH, CHALMERS, VTI, WHITE & SWECO (2022). DESIGNGUIDE FÖR SMARTA GATOR. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1670683/FULLTEXT01.PDF

THE SWEDISH TRANSPORT ADMINISTRATION (2022). VGU BEGREPP OCH GRUNDVÄRDEN. HTTP://TRAFIKVERKET.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1621296/FULLTEXT02.PDF

Evaluation

1. **Good (green):** ≥3 chairs per side
2. **Acceptable (yellow):** 2–3 chairs per side
3. **Bad (red):** <2 chairs per side

Evaluation Reference

Rational.

SPACESCAPE, KTH, CHALMERS, VTI, WHITE & SWECO (2022). DESIGNGUIDE FÖR SMARTA GATOR. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1670683/FULLTEXT01.PDF

Biking Width

Motivation

Affects mobility and the possibility of bicyclists to overtake each other as well as traffic safety, which in turn affect the bike's competitiveness compared to other modes of transport.

Description

Total number of cyclists that fit in width on the street, without regard to the direction and side of the street. On shared streets and streets with both speeds of up to 30 kilometers per hour and motor traffic up to 3000 vehicles per day, cyclists are considered to be able to operate in mixed traffic. On streets with speeds over 30 kilometers per hour or motor traffic over 3000 vehicles per day, conventional bicycle lanes are not counted due to lack of traffic safety. Each bike is estimated to need a width of 1.2 meters.

Unit

Bikes wide (bikes wide).

Formula

Without transit lanes, vehicle travel lanes or bike lanes:

$$\boldsymbol{Biking\ Width} = \frac{\boldsymbol{Pedestrian\ Clear\ Zone}}{1.2}$$

With speed up to 30 km/h and motor traffic up to 3000 vehicles per day:

$$\boldsymbol{Biking\ Width} = \frac{\boldsymbol{Protected\ Bike\ Lanes} + \boldsymbol{Conventional\ Bike\ Lanes} + \boldsymbol{Vehicle\ Travel\ Lanes}}{1.2}$$

With speed above 30 km/h or motor traffic over 3000 vehicles per day:

$$\boldsymbol{Biking\ Width} = \frac{\boldsymbol{Protected\ Bike\ Lanes}}{1.2}$$

If speed and motor traffic flow are unknown:

$$\boldsymbol{Biking\ Width} = \frac{\boldsymbol{Protected\ Bike\ Lanes} + \boldsymbol{Conventional\ Bike\ Lanes}}{1.2}$$

Formula Reference

Rational.

THE SWEDISH TRANSPORT ADMINISTRATION (2022). VGU BEGREPP OCH GRUNDVÄRDEN. HTTP://TRAFIKVERKET.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1621296/FULLTEXT02.PDF

Evaluation

1. **Good (green):** ≥3 bikes wide
2. **Acceptable (yellow):** 2–3 bikes wide
3. **Bad (red):** <2 bikes wide

Evaluation Reference

Rational.

SPACESCAPE, KTH, CHALMERS, VTI, WHITE & SWECO (2022). DESIGNGUIDE FÖR SMARTA GATOR. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1670683/FULLTEXT01.PDF

Pedestrian Crossing Time

Motivation

The ability to cross the street is related to walkability and the extent to which retail and other destination points on both sides of the street are accessible to visitors.

Description

Average time taken by pedestrians to cross the street's carriageways, based on the average route from one side of the carriageway to the other. The analyzed street section is assumed to begin and end with a pedestrian crossing, and that the intermediate sections are evenly distributed. The walking speed is estimated to be five kilometers per hour, equivalent to 1.4 meters per second. Based on studies, the average waiting time is estimated to be four seconds. In the case of a motor traffic of up to 3000 vehicles per day, it is assumed that it will be possible to pass everywhere, without either a pedestrian crossing or waiting time.

Unit

Seconds (sec).

Formula

With motor traffic up to 3000 vehicles per day:

$$\boldsymbol{Pedestrian\ Crossing\ Time} = \frac{\boldsymbol{Transit\ Lanes} + \boldsymbol{Vehicle\ Travel\ Lanes}}{1.4}$$

With motor traffic over 3000 vehicles per day and one pedestrian crossing:

$$\boldsymbol{Pedestrian\ Crossing\ Time} =$$

$$4 + \frac{\boldsymbol{Transit\ Lanes} + \boldsymbol{Vehicle\ Travel\ Lanes} + 2 \times \frac{\frac{\boldsymbol{Analyzed\ Street\ Length}}{\boldsymbol{Pedestrian\ Crossings}}}{4}}{1.4}$$

With motor traffic over 3000 vehicles per day and more than one pedestrian crossing:

$$\boldsymbol{Pedestrian\ Crossing\ Time} =$$

$$4 + \frac{\boldsymbol{Transit\ Lanes} + \boldsymbol{Vehicle\ Travel\ Lanes} + 2 \times \frac{\frac{\boldsymbol{Analyzed\ Street\ Length}}{\boldsymbol{Pedestrian\ Crossings} - 1}}{4}}{1.4}$$

Formula Reference

Rational.

Waiting time estimated from the following studies:

LUNNER, A. & NORLING, S. (2021). ÖVERGÅNGSSTÄLLE ELLER GÅNGPASSAGE? EN STUDIE OM FRAMKOMLIGHET VID OLIKA GÅNG- OCH FORDONSFLÖDEN. KANDIDATUPPSATS, TEKNIK. KUNGLIGA TEKNISKA HÖGSKOLAN. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1582233/FULLTEXT01.PDF

THULIN, H. & OBRENOVIC, A. (2001). LAGEN OM VÄJNINGSPLIKT MOT GÅENDE PÅ OBEVAKAT ÖVERGÅNGSSTÄLLE – EFFEKT PÅ FRAMKOMLIGHET OCH BETEENDE. VTI (RAPPORT 468). HTTP://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:675210/FULLTEXT01.PDF

Evaluation

1. **Good (green):** <40 seconds
2. **Acceptable (yellow):** 40–60 seconds
3. **Bad (red):** >60 seconds

Evaluation Reference

Rational. Good level corresponds to a maximum distance between pedestrian crossings of 80 meters, acceptable level 150 meters.

SPACESCAPE, KTH, CHALMERS, VTI, WHITE & SWECO (2022). DESIGNGUIDE FÖR SMARTA GATOR. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1670683/FULLTEXT01.PDF

Environment

CO_2-emissions

Motivation

Affects global warming and thereby climate change.

Description

Annual amount of net carbon dioxide emissions from motor traffic, after uptake of trees and green spaces, along the analyzed street section. Light vehicles are estimated to emit 400 grams of carbon dioxide per mile, corresponding to 249 grams per kilometer, while the corresponding figure for heavy vehicles is 505. Trees are assumed to be deciduous trees and green areas consist of equal parts evergreen shrubs, deciduous shrubs, perennials, meadows and grasses and the uptake is calculated as an average of standard values. Each tree is estimated to absorb 91.7 kilograms of carbon dioxide annually and green spaces 0.575 kilograms per square meter and year.

Unit

Tons per year (tons/year).

Formula

$$\boldsymbol{CO_2 - emissions} =$$

$$(\boldsymbol{Motor\ Traffic} \times (1 - 0.01 \times \boldsymbol{Heavy\ Traffic}) \times 0.249 +$$

$$0.01 \times \boldsymbol{Heavy\ Traffic} \times \boldsymbol{Motor\ Traffic} \times 0.505) \times \frac{\boldsymbol{Analyzed\ Street\ Length}}{1000} \times 365 -$$

$$\boldsymbol{Trees} \times 91.7 - \boldsymbol{Green\ Space} \times 0.575$$

Formula Reference

Investigated.

U.S. ENVIRONMENTAL PROTECTION AGENCY. (2023). GREENHOUSE GAS EMISSIONS FROM A TYPICAL PASSENGER VEHICLE: QUESTIONS AND ANSWERS – FACT SHEET (EPA-420-F-23-014). OFFICE OF TRANSPORTATION AND AIR QUALITY. HTTPS://NEPIS.EPA.GOV/EXE/ZYPDF.CGI?DOCKEY=P1017FP5.PDF

Evaluation

1. **Good (green):** ≤2 tons/year and meter
2. **Acceptable (yellow):** 2–4 tons/year and meter
3. **Bad (red):** >4 tons/year and meter

Evaluation Reference

Investigated. The levels are based on an example street. A good level corresponds to motor traffic of 2,000 vehicles per day and seven percent heavy traffic, an acceptable level to 6,000 vehicles per day and seven percent heavy traffic. As a reference, the average EU citizen had an annual carbon dioxide emission of 5.5 kilograms in 2020.

CLIMATE WATCH (2024). HISTORICAL GHG EMISSIONS. HTTPS://WWW.CLIMATEWATCHDATA.ORG/EMBED/GHG-EMISSIONS%3FCALCULATION%3DABSOLUTE_VALUE%26END_YEAR%3D2020%26START_YEAR%3D1990 [24-03-28]

Stormwater Delay

Motivation

Affects the load on pipe systems and treatment plants and the caption of rainwater.

Description

Amount of rain that can be delayed per hour. Green areas are assumed to function as grass areas and delay 50 mm of rain per hour, equivalent to 50 liters of water per square meter per hour. Trees are estimated to be able to delay 500 liters per day, equivalent to about 40 liters per hour.

Unit

Millimeters per hour (mm/h).

Formula

$$\boldsymbol{Stormwater\ Delay} = \frac{\boldsymbol{Green\ Space} \times 50 + \boldsymbol{Trees} \times 40}{\boldsymbol{Analyzed\ Street\ Length} \times \boldsymbol{Total\ Street\ Width}}$$

Formula Reference

Investigated.

THE SWEDISH NATIONAL BOARD OF HOUSING, BUILDING AND PLANNING (2019). PARKER OCH GRÖNOMRÅDEN REGLERAR VATTEN VID SKYFALL OCH ÖVERSVÄMNING. HTTPS://WWW.BOVERKET.SE/SV/PBL-KUNSKAPSBANKEN/TEMAN/EKOSYSTEMTJANSTER/NATUREN/BETYDELSE/REGLERAR/ [2023-08-15]

STOCKHOLM VATTEN OCH AVFALL (N.D). DAGVATTEN. HTTPS://WWW.STOCKHOLMVATTENOCHAVFALL.SE/GLOBALASSETS/DAGVATTEN/PDF/INFIGRON_H.PDF

Evaluation

1. **Good (green):** ≥5 mm/h
2. **Acceptable (yellow):** 1–5 mm/h
3. **Bad (red):** ≤1 mm/h

Evaluation Reference

Rational. 10 mm precipitation is a common requirement for delay on private land. The requirements are assumed to be lower on street land.

THE CITY OF GOTHENBURG (2020). DAGVATTEN- OCH SKYFALLSUTREDNING. HTTPS://WWW5.GOTEBORG.SE/PROD/FASTIGHETSKONTORET/ETJANST/PLANOBYGG.NSF/VYFILER/KORTEDALA%20-%20F%C3%B6RSKOLA%20VID%20ANNANDAGSGATAN%20-PLAN%20STANDARDF%C3%B6RFARANDE%20-%20GRANSKNING-DAGVATTEN-%20OCH%20SKYFALLSUTREDNING/$FILE/DAGVATTEN-%20OCH%20SKYFALLSUTREDNING.PDF?OPENELEMENT

NACKA MUNICIPALITY (2022). ANVISNINGAR OCH PRINCIPLÖSNINGAR FÖR DAGVATTENHANTERING PÅ KVARTERSMARK OCH ALLMÄN PLATS. HTTPS://WWW.NACKA.SE/4AACDA/GLOBALASSETS/UNDERWEBBAR/TEKNISK-HANDBOK/AKTUELLA-BILAGOR/DEL-8-VATTEN-OCH-AVFALL/ANVISNINGAR-FOR-DAGVATTENHANTERING_VERSION4.0-2022-10-12.PDF

Stormwater Cleaning

Motivation

Affects the presence of contaminants in soil and water.

Description

Amount of rain that can be infiltrated and purified per hour. Green areas are assumed to have a lag capacity equivalent to that of gras areas. The ability of green areas to remove dissolved pollutants is in the range of 60 to 95 percent, with the lowest level being used in the calculations.

Unit

Millimeters per hour (mm/h).

Formula

$$\boldsymbol{Stormwater\ Cleaning} = \frac{\boldsymbol{Green\ Space} \times 50 \times 0.6}{\boldsymbol{Analyzed\ Street\ Length} \times \boldsymbol{Total\ Street\ Width}}$$

Formula Reference

Investigated.

THE SWEDISH NATIONAL BOARD OF HOUSING, BUILDING AND PLANNING (2019). PARKER OCH GRÖNOMRÅDEN REGLERAR VATTEN VID SKYFALL OCH ÖVERSVÄMNING. HTTPS://WWW.BOVERKET.SE/SV/PBL-KUNSKAPSBANKEN/TEMAN/EKOSYSTEMTJANSTER/NATUREN/BETYDELSE/REGLERAR/ [2023-08-15]

STOCKHOLM VATTEN OCH AVFALL (N.D). DAGVATTEN. HTTPS://WWW.STOCKHOLMVATTENOCHAVFALL.SE/GLOBALASSETS/DAGVATTEN/PDF/INFIGRON_H.PDF

Evaluation:

1. **Good (green):** ≥3 mm/h
2. **Acceptable (yellow):** 0.6–3 mm/h
3. **Bad (red):** ≤0.6 mm/h

Evaluation Reference

Rational. Corresponds to the stormwater delay evaluation based on that 10 mm precipitation is a common requirement for delay on private land. The requirements are assumed to be lower on street land.

THE CITY OF GOTHENBURG (2020). DAGVATTEN- OCH SKYFALLSUTREDNING. HTTPS://WWW5.GOTEBORG.SE/PROD/FASTIGHETSKONTORET/ETJANST/PLANOBYGG.NSF/VYFILER/KORTEDALA%20-%20F%C3%B6RSKOLA%20VID%20ANNANDAGSGATAN%20-PLAN%20STANDARDF%C3%B6RFARANDE%20-%20GRANSKNING-DAGVATTEN-%20OCH%20SKYFALLSUTREDNING/$FILE/DAGVATTEN-%20OCH%20SKYFALLSUTREDNING.PDF?OPENELEMENT

NACKA MUNICIALITY (2022). ANVISNINGAR OCH PRINCIPLÖSNINGAR FÖR DAGVATTENHANTERING PÅ KVARTERSMARK OCH ALLMÄN PLATS. HTTPS://WWW.NACKA.SE/4AACDA/GLOBALASSETS/UNDERWEBBAR/TEKNISK-HANDBOK/AKTUELLA-BILAGOR/DEL-8-VATTEN-OCH-AVFALL/ANVISNINGAR-FOR-DAGVATTENHANTERING_VERSION4.0-2022-10-12.PDF

Temperature reduction

Motivation

Affects the risk of heat-related illnesses such as heat stroke among street visitors, which is especially important for the elderly. It also contributes to reduced energy consumption and lower costs for air conditioning in adjacent properties.

Description

Temperature reduction due to the cooling and shading effect of trees. The relationship between canopy cover and temperature reduction is assumed to be linear from five degrees at complete canopy cover down to zero on treeless streets. The crown is assumed to have a diameter of seven meters.

Unit

Degrees Celsius (°C).

Formula

$$Canopy\ coverage\ (\%) = 100 \times \frac{\boldsymbol{Trees} \times 3.5^2 \times \pi}{\boldsymbol{Analyzed\ Street\ Length} \times \boldsymbol{Total\ Street\ Width}}$$

Up to 100 % canopy coverage:

$$\boldsymbol{Temperature\ reduction} = 5 \times \frac{\boldsymbol{Trees} \times 3.5^2 \times \pi}{\boldsymbol{Analyzed\ Street\ Length} \times \boldsymbol{Total\ Street\ Width}}$$

Over 100 % canopy cover:

$$\boldsymbol{Temperature\ reduction} = 5$$

Formula Reference

Scientific.

JOHNSTON, M. & PERCIVAL, G. EDS. (2015) TREES, PEOPLE AND THE BUILT ENVIRONMENT II. INSTITUTE OF CHARTERED FORESTERS: EDINBURGH

The assumption of tree diameter is based on a combination of several sources.

COWETT, F. & BASSUK, N. (2014). STATEWIDE ASSESSMENT OF STREET TREES IN NEW YORK STATE. URBAN FORESTRY & URBAN GREENING 13(2). 10.1016/J.UFUG.2014.02.001

NACTO (2017). URBAN STREET STORMWATER GUIDE. HTTPS://NACTO.ORG/PUBLICATION/URBAN-STREET-STORMWATER-GUIDE/

SPACESCAPE, KTH, CHALMERS, VTI, WHITE & SWECO (2022). DESIGNGUIDE FÖR SMARTA GATOR. HTTPS://WWW.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1670683/FULLTEXT01.PDF

Evaluation

1. **Good (green):** ≥1.5 °C
2. **Acceptable (yellow):** 0.5–1.5 °C
3. **Bad (red):** ≤0.5 °C

Evaluation Reference

Scientific. All streets should have 30 % canopy cover, which corresponds to a 1.5°C temperature reduction.

KONIJNENDIJK, C. (2021). THE 3-30-300 RULE FOR URBAN FORESTRY AND GREENER CITIES. BIOPHILIC CITIES JOURNAL, 4(2), SS 821-830. HTTPS://DOI.ORG/10.1007/S11676-022-01523-Z

Storable Snow

Motivation

Affects accessibility during winter as well as the cost of the operational work cost for snow removal.

Description

Snowfall that can be stored in plough banks in the flex zone for furniture. The flex zone intended for parking and loading is not assumed to be used as a snow storage facility. All streets are assumed to have a two meters wide, plowed pedestrian clear zone on each side of the street. Other plowed widths are estimated to be two and a half meters for cycle paths and cycle lanes in total, three and a half meters per public transport lane and three meters per car lane. The relationship is a recalculation of The Swedish Transport Administration's diagrams regarding snow bank width based on different snow depths and plough widths.

Unit

Centimeters (cm).

Formula

The amount of storable snow depends on the size of the plowed area.

$$Plowed\ width =$$

$$4 + Plowed\ bike\ lane + 3.5 \times \boldsymbol{Number\ of\ Transit\ Lanes} + 3 \times \boldsymbol{Number\ of\ Transit\ Lanes}$$

With bike lanes:

$$Plowed\ bike\ lane = 2.5$$

Without bike lanes:

$$Plowed\ bike\ lane = 0$$

With plowed width up to 5 meters:

$$\boldsymbol{Storable\ Snow} = 0.57 \times \boldsymbol{Flex\ Zone}\ (\boldsymbol{Pedestrian/Curb}) - 0.39$$

With plowed width between 5 and 10 meters:

$$\boldsymbol{Storable\ Snow} = 0.42 \times \boldsymbol{Flex\ Zone}\ (\boldsymbol{Pedestrian/Curb}) - 0.44$$

With plowed width between 10 and 15 meters:

$$\boldsymbol{Storable\ Snow} = 0.32 \times \boldsymbol{Flex\ Zone}\ (\boldsymbol{Pedestrian/Curb}) - 0.36$$

With plowed width over 15 meters:

$$\boldsymbol{Storable\ Snow} = 0.29 \times \boldsymbol{Flex\ Zone}\ (\boldsymbol{Pedestrian/Curb}) - 0.42$$

Formula Reference

Rational.

TRAFIKVERKET (2022). VGU RÅD. HTTP://TRAFIKVERKET.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1621302/FULLTEXT03.PDF

Evaluation

1. **Good (green):** ≥30 cm
2. **Acceptable (yellow):** 10–30 cm
3. **Bad (red):** ≤10 cm

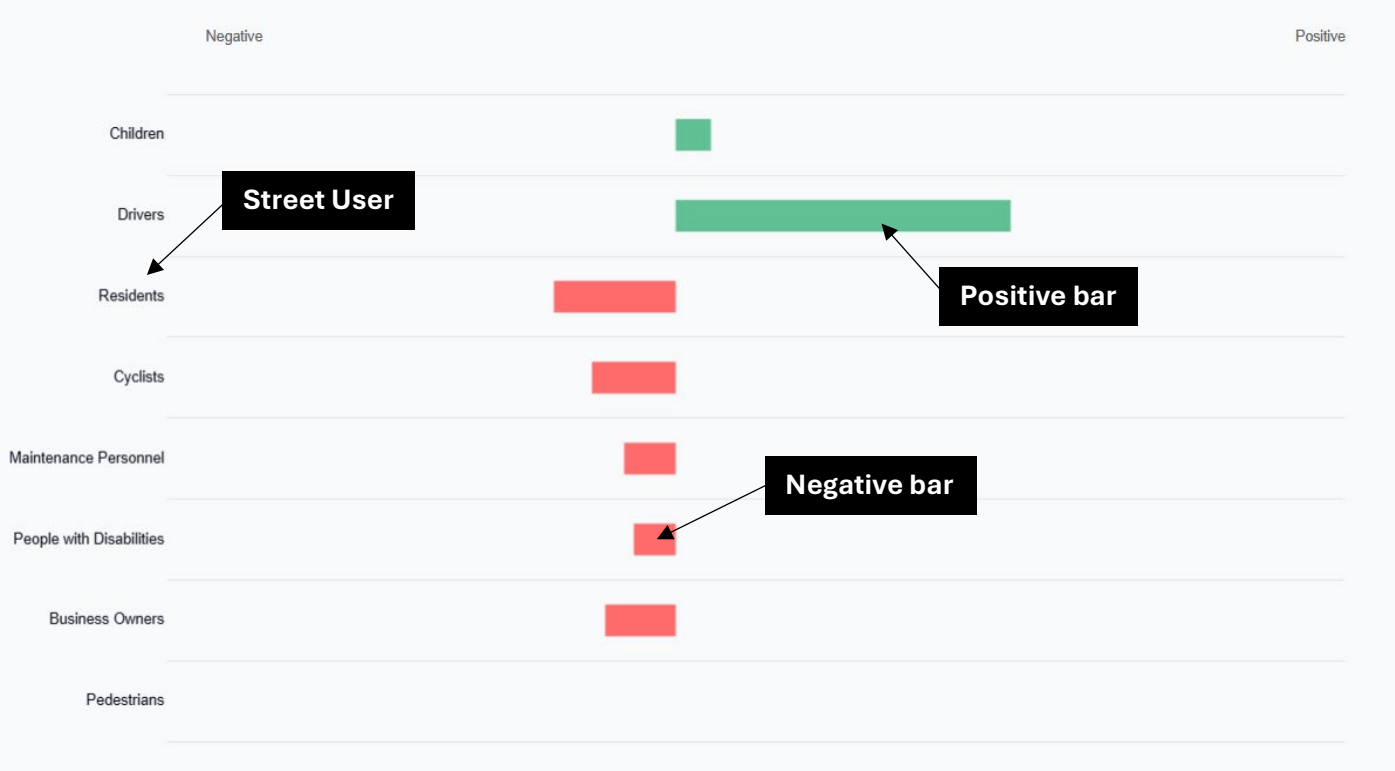
Evaluation Reference

Rational. Dimensionerande snödjup i mellersta snözonen används som utgångspunkt.

THE SWEDISH TRANSPORT ADMINISTRATION (2022). VGU RÅD. HTTP://TRAFIKVERKET.DIVA-PORTAL.ORG/SMASH/GET/DIVA2:1621302/FULLTEXT03.PDF

Street Users

In the user analysis, a number of relevant user groups have been selected. Each user group is associated with a set of Streetmeter's performances that this group is considered to value (see Total number of valued performances in the formulas below). The street's performance from the user group's perspective is presented in the form of green, yellow, and red bars. Since the number of valued performances differs between user groups, the respective bar's length is based on the proportion of the valued performances that are good, acceptable, and poor. All the bars thus go from 0 (neutral position in the middle) to 1 (maximally positive or negative). Which performances, and how many they are, are presented in the coming chapters according to the layout below.



Streetmeter is a constantly evolving web platform. The screenshot is from April 2024.

Children

Description

Children are assessed to value the following 20 performances:

- Noise Level
- Share of Active Transportation
- Risk of Serious Traffic Injury
- Air Quality (PM_{10} Annual Mean)
- Air Quality ($PM_{2.5}$ Annual Mean)
- Air Quality (NO_x Annual Mean)
- Increased Risk of Asthma Attack
- Neighbour Relations
- Doorway Density
- Surface Illumination
- Safe Walking from Age
- Safe Biking from Age
- On-Street Bike Parking Access
- Wheelchair Width
- Biking Width
- Pedestrian Crossing Time
- Choice to Travel
- CO_2-emissions
- Cultivation Capacity
- Temperature Reduction

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{20}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{20}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{20}$$

Drivers

Description

Drivers are assessed to value the following 4 performances:

- On-Street Car Parking Revenue (deviant evaluation: reversed assessment of positive and negative performance)
- Passenger Capacity
- Motor Traffic Level of Service
- On-Street Car Parking Access (deviant evaluation: more on-street car parking places than entrances give positive evaluation while fewer give negative evaluation)

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{4}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{4}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{4}$$

Residents

Description

Residents are assessed to value the following 24 performances:

- Noise Level
- Share of Residents with a View of Greenery
- Risk of Serious Traffic Injury
- Greenery's Oxygen Production
- Air Quality (PM_{10} Annual Mean)
- Air Quality ($PM_{2,5}$ Annual Mean)
- Air Quality (NO_x Annual Mean)
- Increased Risk of Asthma Attack
- Neighbour Relations
- Doorway Density
- Surface Illumination
- Public Seating
- Residential Value Creation
- Safe Walking From Age
- Safe Biking From Age
- Motor Traffic Level of Service
- On-Street Car Parking Access
- On-Street Bike Parking Access
- Pedestrian Crossing Time
- Choice to Travel
- CO_2-emissions
- Stormwater Delay
- Cultivation Capacity
- Temperature Reduction

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{24}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{24}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{24}$$

Cyclists

Description

Cyclists are assessed to value the following 17 performances::

- Noise Level
- Share of Active Transportation
- Risk of Serious Traffic Injury
- Greenery's Oxygen Production
- Air Quality (PM_{10} Annual Mean)
- Air Quality ($PM_{2,5}$ Annual Mean)
- Air Quality (NO_x Annual Mean)
- Increased Risk of Asthma Attack
- Doorway Density
- Surface Illumination
- Safe Biking From Age
- Passenger Capacity
- Motor Traffic Level of Service
- On-Street Bike Parking Access
- Biking Width
- CO_2-emissions
- Temperature Reduction

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{17}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{17}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{17}$$

Maintenance Personnel

Description

Maintenance personnel are assessed to value the following 43 performances:

- Risk of Serious Traffic Injury
- Air Quality (PM_{10} Annual Mean)
- Air Quality ($PM_{2,5}$ Annual Mean)
- Air Quality (NO_x Annual Mean)
- Outdoor Dining (deviant evaluation: reversed assessment of positive and negative performance)
- On-Street Car Parking Revenue
- Weelchair Width
- Biking Width
- CO_2-emissions
- Stormwater Delay
- Stormwater Cleaning
- Cultivation Capacity (deviant evaluation: reversed assessment of positive and negative performance)
- Storable Snow

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{13}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{13}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{13}$$

People with Disabilities

Description

People with disabilities are assessed to value the following 4 performances:

- Noise Level
- Risk of Serious Traffic Injury
- Public Seating
- Outdoor Dining (deviant evaluation: reversed assessment of positive and negative performance)
- On-Street Car Parking Access
- Weelchair Width
- Pedestrian Crossing Time
- Choice to Travel
- Temperature Reduction

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{9}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{9}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{9}$$

Business Owners

Description

Business owners are assessed to value the following 10 performances:

- Risk of Serious Traffic Injury
- Air Quality (PM_{10} Annual Mean)
- Air Quality ($PM_{2,5}$ Annual Mean)
- Air Quality (NO_x Annual Mean)
- Increased Risk of Asthma Attack
- Meeting Place
- Neighbour Relations
- Doorway Density
- Surface Illumination
- Potential Outdoor Dining
- Public Seating
- Outdoor Dining
- Office Value Creation
- Retail Turnover
- Outdoor Dining Revenue
- On-Street Car Parking Access
- On-Street Bike Parking Access
- Choice to Travel
- CO_2-emissions
- Temperature Reduction

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{20}$$

$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{20}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{20}$$

Pedestrians

Description

Pedestrians are assessed to value the following 23 performances:

- Noise Level
- Andel aktiva transporter
- Risk of Serious Traffic Injury
- Greenery's Oxygen Production
- Air Quality (PM_{10} Annual Mean)
- Air Quality ($PM_{2,5}$ Annual Mean)
- Air Quality (NO_x Annual Mean)
- Increased Risk of Asthma Attack
- Meeting Place
- Neighbour Relations
- Doorway Density
- Surface Illumination
- Public Seating
- Outdoor Dining
- Safe Walking From Age
- Passanger Capacity
- Bus Speed
- Motor Traffic Level of Service
- Weelchair Width
- Pedestrian Crossing Time
- Choice to Travel
- CO_2-emissions
- Temperature Reduction

Formula

$$[Positive\ bar\ (green)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{23}$$

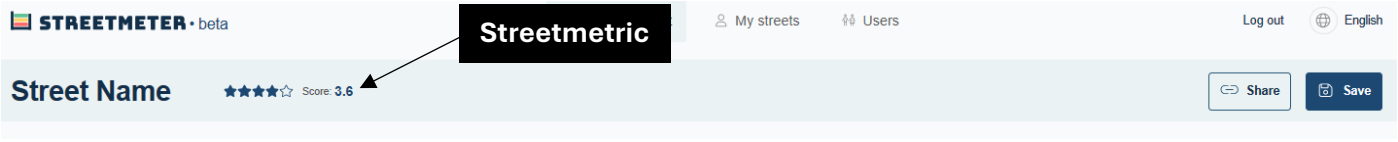
$$[Neutral\ bar\ (yellow)] = \frac{[Number\ of\ good\ (green)\ valued\ performances]}{23}$$

$$[Negative\ bar\ (red)] = \frac{[Number\ of\ bad\ (red)\ valued\ performances]}{23}$$

Street Score

Streetmetric

Streetmetric is Streetmeter's unique rating system that enables easy comparison of the value-creating effect of streets. The rating is an indexed number from one to five that shows how close the street is to an optimum. The calculation is based on that good (green) values give two points, acceptable (yellow) values one point, and poor (red) values zero points. Streetmetric is presented in the form of a rounded number of stars.



Streetmeter is a constantly evolving web platform. The screenshot is from April 2024.

Formula

$$\boldsymbol{Streetmetric} = 5 \times \frac{2 \times [Number\ of\ good\ (green)\ valued\ performances] + 1 \times [Number\ of\ good\ (green)\ valued\ performances]}{82}$$