Introduction to Sustainable Transportation

Ryan P. Avery, PhD, PE, AICP, GISP, ENV SP

University of Washington
Why Does Sustainability Matter?

Figure 6: Human development index vs. ecological footprint by country (Source: Living Planet Report 2006, World Wildlife Fund).

World average biocapacity available per person

Within biosphere's average capacity per person, low development

Human Development Index

Ecological Footprint (2006 global hectares per person)

Threshold for high human development

USA
Canada

Sustainability Quadrant

Plotter by Irene Dhong, UFL ENV 6932
Why Does Sustainability Matter?

Why Sustainable Transport?

Transport accounts for much of our:

- Energy Use
- Carbon Emissions

Urbanization is continuing worldwide:

- Increased density is an opportunity
- Provides economies of scale
How Do We Get There?

Source: Utah Street Connectivity Study
Patterns of Development

TRADITIONAL SUBURBAN RESIDENTIAL

Source: iStockphoto/Scott Cramer

TRANSIT-ORIENTED DEVELOPMENT

Source: thetransitpass.wordpress.com
What Can We Do?

Change how we plan, design, build, and live:

• Consider life-cycle costs and effects
• New focus on livability, especially for land use and development
• Alternative energy sources
• Don’t forget freight/goods movement
Planning is Already Changing

- Complete Streets
- Walk/Bike Emphasis
- Demand Management
- Pricing/Tolling
- Transit-Oriented Development
- Focus on Resiliency

Photo: http://www.connectnorwalk.com/
Can Technology Save Us?

Connected/Autonomous vehicles?
Hyperloop?
Air Scrubbers?
Transporters?
Thank You!

Masdar City, Abu Dhabi, United Arab Emirates
APA Webinar
Sustainable Transportation - What is it? With Examples from a Sustainability Icon, Norway!

August 17, 2018
Agenda

> Introductions
> Why sustainable transportation?
> About the University of Washington Program
> Overview of Sustainable Transportation (Ryan)
> Norway and Sustainable Transportation (Ed)
> Questions
Your presenters

Dr. Ed McCormack
- Director, UW’s Master in Sustainable Transportation Program
- Research Associate Professor, UW Civil & Environmental Engineering
- Former Senior Engineer for Norwegian Public Roads Administration
- PhD: Geography

Dr. Ryan P. Avery, PE, AICP, GISP
- Senior Transportation Planner / Engineer at WSP
- Affiliate Professor, UW Civil & Environmental Engineering
- PhD: Civil & Environmental Engineering
Why Sustainable Transportation?
Why do we have a program in sustainable transportation?

New / major considerations:
> Climate change
> Human health
> Energy and resources
> Mobility and social equity
> Economy and e-commerce
> etc...

Opportunities for change:
> Non-motorized modes
> Travel demand management
> Tolls and pricing
> Public transit
> Autonomous vehicles
> Land use, transit-oriented development
> etc...
University of Washington’s Master of Sustainable Transportation (MST)

Focus on sustainable transportation:
> Planning, policy, research, and analysis

Explores the growing concern of transportation impacts across all categories:
> Environmental, social, energy, and economic impacts

Designed for working professionals:
> Convenient, part-time, online format with 43 credits
> 9 courses in three Focus Areas over 3 years

> MST Program website: www.sustainable-transportation.uw.edu/
Norway and Sustainable Transportation
We will:

• Discuss why Norway is a sustainability transportation icon

• Present a few examples

• Look at Norway’s programs and attitudes

• Speculate on why they value sustainability
Norway Overview

• High per-capita income (# 5 in world, US is # 9)
• Major oil exporter
• Income evenly distributed (Gini index)
• Social welfare democracy
• Often in the top ranks in happiness surveys
• Not officially part of the Europe Union
Sustainability

Why Does Sustainability Matter?

Norway: Ranked 1 in Human Development
Norway Facts

• Population 5.2 million (Minnesota)
• 125,000 square miles (New Mexico)
• 57,000 roadway miles (Wyoming)
• Density 34 people /sq. mile (Nevada)
• 16,000 miles of coast line
• Rugged, mountainous, arctic country
• Transportation budget around $7 billion (2017)
Challenges to Transportation - Mountains
Challenges to Transportation
- Winter
Challenges to Transportation – Historic Urban Form
Norway as a Green Place

- Stated national goals:
  - all new vehicles are zero emission by 2025
  - zero passenger car growth in cities
  - carbon neutral by 2030 (partially by buying carbon offsets)
- Higher environmental impacts due to an advanced society
- But environmental policies well integrated
- Stable GHG even though transport volumes have increased
- 99% power from hydroelectric
Supports Alternatives to Fossil Fuel Vehicles

- Electric Cars: 52% of all new cars sales in 2017, 2nd largest Tesla market

Norway powers ahead (electrically): over half new car sales now electric or hybrid
Why are Electric Vehicles Common?

• Due to national policy/regulations they are less expensive than gas/diesel vehicles
  – Tax breaks to purchase e-cars
  – Lower roadway tolls
  – Free charging
  – Free ferries fares
  – Lower or free parking rates
  – Gas expensive, electricity relative cheap
Many Charging Stations
Green Highways

- Fossil fuel free corridor stretching from Norway to Sweden
- Freight highway
- Series of stations for renewable fuel and charging
Norway’s Steep Vehicle Taxes

- Fuel tax (gasoline ~$8 per gallon)
- Vehicle purchase tax (tied to emissions)
- Annual registration tax
- Scrap deposit tax
- Income tax on company cars

- Electric cars not taxed near as much

- Adds around $3 billion a year to treasury
National Transport Plan (2018 - 2029)

• Prioritizes resources in transportation
• Climate considerations “are the basis of the work of the transport agencies”
• This drives many goals:
  – zero growth in car traffic
  – urban growth in transit and non-motorized modes - not in cars
  – major investment in cycling
  – move freight off roads to sea and rail
  – coordinated transportation planning
• Budget for land transport: $7.3 billion/year
National Transport Plan

• Goal - cut greenhouse gases from transport sector by 50%
• Incentives for zero and low emission transport
  – continued tax breaks and subsidies
  – parking priority
  – more charging stations to support long trips
• Significant increase in use of sustainable biofuels
• Investment in existing transit systems plus new bus rapid transit and light rail

Large order placed for hybrid buses in Norway

Tide Buss in Norway has ordered 35 electric buses, including 25 Volvo buses, meaning the city of Trondheim has the largest electric bus fleet in
Transportation Funding - Tolls

• Common in Norway (50 toll systems currently)
• 40% of annual construction budget comes from tolls
• Tolls cover investment costs plus used to support transit and non-motorized transportation
• Tolls to reduce traffic and emissions
• Often a public-private partnerships
• Policy tool
Click an project for further details
Urban Toll Rings

- Around several major cities
- Policy and fiscal tool (with a non-motorized allocation)
- Increasing discussion about use for congestion management
Why are Tolls Common in Norway?

• Mountainous country – roads expensive
• Political parties agreed action needed
• Tolls go to new transportation infrastructure
• Tolls last only 15 years
• Toll stations do not create bottlenecks
• Toll roads are clearly higher quality
• Can have different rates for zero emission vehicles
• Pay for your impacts ethic
Non-motorized travel in Norway

• 25% of all trips on foot (USA 9%)
• 5% of all trips on bikes (USA 12%)
• Most Norwegian towns have bike/ped facilities
• Non-motorized facilities designed into most new transportation projects
• Low rate of pedestrian fatalities (2 per million people)
Extensive Bike and Pedestrian Infrastructure
National Transport Plan

- Goal: increase bike ridership to between 10% and 20%
- Express bike highway - two-lane, cross-country bike tracks in and near nine largest cities
- Tax breaks for e-bikes
- $935 million for bike infrastructure
- $2.2 billion for public transport, walking and cycling

https://www.smp.no/ntb/innenriks/2016/02/29/Vil-bruke-8-milliarder-pa-superveier-for-syklister-12215909.ece
National Transport Plan

• $923 million for pedestrian and bike infrastructure
• Goal: 10% to 20% bike ridership
• Prioritize development of 10 bike express routes in 9 major cities
  – high quality separate facilities
  – designed for fast travel (25 MPH)
  – commuter links between inner cities and outer suburbs

https://www.visitnorway.com/media/news-from-norway/norwegian-proposal-goes-viral-may-spend-1-billion-on-bike-highways.html
https://www.citylab.com/solutions/2016/03/norway-bike-highways-billion-dollars/472059/
Urban Areas

- Fuel taxes and funding used to remove passenger cars
- Urban environmental agreements ($4.1 billion) with local governments for land use plans that supports zero growth of cars
- New transit services
- Mitigation required for projects that increase passenger cars usage
Roundabouts

- Replaced most traffic signals
- Lower cost, maintenance and energy
- Better throughput and safety
Norway and Tunnels

- Over 900 tunnels
- Replace ferry routes
- Many long and deep tunnels
- A number have roundabouts
- Adding 40 to 50 miles of tunnel per year
- Under urban areas
Sustainable Impact: Tunnels

- Tunnels better in mountains (less climbing and snow plowing)
- Replace ferries
- Reduce urban congestion and optimize space
Why is Norway so Sustainable?

• Norwegian Social Attitudes
  – Equality and fairness
  – History of cooperation among equals
  – History of small farm ownership so a focus on self-independence and sustainability
  – Concern about esthetics and nature
Planning Attitudes?

- **Norway**
  - Top down planning
  - Driven by social mandates “e.g. Lower greenhouse gas emissions”
  - Often EU programs
  - Trust their government to do the right thing
- **USA**
  - Bottom up planning
  - Often driven by stakeholder concerns
  - More individual programs
  - Skepticism of government

---

**Key EU targets for 2030**

- At least 40% cut in greenhouse gas emissions compared with 1990
- At least 27% of total energy consumption from renewable energy
- At least 27% increase in energy efficiency
Norway Overview

- Smaller more homogeneous society
- Citizens trust their government
- Willing to spend funds to make life better
- Oil wealth helps
- Environmental concerns always on agenda
- But also major exporter of oil and user of energy

**Bottom line:**
Beautiful country and citizens interested in keeping it that way
Contact Information

Ed McCormack
Email: edm@uw.edu
Phone: 206.543.3348

Ryan Avery
Email: rpavery79@gmail.com
Phone: 206.382.5219

Master of Sustainable Transportation Program
https://www.sustainable-transportation.uw.edu/