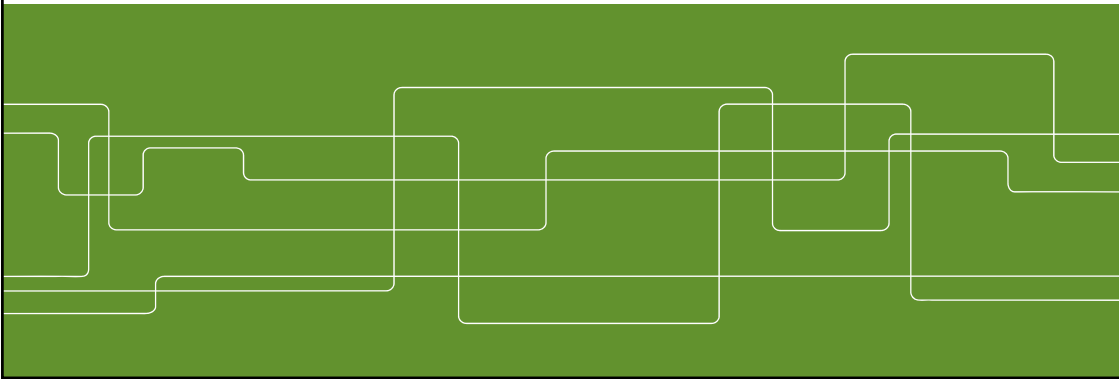




Public Health & Road Ecology

2015-03-27



Today

1. Travel & Public Health
2. Individual Assignment #1
3. Group Project Assignment
4. Road Ecology (*time permitting*)

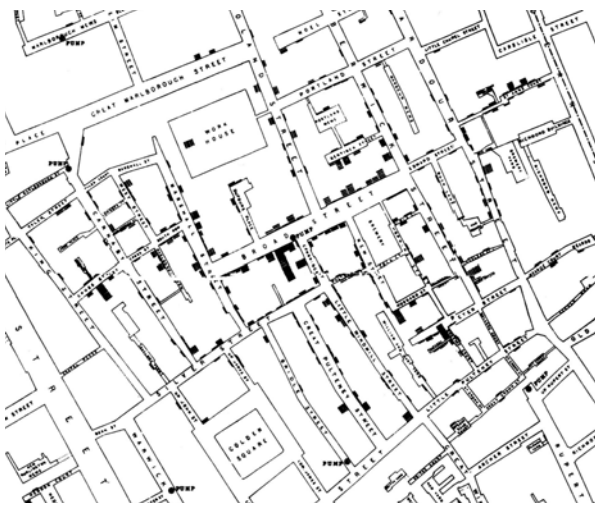




TRAVEL AND PUBLIC HEALTH



Travel and Public Health?





WHO HELI

(Health and Environment Linkages Initiatives) -

<http://www.who.int/heli/en/>

Urban air pollution: 1.2 mill deaths

Deaths attributable to urban air pollution, 2004



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: Global Health Risks, WHO 2009.
© WHO 2010. All rights reserved.



WHO HELI

(Health and Environment Linkages Initiatives) -

<http://www.who.int/heli/en/>

Road traffic accidents - 1.3 million deaths annually; low- and middle-income countries bear 90 % of the death and injury toll

Physical inactivity – 3.2 million deaths

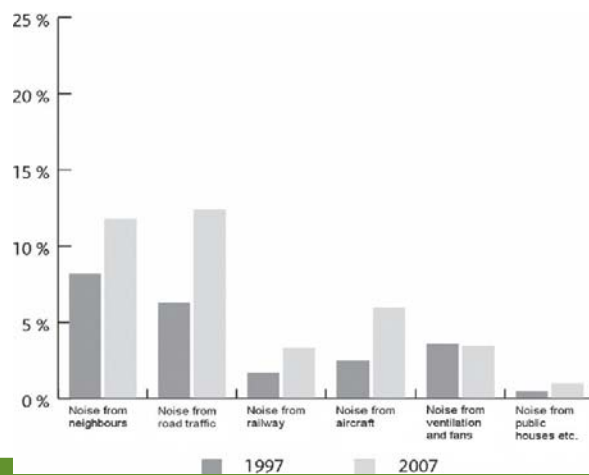


WHO HELI

(Health and Environment Linkages Initiatives) -

<http://www.who.int/heli/en/>

Traffic noise – stress, heart diseases, analytical impairments



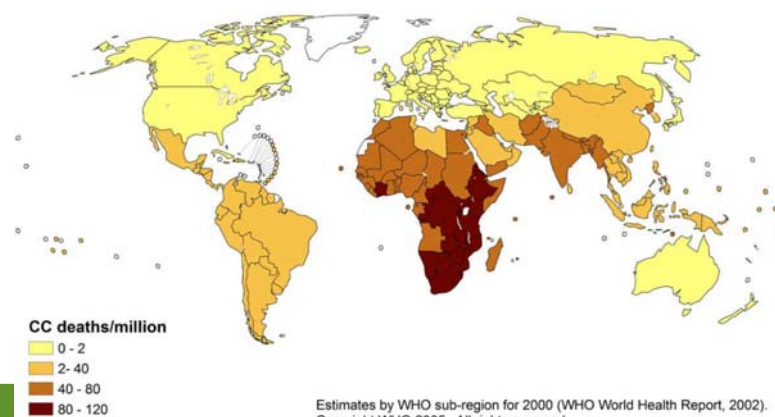
WHO HELI

(Health and Environment Linkages Initiatives) -

<http://www.who.int/heli/en/>

Climate change – 150k deaths

Deaths from climate change





WHO HELI

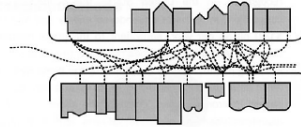
(Health and Environment Linkages Initiatives) -

<http://www.who.int/heli/en/>

Social Cohesion

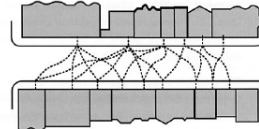
Light Traffic

3.0 friends per person
6.3 acquaintances



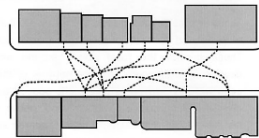
Moderate Traffic

1.3 friends per person
4.1 acquaintances



Heavy Traffic

0.9 friends per person
3.1 acquaintances

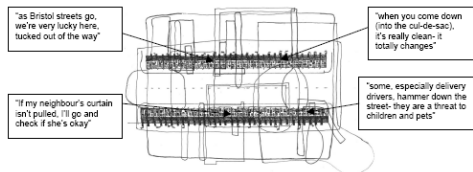


WHO HELI

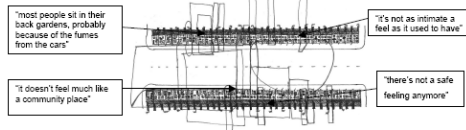
(Health and Environment Linkages Initiatives) -

<http://www.who.int/heli/en/>

Social Cohesion



LIGHT TRAFFIC: 140 VEHICLES PER DAY



MEDIUM TRAFFIC: 8,420 VEHICLES PER DAY





How to address these problems?

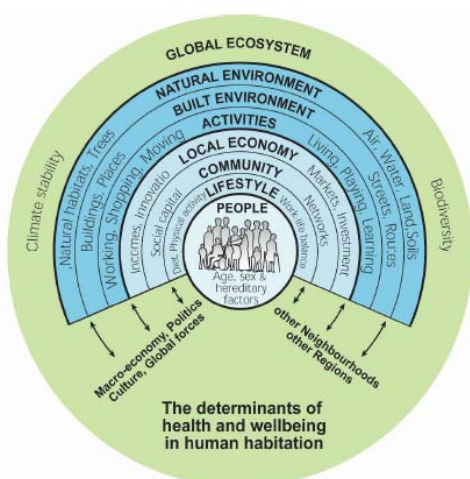


“Health is **not only the absence of disease** but **a state of physical, mental and social well-being**. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being, without distinction of race, religion, political belief or economic or social condition” (WHO, 1946).

“Health ultimately depends on the **ability to manage** successfully the **interaction** between the physical spiritual, biological and economic/social environment” (UNEP 1992 – Chapter 5, para 6.3).

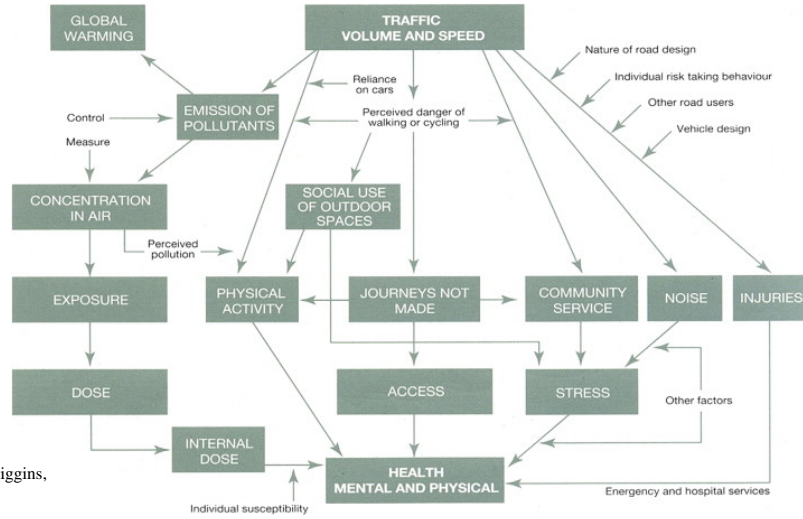


Knowledge of Health Determinants

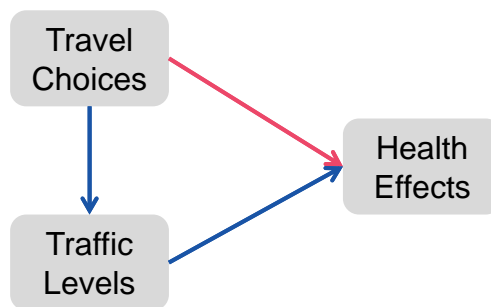




We may know what traffic phenomena cause what problems

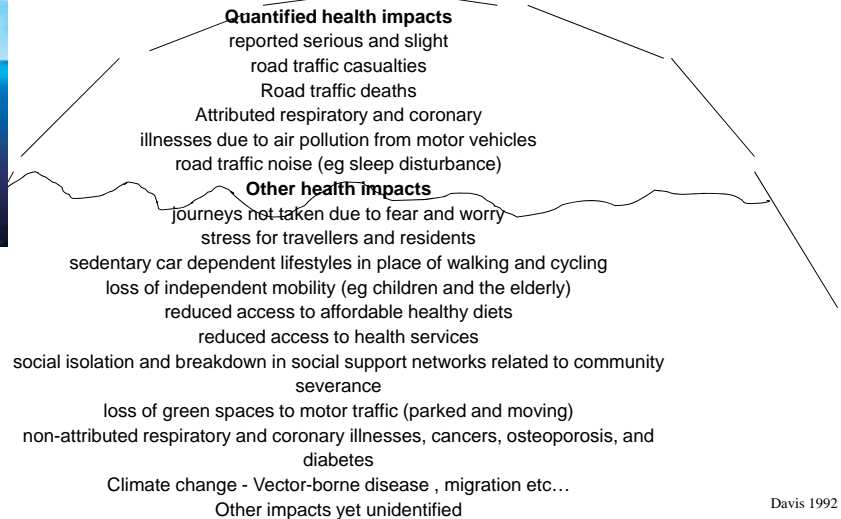


Simplified Effect Linkages





Road Transport Morbidity and Mortality Iceberg



Some Evidence



Studied 31,000 bus drivers and conductors:

Conductors climbed 500-700 steps per shift

Drivers sat for 90% of their shift

Found less coronary artery disease (CAD) in
 conductors



Studied 110,000 postal workers:

Demonstrated that postmen who cycled or walked to
 deliver mail had fewer CAD events than colleagues
 with less active jobs



“Men doing physically active work have a lower mortality
 from coronary heart disease in middle age than men in less
 active work”

Morris et al, 1953 Coronary heart disease and
 physical activity at work. Lancet 1953;2:1053-7



What does this have to do with transport and urban planning?

Physical activity is the 'best buy' of public health

- Reduces risk of :
 - Dying prematurely (all-cause mortality)
 - Heart disease by 50%
 - Stroke by up to 40%
 - Developing high blood pressure and helps reduce blood pressure in people who already have it
 - Developing Type 2 Diabetes
 - Developing colon and breast cancer
- Helps control weight
- Helps build & maintain healthy bones, muscles and joints
- Promotes psychological well-being



What does this have to do with transport and urban planning?

- Minimum of 5 x 30 minutes of moderate physical activity is required per week for population health
- 70% of adults do not achieve this

“It is likely that for many people, 45-60 minutes of moderate intensity physical activity a day is necessary to prevent obesity. For bone health, activities that produce high physical stresses on the bones are necessary.”

(UK Dept. of Health, 2004 “At Least Five a Week”)



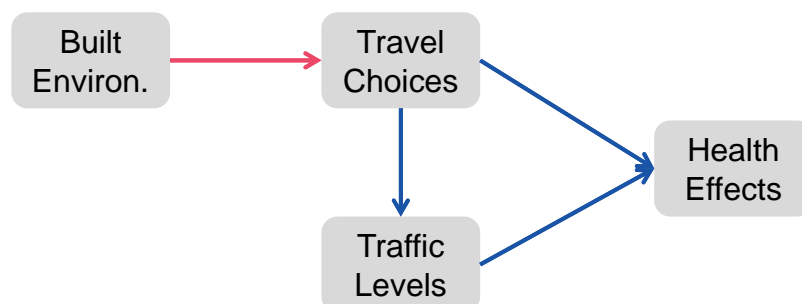
What does this have to do with transport and urban planning?

“For most people, the easiest and most acceptable forms of physical activity are those that can be incorporated into everyday life. Examples include walking or cycling instead of driving...” (UK Dept. of Health, 2004 “At Least Five a Week”)

- Built environment one of many variables to effect physical activity
- Public health research suggests that environmental changes may be **more effective in changing long-term physical activity patterns** than interventions centred on structured activities, e.g., formal exercise programmes



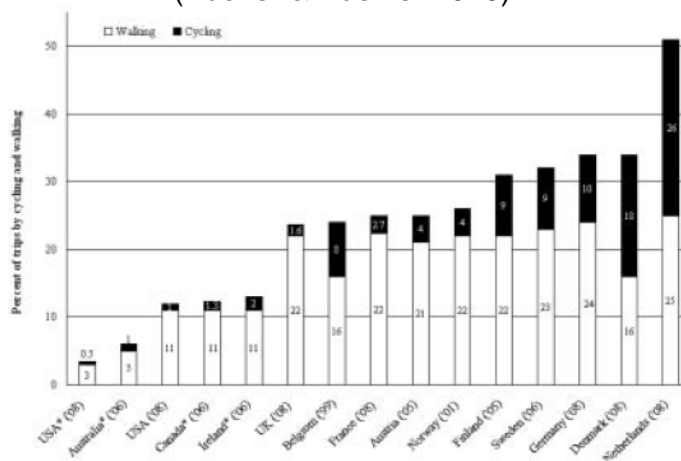
Simplified Effect Linkages





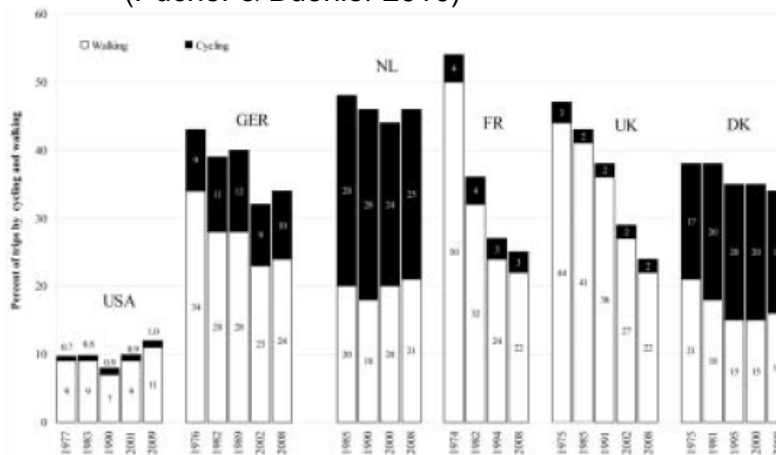
How much do people walk/bike?

International Comparison
(Pucher & Buehler 2010)



How much do people walk/bike over time?

Changes over time, 1974 - 2009
(Pucher & Buehler 2010)





For what trips do people walk/bike?

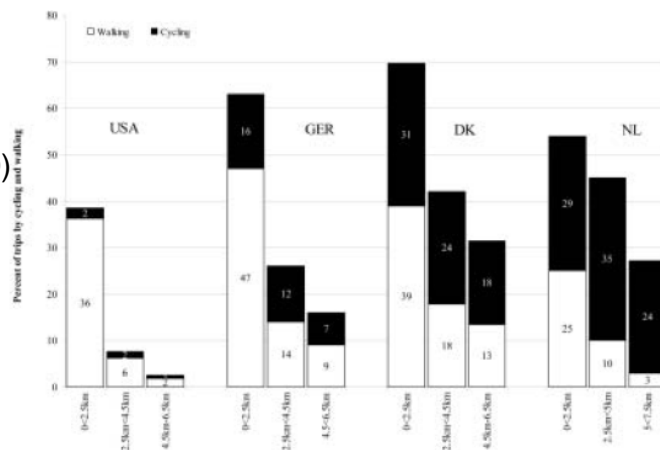
Differences by Distance:

< 2,5 km

2,5 – 4,5 km

> 4,5 km

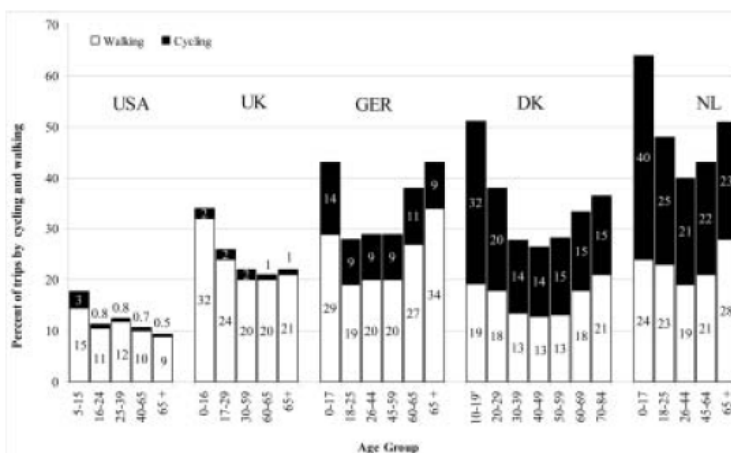
(Pucher & Buehler 2010)



Who walks/bikes?

Differences by Age Group

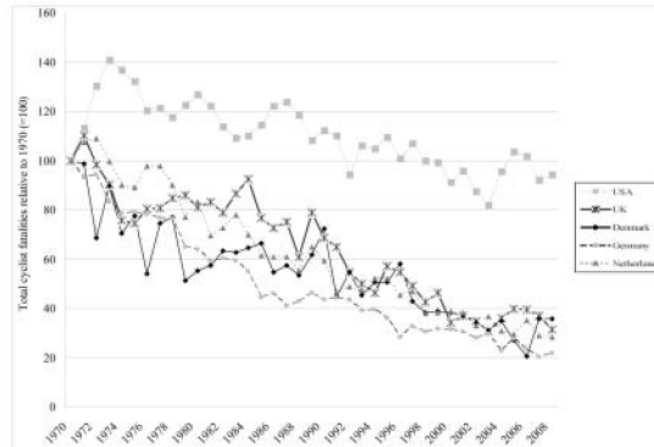
(Pucher & Buehler 2010)





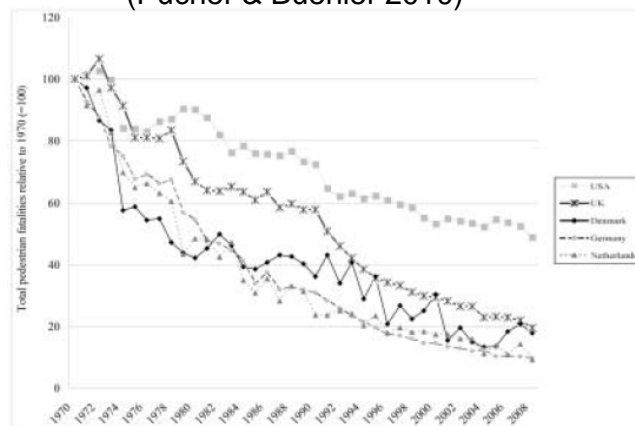
How safe is cycling?

Cycling Fatalities (Pucher & Buehler 2010)



How safe is walking?

Pedestrian Fatalities, compared to 1970 (Pucher & Buehler 2010)





Built Environment is Associated with Physical Activity

- **Parks** (Zlod, Schmid, 2004 AJPH)
- **Greenery** (Ellaway A et al, 2005 BMJ)
- Near **Utility Destinations & Recreational Facilities** (TRB/Inst. of Medicine 2005)
- **Neighborhood Environment Score** (Craig et al 2002, AJPM)
- **Perceptions** of the Environment (Andy et al 2004, AJPH)
- **“Traditional” or “Walkable”** Designs (Saelens et al 2003, ABM; Frank et al 2005, AJPM)



Travel Mode is Associated with Improved Fitness

- **Commuting by Bike/Walk/Public Transport** (Wen et al 2006, IJO)
- **Kilometers Walked per Day** (Frank et al 2004, AJPM)



Built Environment is Affects Walking/Biking in Particular Ways

Handy et al 2002:

Safety, comfort, aesthetics > time, distance, cost

Local neighborhood > regional characteristics

Derived aspect of demand less important

Need better data:

- Sidewalk connectivity
- Graffiti
- Amenities
- Walking behavior



So what can we do to increase walking?

Speed limits

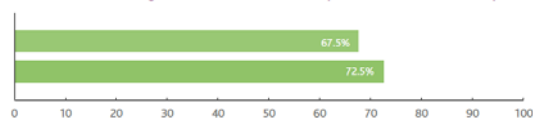
Safe routes to school (ex. California SR2S – tripled the participation rate)

Traffic calming, ex. Glasgow

- 20% walk more themselves
- 13% more allow their children to walk



Increase in children walking to school in Portsmouth after implementation of area-wide 20mph





So what can we do to increase walking?

Mixed priority routes in Several Cities in the UK:

- Pedestrian numbers increased by 2% to 22%
- Pedestrian movement at crossings increased by up to 25%
- Vehicle speeds reduced
- Small reductions in vehicle flows
- Noise pollution decreased
- Annual casualties reduced by up to 63%, compared with a national reduction of 17%.



So what can we do to increase walking?

Relocation of space, e.g. Copenhagen:

- Reallocation of space and pedestrianisation since 1962.
- Reallocating road space from general traffic to buses and cycles,
- Limits on through traffic
- Reallocating parking spaces to public open space by 2-3% annually
- Increasing the size of pedestrian areas and prioritising pedestrians and cyclists in the inner city.





So what can we do to increase walking?

Relocation of space: Broadway in Manhattan, New York

- Pedestrian numbers have increased by 11% in Times Square and 6% in Herald Square
- Journey times for taxis and buses have decreased by up to 15%
- Number of injuries to pedestrians has decreased by 35%
- Number of injuries to motorists and passengers decreased by 63%.
- Broad public support with 74% of residents of New York agreeing that Times Square has improved dramatically as a result of the changes.

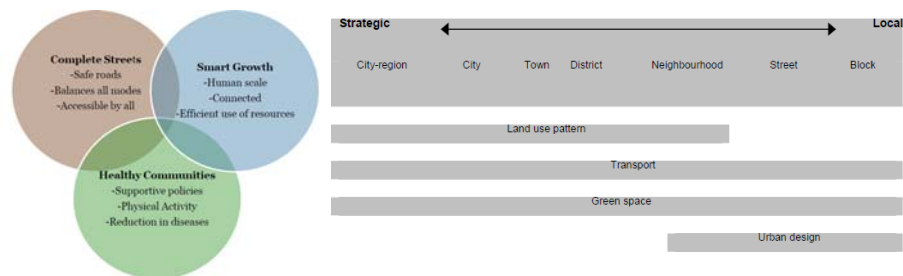
Shared space



If the benefits are clear, why it is so difficult to implement?

Important key messages:

- Cars don't attract investment; people do
- Accessible streets = accessible businesses
- You can sit with a cup of coffee on a "Complete Street" – 3Rs (remove, reduce, relocate)



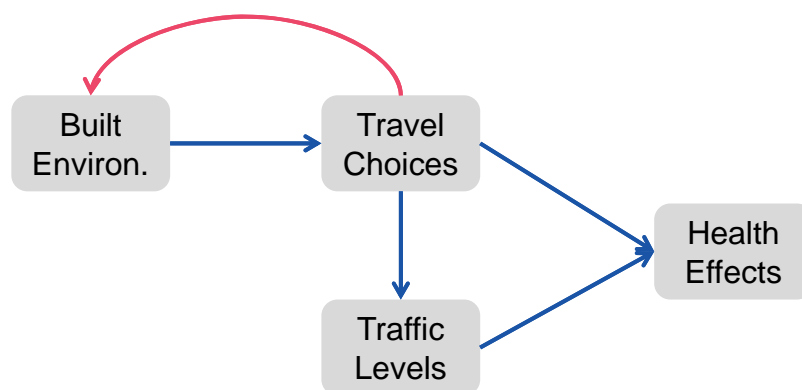


Survey

Neighborhood	Walked/Biked Today	Other Mode Today
Highly Walkable	6	9
Moderately Walkable	3	12
Not Walkable	--	--



Simplified Effect Linkages





INDIVIDUAL ASSIGNMENT 1



Revised Assignment 1: Sustainability Challenges

Choose one specific transport-related sustainability *challenge* to focus on. Write a short reflection in free text (about 600 words for the text). Add a reference list (no limits on this)). Reflect on the following:

- Given current trends, how do you expect the effects of this challenge to play out on ecological sustainability – across different geographic areas (urban/rural, different parts of the world, etc.) and across time (next 5 years, next 20 years, next 100 years)?
- Next, given current trends, as well as considering the ecological effects, how do you expect this challenge to affect economic sustainability, again considering the same spatial and temporal dimensions?
- Finally, how do you expect the effects on social sustainability to play out, given current trends as well as the ecological and economic aspects – across different population groups and across time?



Timeline

- **Tuesday, 31st January, 8.00**
Bring draft to class (2 printed copies)
- **Friday, 10th April, 12.00**
Submit assignment in Course Web
- **Late Assignments (up to 2 days)**
Marked down one grade-letter

- **Note:**
 - If you have started already on the old assignment, you may choose to continue.



PROJECT ASSIGNMENT



Your Task

- Chose one policy specific measure/strategy/plan that has been implemented in one of your two case locations (cities, regions, or countries) and which have the potential to make the transport system more sustainable.
- Measures/strategies/plans may be of very different kinds, for instance: support for urban sustainability plans, a congestion charging system, an infrastructure investment scheme, cycling amenities, electric vehicle charging facilities, a specific urban design strategy, etc.
- But be sure to choose something specific, to keep the size of the project manageable.



Your Task

1. Describe the specific experiences of the policy measure/strategy/plan in the implemented location.
 - a) What were the key success factors or challenges for the implementation, particularly with respect to travel behavior and how transport systems function?
 - b) How may the policy measure/strategy/plan affect the three dimensions of sustainability, into the future?
2. Second, analyse how this policy measure/strategy/plan could be implemented in your second case study location.
 - a) How suitable is it, considering the different contextual factors in the two locations? Consider for example institutional, cultural, environmental, and human aspects.
 - b) Should it be adjusted to better fit the contextual factors in the other location, and if so, how?
 - c) What barriers may arise, and how can they be overcome?
3. Finally, make a critical assessment of the overall potential for success for this policy measure/strategy/plan in the second location, given the findings in Part 2.



Timeline

- **Tuesday, March 31**
Groups Formed – write in at Course Web
- **Tuesday, April 14**
Decide on a topic – write in at Course Web
- **May 19 & 21**
Seminar presentations
- **May 15** (not May 18)
Report due
- **May 29**
Reflection on group work due



ROAD ECOLOGY



TYPES OF EFFECTS



Impacts on Ecology (Southerland 1994, for EPA)

Destruction of Habitat

- Conversion of land to transport uses ("right-of-way")
- Leveling land, clearing vegetation
- Filling/draining wetland





Impacts on Ecology (Southerland 1994, for EPA)

Fragmentation of Habitat

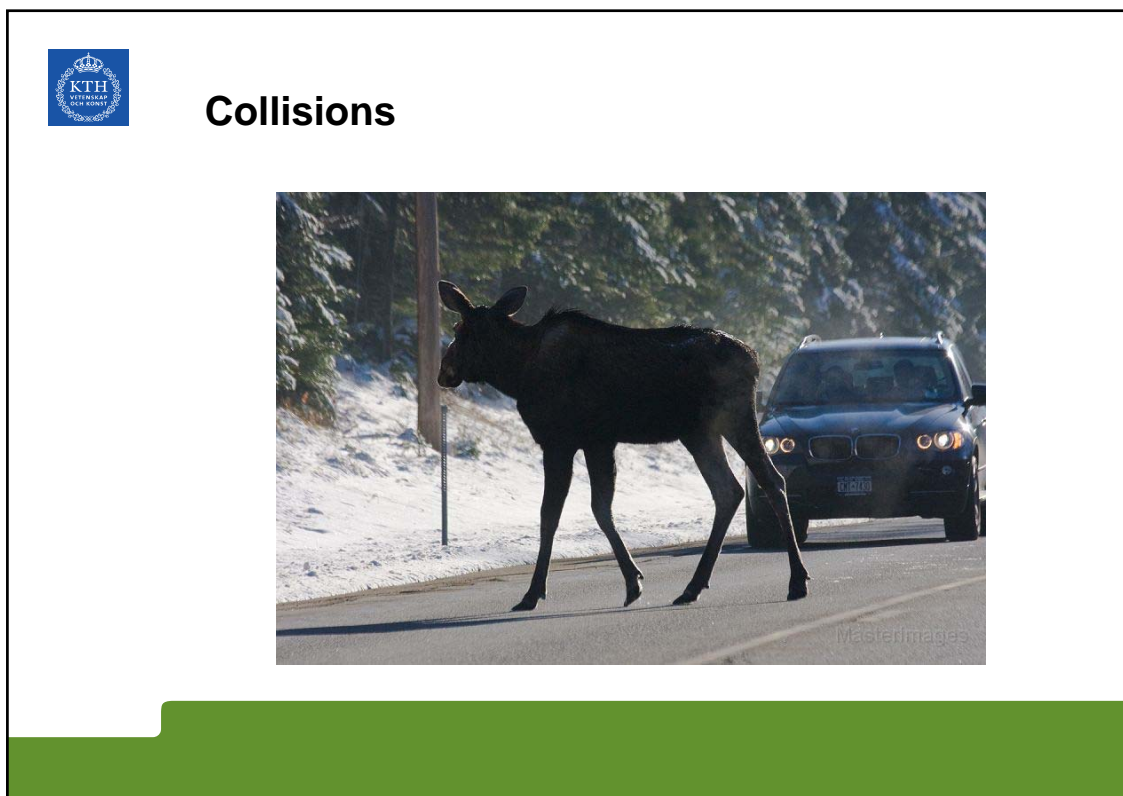
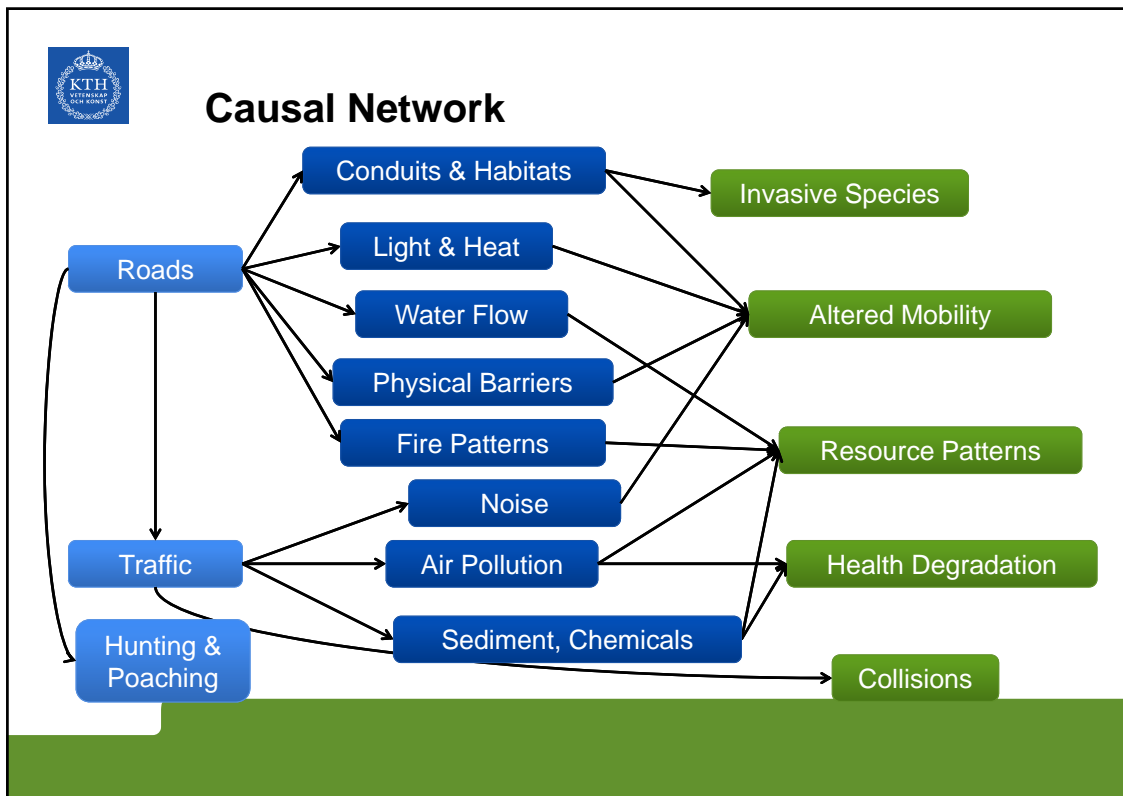
- Reduced genetic diversity
- Higher chance of local extinction
- Extinction of wide-ranging species (wolves, black bears, panthers, etc.)
- Loss of interior or area-sensitive species (e.g. certain birds)
- Abundance of weedy species



Impacts on Ecology (Southerland 1994, for EPA)

Degradation of Habitat

- Pollution
- Disruption of...
 - Hydrology
 - Fire regimes
 - Animal migration
 - Competitor & predator-prey dynamics





Vehicle Disturbance & Road Avoidance

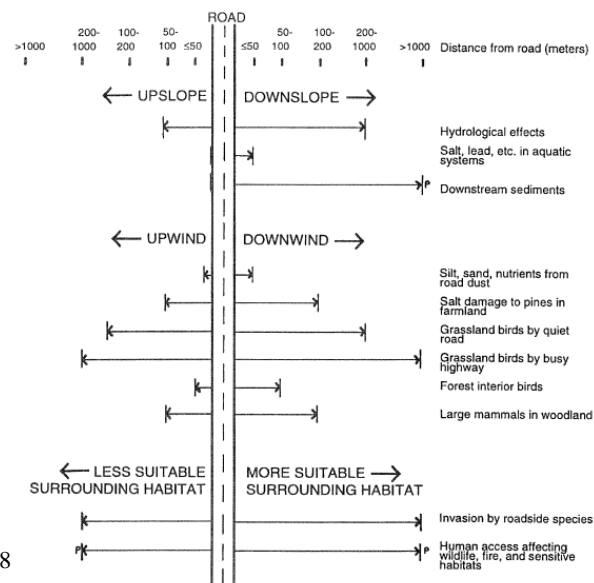
E.g. kilometre road per square kilometre

Effects related to:

- Faunal movement
- Population fragmentation
- Human access
- Hydrology
- Aquatic Systems
- Fire patterns



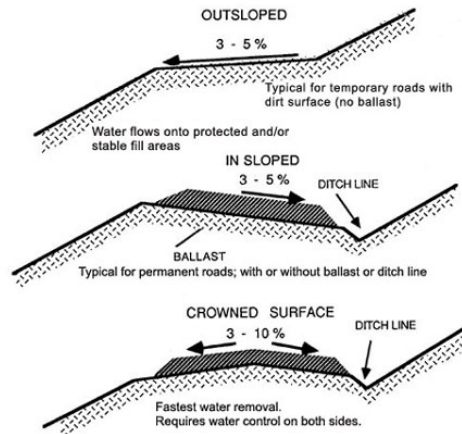
Barrier Effects & Habitat Fragmentation



Forman & Alexander 1998



Water Runoff



UN Food and Agriculture Org. 1998



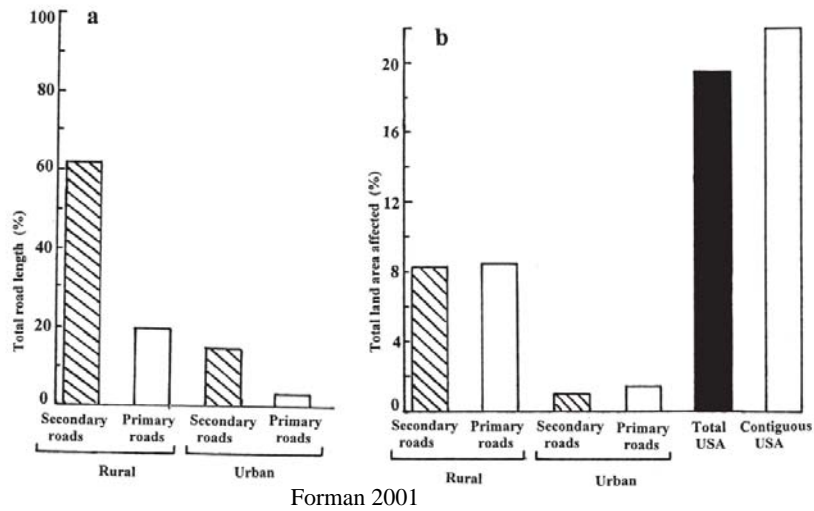
Sediment & Chemical Runoff



Sydney Catchment Authority 2013



How big of a problem?

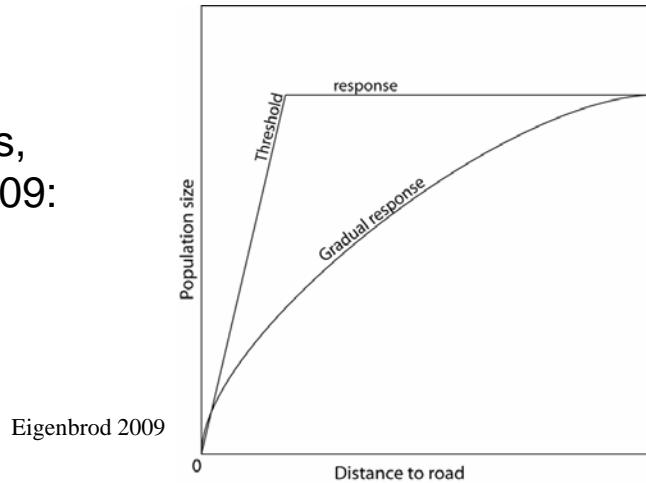


ASSESSING ECOLOGICAL EFFECTS OF ROADS



Quantitative Measures

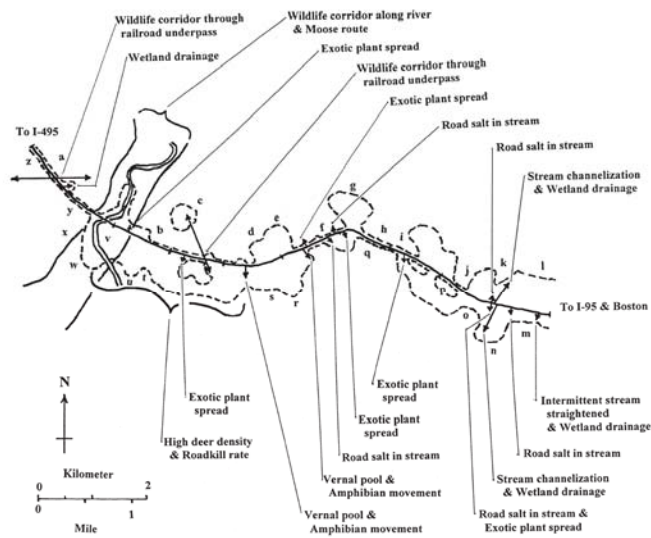
Road Density
 Road Location
 Road Effect Zones,
 e.g. Eigenbrod 2009:



Eigenbrod 2009



Road Effect Zone



Forman 2001

Figure 1. Road-effect zone along 10 km of a Massachusetts bigway. Locations of key road effects are indicated by arrows. Dashed lines border areas where forest and grassland bird communities are estimated to be affected by



MITIGATION MEASURES

Buffers & Corridors

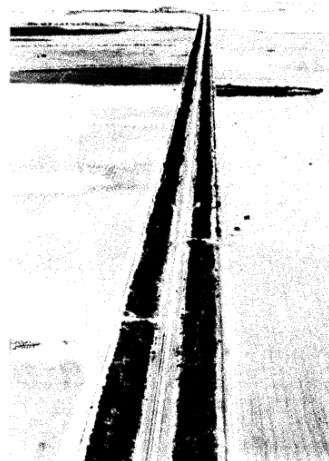


Broader Policies

Forman & Alexander 1998

Australia

- Biodiversity – e.g. wildflower protection
- Network of road reserves with vegetation strips
- Burning, weed control
- Close cooperation between ecologists, engineers



Forman & Alexander 1998



Broader Policies

Forman & Alexander 1998

North America

- Vehicle pollutants
- Engineering solutions for soil erosion & sedimentation
- Some states:
 - Over- & Underpasses
- National policy focused on urban areas



Broader Policies

Forman & Alexander 1998

Netherlands

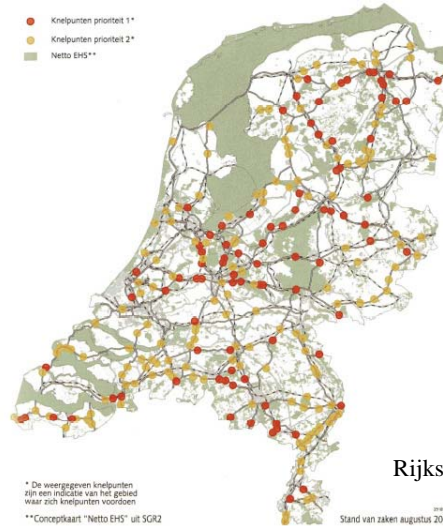
- Open roadside vegetation
- Roadkills
- Animal movement
- Nature restoration
- “Ecological network”
- Overpasses, tunnels, culverts





Mapping the Ecological Network

Netherlands →



Wolverine Overpass ("Ecoduct") Banff, Alberta, Canada





Undercrossing for Panthers Florida, USA



Elevated Viaduct Loing River, France





Toad Tunnels California, USA



Badger Culvert British Columbia, Canada





Highway Landscape Plans Netherlands

Ontwerpprincipes voor de omgeving van de weg als palet van elf karakteristieke gebieden

