

Comparing the cost of cars and bicycles

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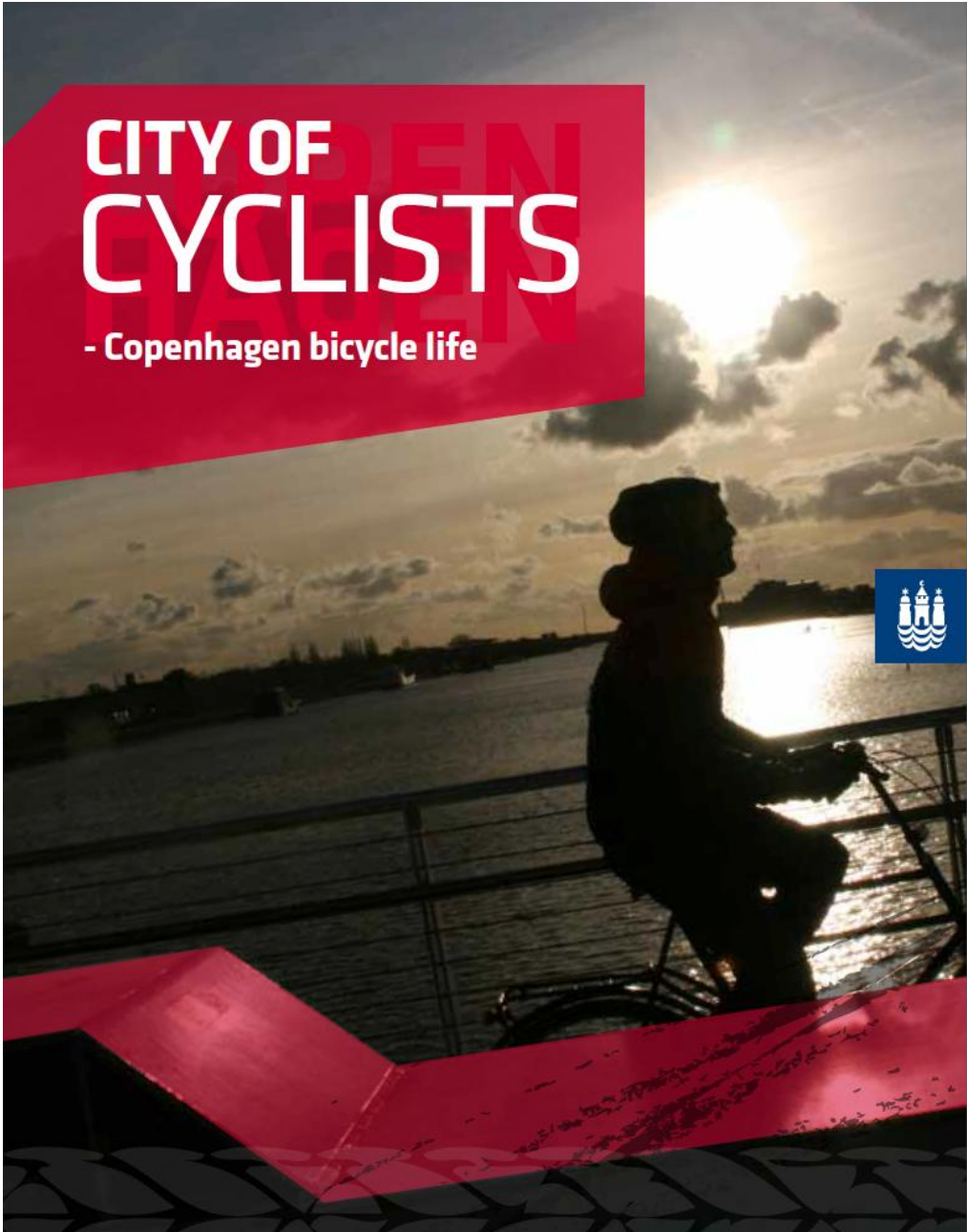
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CITY OF CYCLISTS

- Copenhagen bicycle life



Communication in Copenhagen

- All communication positive
- NO discussion of environment
- Cycling fun & healthy
- Copenhager = cyclist

Challenge: Expand bicycle infrastructure

Difficulty: (perceived) cost of bicycle infrastructure development

- Cost-benefit analysis (CBA) standard instrument for infrastructure planning
- Usually focused on car (not comparison of transport modes)
- Copenhagen:
 - i. Agreement across political parties to compare cars with bicycles
 - ii. Agreement on factors to be considered, along with unit cost

Parameters used in Copenhagen's CBA

| CBA parameter | Methodology to quantify effect |
|---|--|
| Vehicle operating costs | Change in vehicle kilometre by mode, i.e., for different motorized vehicles, public transportation and bicycles. |
| Time costs | Change in transport time by transport mode. |
| Accident costs | Change in the number of accidents with and without bicycles involved. |
| Pollution and related externalities | Change in vehicle kilometres for each mode of transportation. |
| Recreational value ^a | Change in cycle kilometres and cyclists' statements. |
| Health benefits | Change in cycle kilometres. |
| Safety ^a | Change in the number of accidents, cyclist statements and change in cycle kilometres. |
| Discomfort ^a | Change in cycle kilometres. |
| Branding, tourism, and open land value ^a | Not considered to be traffic effects |

^a Not included/measured in the CBA.

Results

If considering social and private cost:

- Cost of car: 50 Cent/km, cost of bicycle: 0.08 Cent/km

If considering only cost to society:

- Cost of a car: 15 Cent/km, benefit of bicycle: 16 Cent/km.

Average cost per kilometre for cycling/car, summary for 2008 (Euro).
Source: COWI and Københavns Kommune (2009).

| | Cycling (16 km/h) | | | Car (50 km/h) | | | |
|--------------------------|-------------------|--------|--------|---------------|--------|--------|-------|
| | Private | Social | Total | Private | Social | Duties | Total |
| Time costs (travel time) | 0.672 | 0 | 0.672 | 0.215 | 0 | 0 | 0.215 |
| Vehicle operating costs | 0.044 | 0 | 0.044 | 0.296 | 0 | -0.159 | 0.137 |
| Prolonged life | -0.358 | 0.008 | -0.348 | 0 | 0 | 0 | 0 |
| Health | -0.149 | -0.242 | -0.391 | 0 | 0 | 0 | 0 |
| Accidents | 0.034 | 0.073 | 0.105 | 0 | 0.030 | 0 | 0.030 |
| Perceived safety | + (?) | 0 | + (?) | ? | ? | 0 | ? |
| Discomfort | ? | 0 | + (?) | ? | ? | 0 | ? |
| Branding/tourism | 0 | -0.003 | -0.003 | ? | ? | 0 | ? |
| Air pollution | 0 | 0 | 0 | 0 | 0.004 | 0 | 0.004 |
| Climate change | 0 | 0 | 0 | 0 | 0.005 | 0 | 0.005 |
| Noise | 0 | 0 | 0 | 0 | 0.048 | 0 | 0.048 |
| Road deterioration | 0 | 0 | 0 | 0 | 0.001 | 0 | 0.001 |
| Congestion | 0 | 0 | 0 | 0 | 0.062 | 0 | 0.062 |
| Total | 0.243 | -0.164 | 0.081 | 0.511 | 0.152 | -0.159 | 0.503 |

Note: Car occupancy is 1.54 persons per car (DTU Transport and COWI, 2010); external values for cars are reported for gasoline cars in the city during off-peak hours. Cycling's health benefits are split into private and social benefits, it is assumed that 50% of the gain is own consumption and thus internalized. The rest is taxes, etc. In cases where unit prices cannot be estimated as yet, the table contains question marks (?). Plususes indicate where these are expected to entail a cost.

Comparison Calgary

| | Cycling (16 km/h) | | | Driving (50 km/h) | | |
|------------------------------------|-------------------|--------------|-------------|-------------------|-------------|-------------|
| | Private | Social | Total | Private | Social | Total |
| Time Costs (travel time, non-work) | 0.75 | 0 | 0.75 | 0.24 | 0 | 0.24 |
| Vehicle Operating Costs | 0.11 | 0 | 0.11 | 0.49 | 0 | 0.49 |
| Prolonged Life | -1.18 | 0 | -1.18 | 0 | 0 | 0 |
| Health | -0.48 | -0.48 | -0.96 | 0 | 0 | 0 |
| Accidents/Collisions | 1.22 | 0.12 | 1.35 | 0 | 0.044 | 0.044 |
| Air Pollution | 0 | 0 | 0 | 0 | 0.001 | 0.001 |
| Climate Change | 0 | 0 | 0 | 0 | 0.015 | 0.015 |
| Noise | 0 | 0 | 0 | 0 | 0.016 | 0.016 |
| Road Deterioration | 0 | 0 | 0 | 0 | 0.003 | 0.003 |
| Congestion | 0 | 0 | 0 | 0 | 0.013 | 0.013 |
| Winter Maintenance | 0 | 0.006 | 0.006 | 0 | 0.004 | 0.004 |
| Total | 0.43 | -0.35 | 0.08 | 0.73 | 0.10 | 0.83 |

Results Calgary:

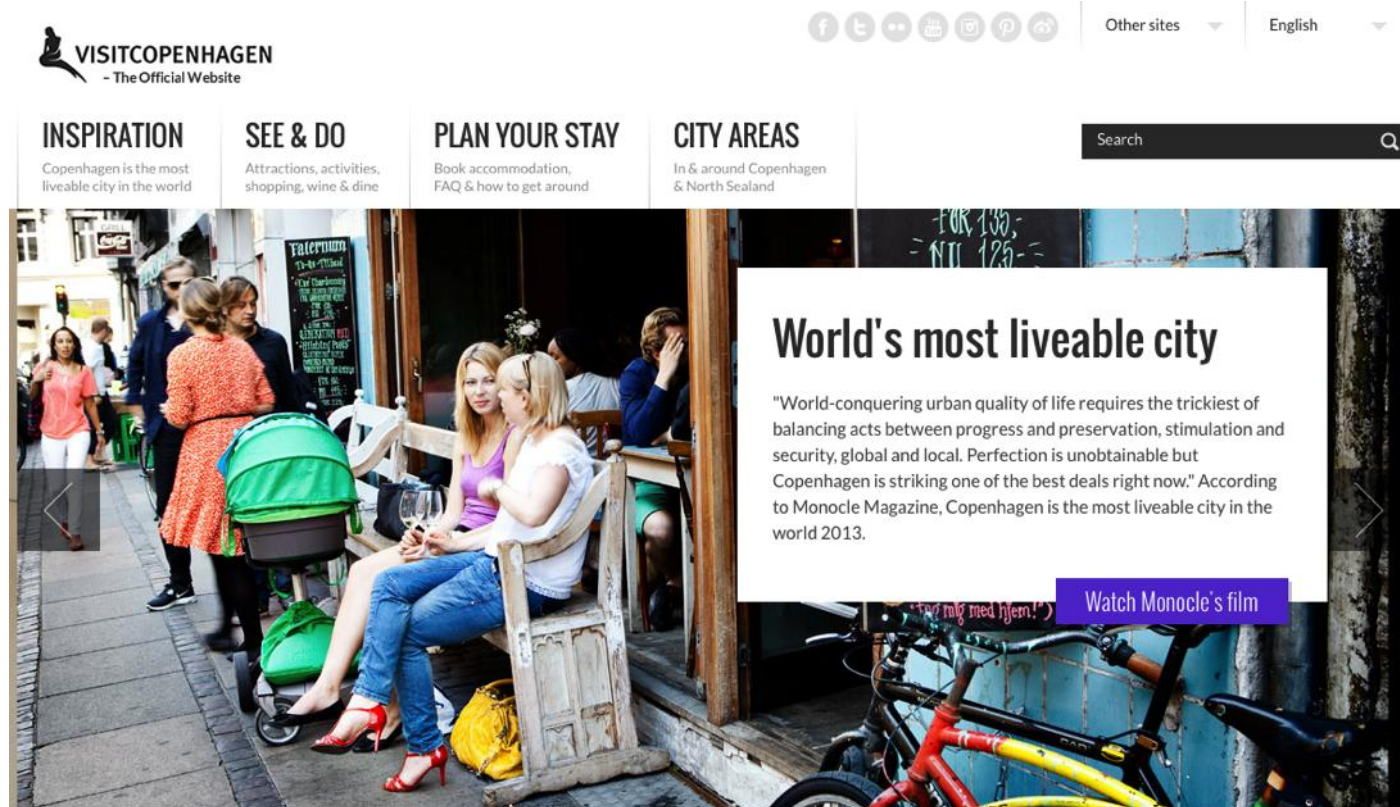
Private and social cost of cycling: 5.7 Cent/km; cost of driving: 59 Cent/km

Social benefit of cycling: 25 Cent/km; cost of driving: 7 Cent/km

Source: Dekker, K. (2016) The Dollars and Cents of Driving and Cycling: Calculating the Full Costs of Transportation in Calgary, Canada. Master thesis, Uppsala University, Sweden.

Update 2017: To re-consider

- Time valuation (equal between transport modes)
- Climate change (Scientific, rather than spot price values)
- Smell (exposure to diesel exhaust fumes)
- Tourism (value of attractiveness of cycling opportunities and bicycle life)
- Accidents



The image is a screenshot of the Visit Copenhagen website. At the top, there is a navigation bar with social media icons (Facebook, Twitter, YouTube, Instagram, Pinterest, RSS) on the left, and 'Other sites' and 'English' dropdown menus on the right. Below the navigation bar is a main menu with four categories: 'INSPIRATION' (Copenhagen is the most liveable city in the world), 'SEE & DO' (Attractions, activities, shopping, wine & dine), 'PLAN YOUR STAY' (Book accommodation, FAQ & how to get around), and 'CITY AREAS' (In & around Copenhagen & North Sealand). A search bar is located on the right side of the main menu. The main content area features a large photograph of a street scene in Copenhagen. In the foreground, two women are sitting on a wooden bench outside a cafe. One woman is wearing a purple top and blue jeans, and the other is wearing a white top and blue jeans. They are both wearing red high-heeled shoes. A green baby stroller is parked next to them. In the background, a woman in a red dress is walking, and a man in a blue jacket is standing. A chalkboard menu is visible in the background. Overlaid on the right side of the photograph is a white text box with the heading 'World's most liveable city'. Below the heading is a quote: "World-conquering urban quality of life requires the trickiest of balancing acts between progress and preservation, stimulation and security, global and local. Perfection is unobtainable but Copenhagen is striking one of the best deals right now." According to Monocle Magazine, Copenhagen is the most liveable city in the world 2013. At the bottom right of the text box is a purple button that says 'Watch Monocle's film'.

VISITCOPENHAGEN
- The Official Website

INSPIRATION
Copenhagen is the most liveable city in the world

SEE & DO
Attractions, activities, shopping, wine & dine

PLAN YOUR STAY
Book accommodation, FAQ & how to get around

CITY AREAS
In & around Copenhagen & North Sealand

Search

World's most liveable city

"World-conquering urban quality of life requires the trickiest of balancing acts between progress and preservation, stimulation and security, global and local. Perfection is unobtainable but Copenhagen is striking one of the best deals right now." According to Monocle Magazine, Copenhagen is the most liveable city in the world 2013.

Watch Monocle's film

Summary

- Investments in bicycle infrastructure economically justified, where bicycle traffic will replace car traffic (i.e. in virtually any city).
- As benefits accrue mostly nationally, while cost for bicycle infrastructure arises locally, governments should provide funding for bicycle infrastructure projects in communities.

Use of results in Copenhagen:

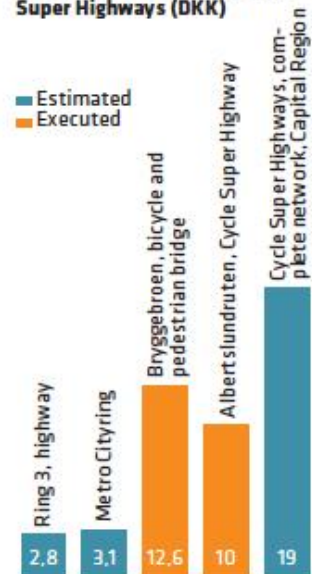
building of 28 „super highways“ at a cost of DKK1 billion (€135 million)

Benefit to society estimated at DKK7.3 billion (€980 million)



7,300 M

Socio-economic gain by complete network of 28 Cycle Super Highways (DKK)



Internal rate of return for larger investments in infrastructure (%)

CYCLE SUPER HIGHWAYS ARE GOOD VALUE

In the spring of 2012, Albertslundruten, Copenhagen's first Cycle Super Highway was inaugurated as a test route of 17.5 km passing through the municipalities of Albertslund, Glostrup, Rødovre, Frederiksberg and Copenhagen. In total 28 Cycle Super Highways are planned, which together form a network of high-class bicycle commuter routes across 22 municipalities in the Capital Region.

An analysis of the socio-economic impact of the overall network of 28 Cycle Super Highways shows that over a 50-year period with an investment of just under DKK 1 billion, there is an expected economic gain to society of DKK 7.3 billion. This is equivalent to an internal rate of return on investment of 19%. The ministry of finance's minimum requirement is 5% for infrastructure projects and compared with other investments in infrastructure, this is a very high return.

Especially the health benefits of the extra cycling are beneficial, as the people who cycle daily are expected to have a longer life expectancy on average. In addition, the increase in the number of people engaged in a more active form of transportation is expected to result in 34,000 less sick days per year.

Literature

- Gössling, S. 2013. Urban Transport Transitions: Copenhagen, City of Cyclists. *Journal of Transport Geography*, 33: 196-206.
- Gössling, S. and Choi, A. 2015. Transport transitions in Copenhagen: Comparing the cost of cars and bicycles. *Ecological Economics*, DOI: 10.1016/j.ecolecon.2015.03.006.