



LEDS Global Partnership

Clean Transport Development Webinar Series **Development Impact Assessments for Transportation**

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www.LEDSGP.org





Agenda

- Introduction to Development Impact Assessments (DIA) for transportation projects
- Impacts most commonly assessed
 - Why they are assessed
 - How they are assessed
 - What techniques, guides, and tools are used for assessment
 - Difficulties to assessment
- How to prioritize between impacts
 - Specific goals and initiatives
 - Livability indexes or gross national happiness
 - Monetizing “externalities”

Introduction to Transportation DIA

- DIA: a systematic way to make sure that projects and policies contribute towards a country's development goals.
- Each country has different development goals, but the ***United Nations' Millennium Development Goals*** (right) provide a good insight
- They can be categorized as economic, social, and environmental/health
- Transportation has strong impacts on all of these development categories





Transportation DIA in LEDS Context

- DIA Identifies and evaluates the link between low carbon transport and other development objectives
- Also referred to as co-benefits analysis, but DIA recognizes that some impacts may be negative
- Informs and supports transport decisions and data-driven choices
- Can be applied to projects, policies, or entire transportation systems
- Incorporates new partners that may not otherwise be interested in climate protection





Transportation Projects & Policies to be Assessed

- New access to road or rail systems
- Road expansion to increase capacity
- *Avoid* kilometers travelled
 - Urban development planning
 - Transportation demand management projects
- *Shift* kilometers travelled
 - Non-motorized transport
 - Mass transit
- *Improve* kilometers travelled
 - Fuel economy technologies
 - Alternative fuels

Increases GHG

Reduces GHG



Variety of Development Impacts

- Economic Performance
 - Cost savings for travelers and businesses
 - Trade (gross domestic product)
 - Employment and wages
 - Energy Security (and business security)
- Environment and Public Health
 - GHG emissions
 - Air Pollution (linked to public health)
 - Road safety
 - Exercise increase
- Social Performance
 - Accessibility
 - Community cohesion
 - Equity (socioeconomic, gender, race, disability)
 - Time savings



Assessment Level of Sophistication

Assessment Strategy, as Level of Sophistication Increases

Studies

- Determines causal relationships to extrapolate from

Guide

- A series of steps to help you chose the best way to extrapolate and what data to use

Tools/Models

- Asks for specific data, automatically extrapolates from most appropriate studies, calculates and reports end result

Transportation Demand Model

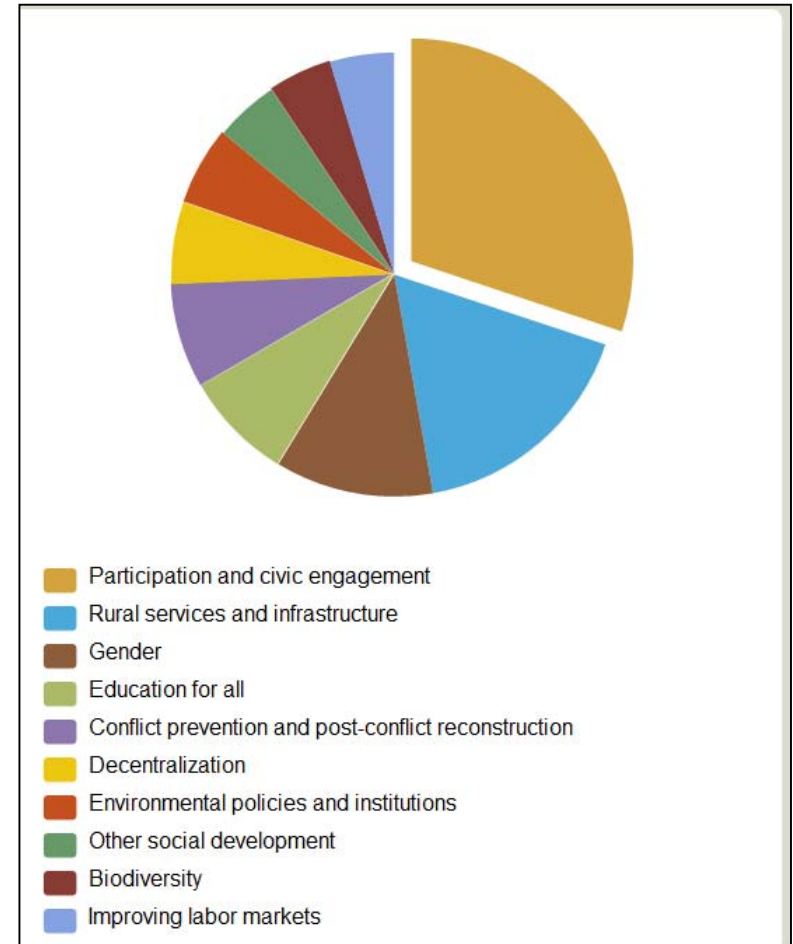
- Geographic framework model of entire transportation system, complete with feedback loops, that can incorporate more specific models

- Depends on availability of studies, data, experts, funding, and tools
- Various impacts have more of these resources available than others
- Assessment strategy depends on how many resources are available
- All strategies build on and incorporate each other



Why Assess Economic Impacts?

- Overarching goal of “development”
- “Job Creation” carries much political weight in most countries
- Assessments help compete for private sector investment and development bank funding
- Appeals to portions of population that might not be motivated by environmental, health, or social benefits



World Bank projects funded by theme, 2013. www.worldbank.org



Economic Impacts

Transportation projects and policies can boost the economy through five mechanisms:

1. Reduce business travel and transport costs
2. Reduce personal travel costs (thereby increasing customer's expendable income)
3. Increase business market reach for suppliers, customers, and workers
4. Improve job access
5. Energy security



Reduce Personal and Business Travel Costs

- Most money spent on petroleum leaves the local economy (economic loss instead of transfer)
- Reductions achieved through *avoiding, shifting, or improving* kilometers traveled make businesses more competitive and enable customers to purchase more
- Very quantifiable with numerous calculators and good default assumptions available. . .

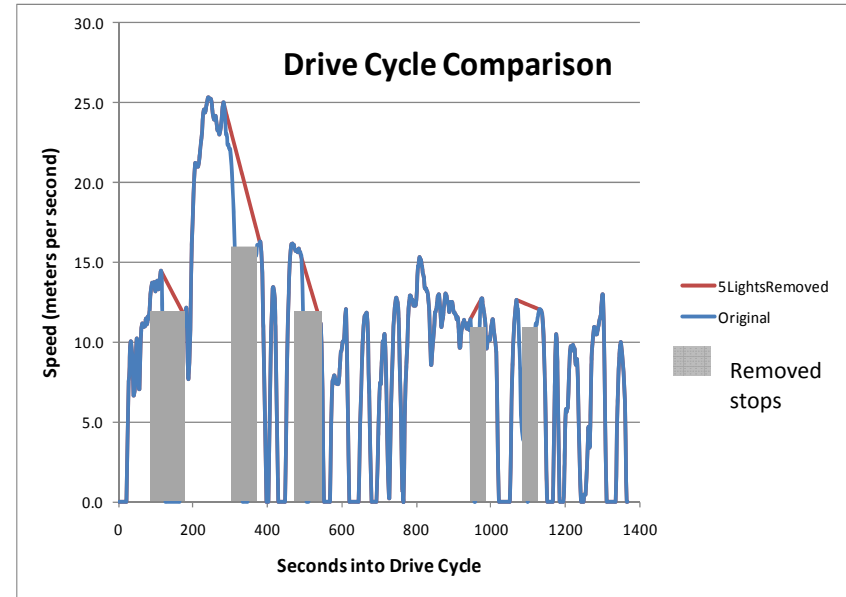
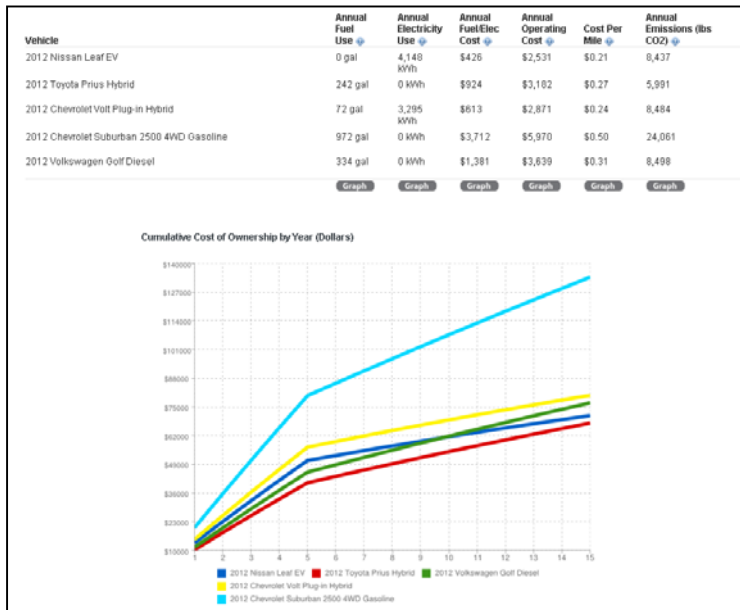


Travel Cost Calculators

Model	Audience	Project	Output	Difficulty 1-10
Vehicle Cost Calculator	Vehicle Purchasers	FE improvements and alternative fuels	Cumulative \$ spent on owning and operating various vehicles	2
Fueleconomy.gov Trip Calculator	Vehicle Purchasers	FE improvements and alternative fuels	\$ fuel cost for specific trip	1
Future Automotive Systems Technology Simulator	Fleet Operators, Road designers	Traffic Flow Improvements, PHEVs	fuel savings of specific vehicles on various drive cycles	9
Vehicle Infrastructure Cash-flow Evaluation (VICE) Model	Fleet Operators	CNG vehicles and refueling station	NPV, ROI, and payback period	5
Petroleum Reduction Planning (PReP) Tool	Fleet Operators	Alt Fuel, Fuel Econ, Idle and KMT Reduction, Ecodriving	Fuel Cost Savings	2
Marginal Abatement Cost (MAC) Tool	Companies, Policymakers	FE improvements and alternative fuels	\$/ton carbon abated for various projects	?
APTA Transit Savings Calculator	Commuter	Bus, BRT, or Rail	Annual cost savings	1
Health Economic Assessment Tool (HEAT)	Commuter, Public Health Official	Bicycling, Walking	Comprehensive (including health) cost comparison between driving, cycling, and walking	?
Transport Emissions Evaluation Models for Projects (TEEMP)	Regional Planners	BRT and Metro	Annual costs and saving, including health externalities	6
Tool for Rapid Assessment of City Energy (TRACE)	City Planners	Passenger Transport	Recommendation of most cost-effective efficiency-improving projects	7

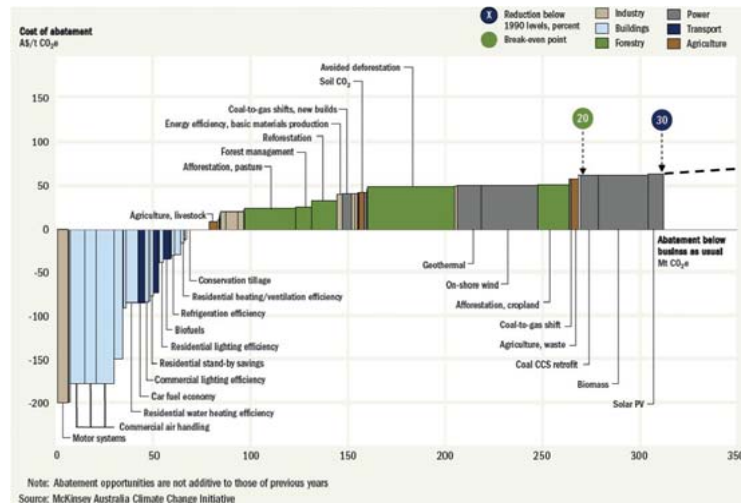


Travel Cost Calculators



Vehicle Cost Calculator

FASTSim



MAC Tool

Increase Business Market Reach and Job Access

- Assesses the changes in sales, gross regional product, employment, and wages associated with transportation projects
- Assessed by “input-output models,” often tied to transportation demand models
- These models are expensive and data-intensive, but lessons can be learned from related assessments
 - Guides highlight these lessons learned and help with model choice

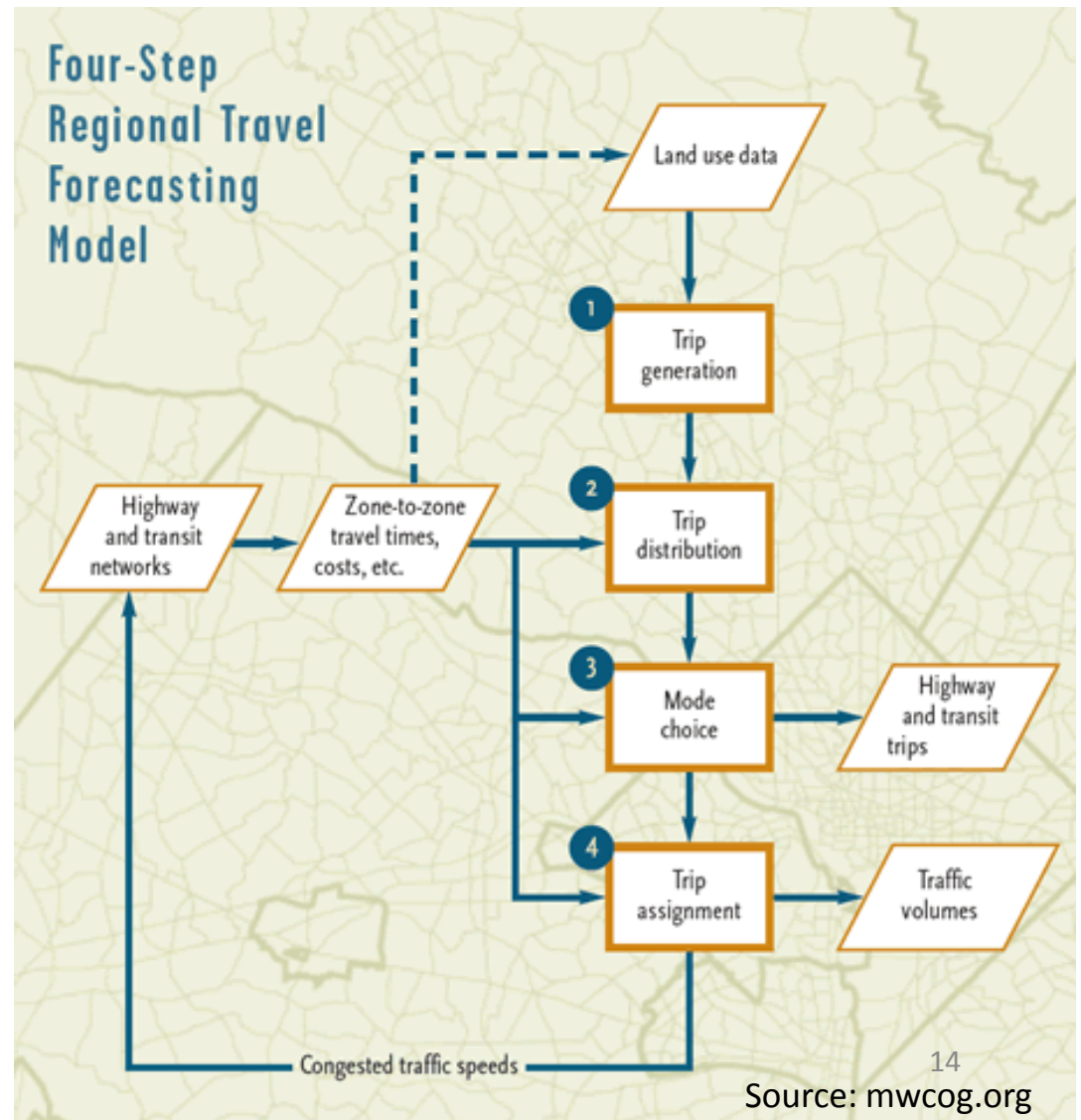
www.ilo.org/



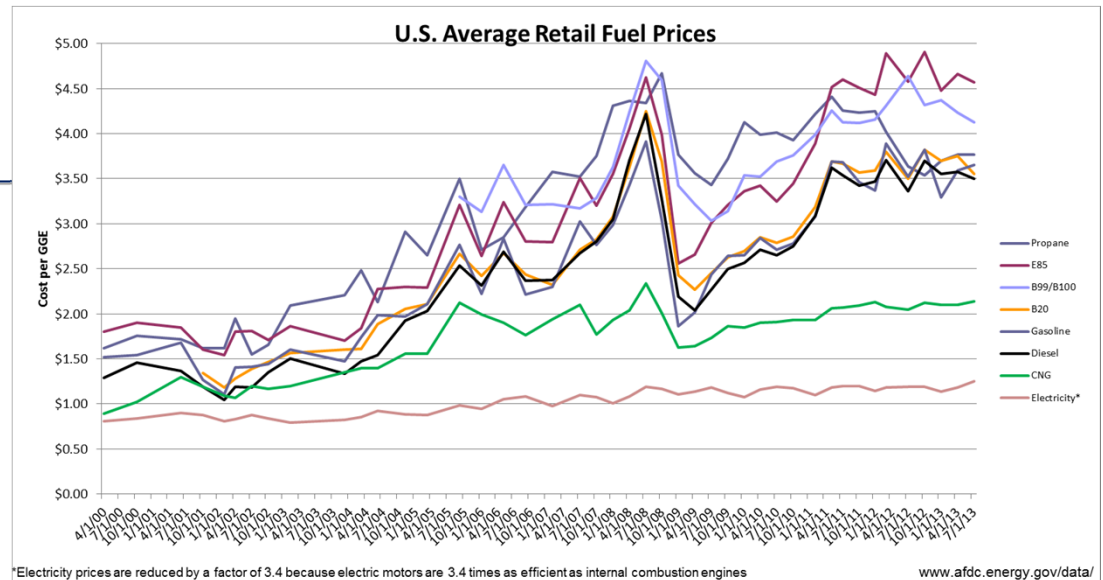
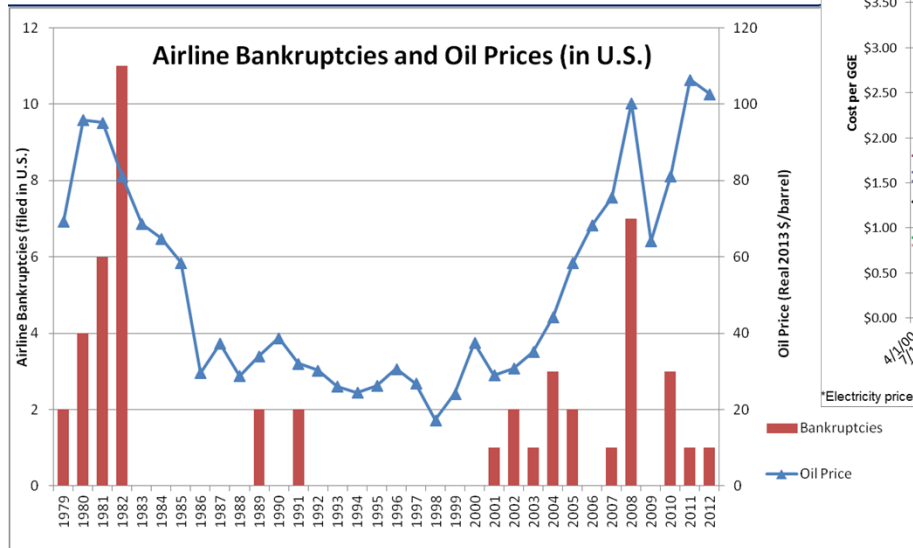
www.vtpi.org/

Transportation Demand Models

- Can be the backbone of many development impact assessments and models (Economic, Environmental, and Social)
- Most use 4 steps →
- Numerous model choices with contractor support
- TRANSIMS is the leading open-source model



- Price volatility kills business plans
- Some fuels are less volatile than others
- Increasing fuel economy by 25% decreases fuel price volatility by 25%
- Decreasing VKT by 25% decreases price volatility by 25%



Source: Alternative Fuels Data Center www.afdc.energy.gov/data



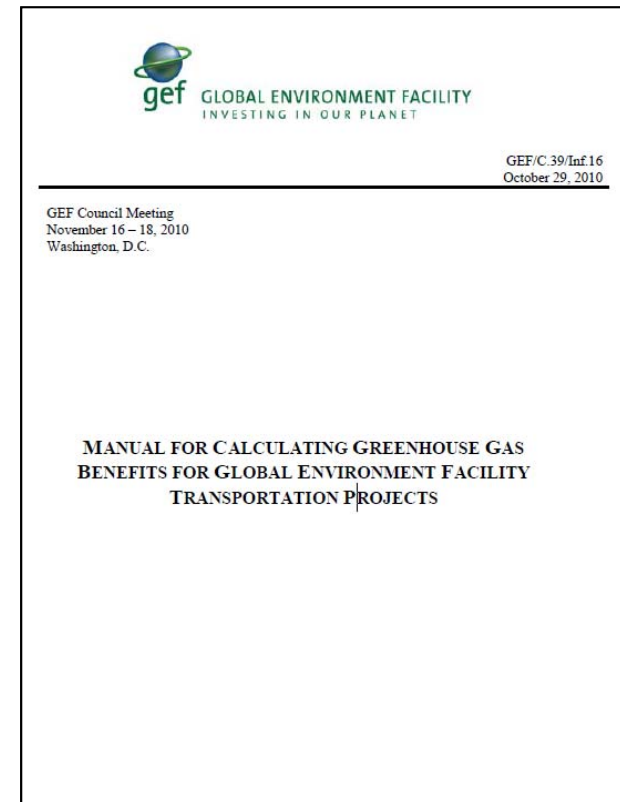
Why Assess Environmental and Health Impacts?

- International companies are increasingly being held accountable for their safety and environmental impacts in developing countries
- Many environmental issues are global—drawing international support
 - Foundations (i.e. Clinton and Gates)
 - Global Environment Facility
 - Development Banks
 - Carbon Markets

2013 Savar (Bangladesh) garment factory building collapse
Source: Voice of America



- Avoid, Shift, and Improve projects reduce GHG emissions, generally in that order
- Need to assess the lifecycle (well-to-wheel) emissions of fuels
- Numerous tools and default values to calculate and compare GHG emissions from specific transportation projects
- GEF Guide introduces good process and tools

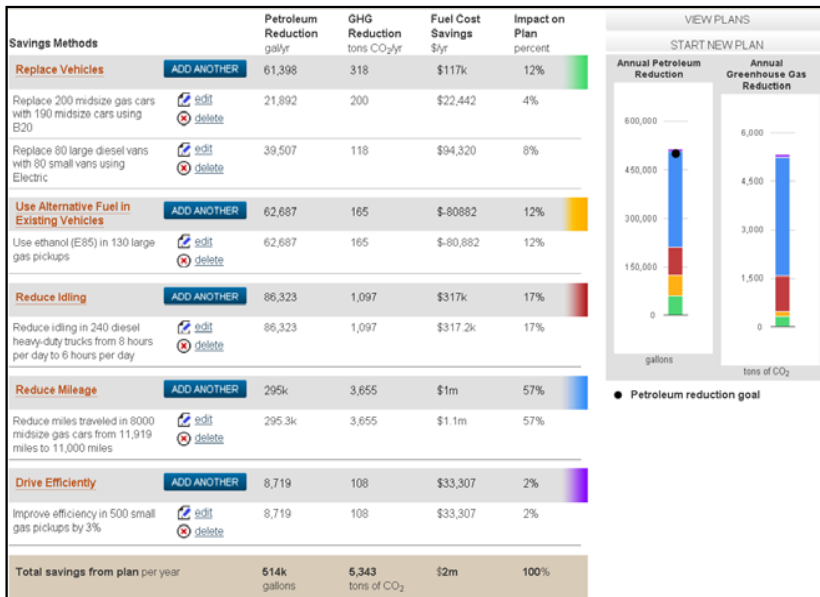




GHG Calculators

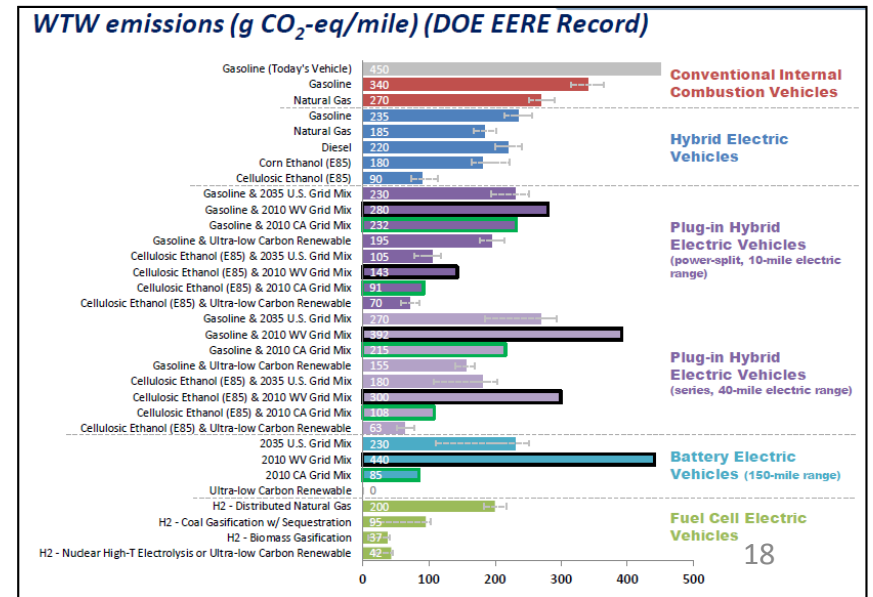
Model	Project	Audience	Difficulty 1-10
Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) GREET Fleet (Simplified version of GREET)	Alternative Fuels (current and emerging) with over 100 feedstock/production pathway/vehicle combinations Existing Alternative Fuels	Analysts & Policymakers Fleet Operators	7 3
Petroleum Reduction Planning (PREP) Tool	Alt Fuel, Fuel Econ, Idle and KMT Reduction, Ecodriving Bikesharing program, Bikeway, BRT, Commuter	Fleet Operators	3
Transport Emissions Evaluation Models for Projects (TEEMP)	Strategies, Ecodriving, Expressway, Parking Pricing, Pay-as-you-go Insurance, Rail (Freight and Commuter)	Transportation Planners, Analysts, Policymakers	2-6
Long-range Energy Alternatives Planning (LEAP) System	Energy Policy- big picture	City Policymakers	?

All outputs are tons CO₂e reduced, accounting for the full lifecycle of the fuel



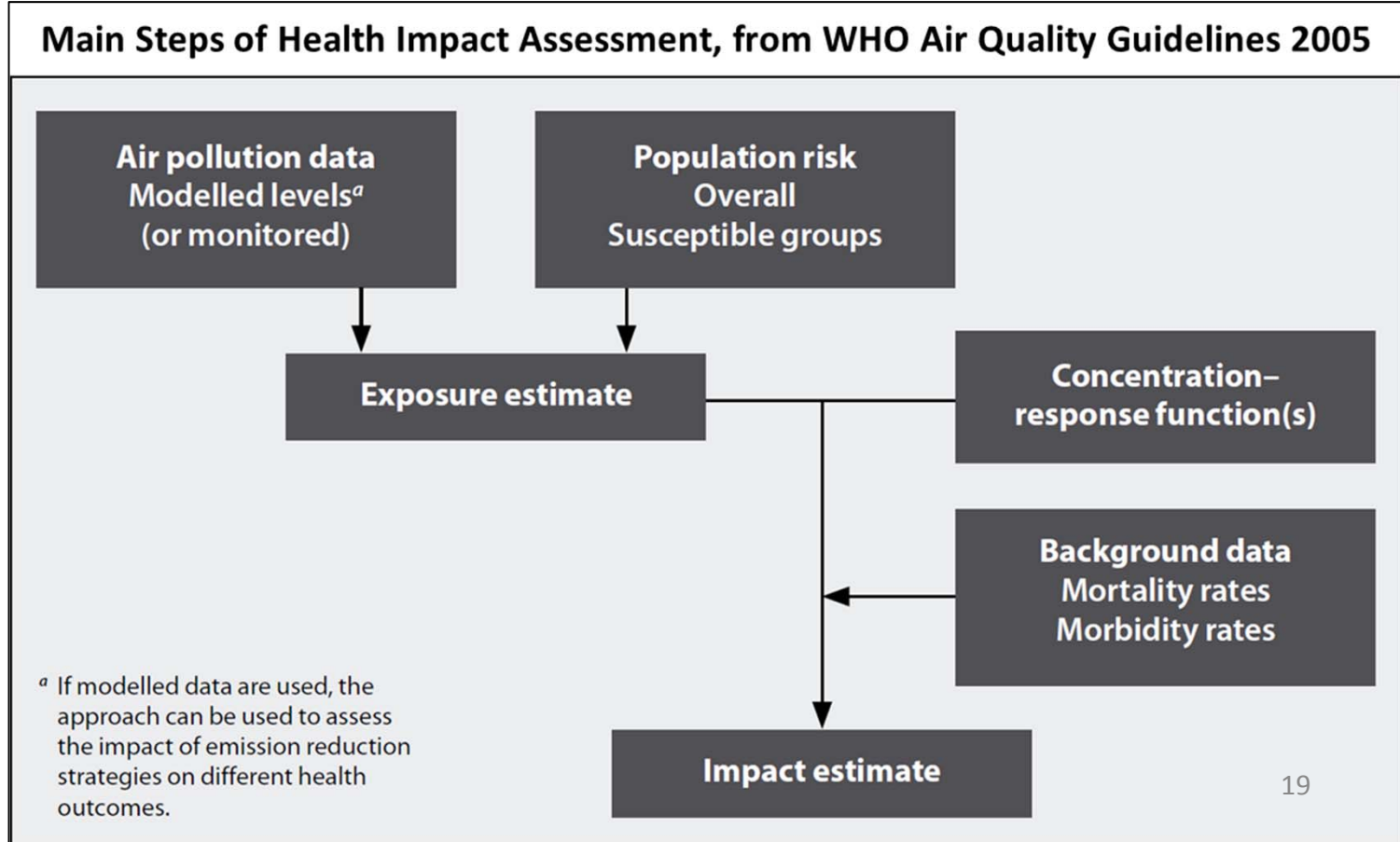
GREET →

← PREP



First determine change in CO, NO_x, SO₂, PM emissions, then extrapolate impacts from previous studies with the help of WHO Air Quality Guidelines, linked documents, and models

Models
AirQ 2.2.3
 (WHO)
 and
BenMAP
 (U.S. EPA)
 calculate steps after
 “air
 pollution
 data”



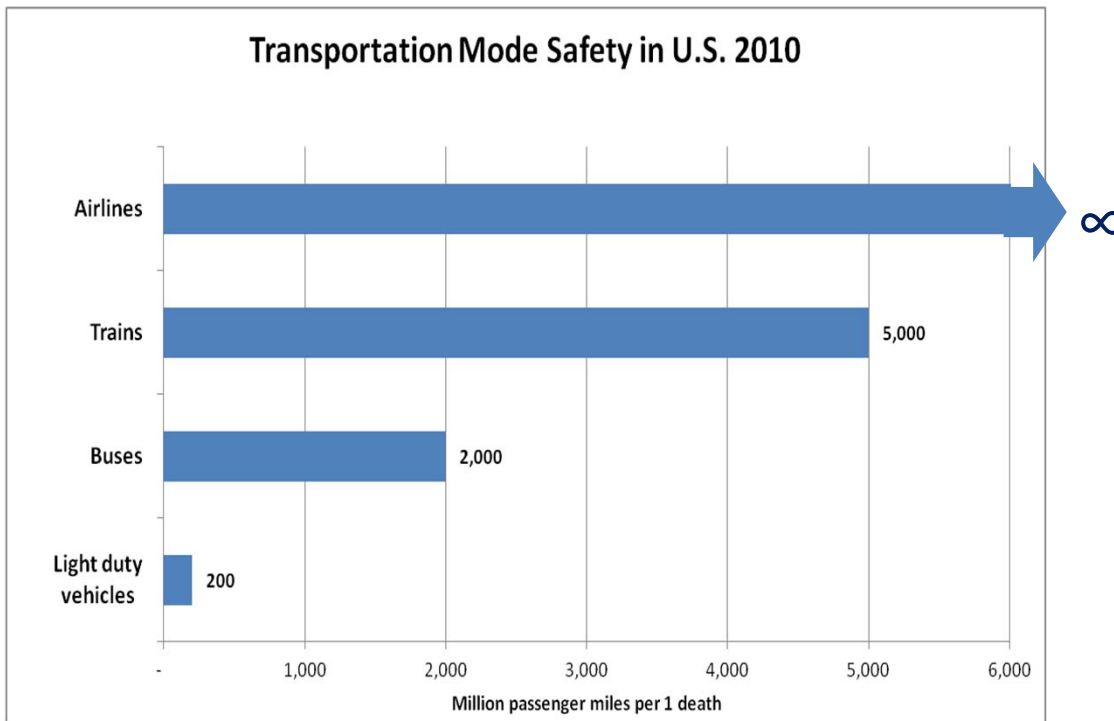


Local Air Pollution

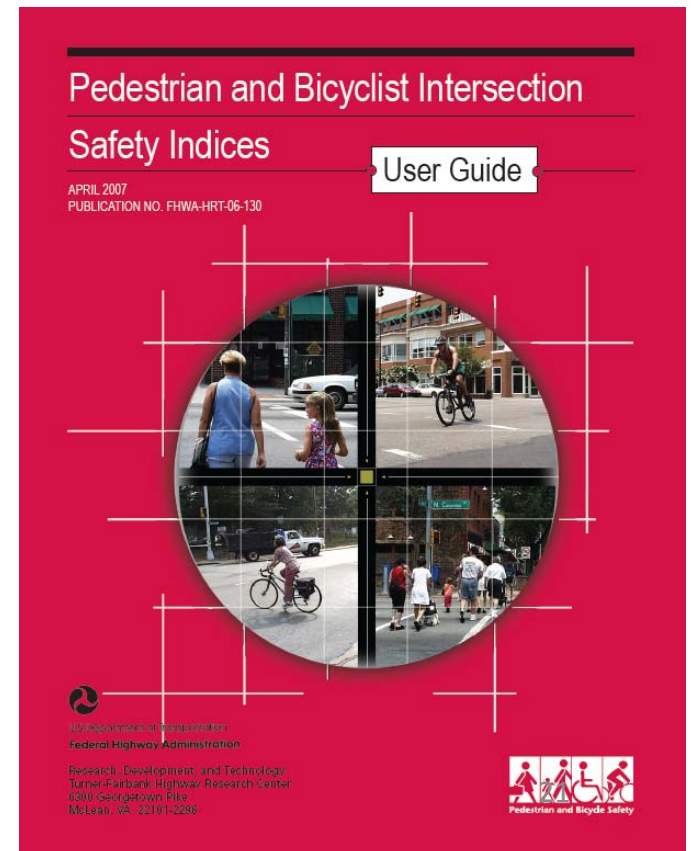
Models to estimate changes in emissions from transportation projects

Model	Project	Audience	Difficulty 1-10
Long-range Energy Alternatives Planning (LEAP) System	Energy Policy- big picture	City Policymakers	?
Motor Vehicle Emission Simulator (MOVES)	Change in vehicle stock	Transportation Planners, Analysts, Policymakers	9
Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET)	Alternative Fuels (current and emerging) with over 100 feedstock/production pathway/vehicle combinations		7
Transport Emissions Evaluation Models for Projects (TEEMP)	Bikesharing, Bikeway, BRT, Commuter Rail, Expressway, Pedestrian Improvement	Transportation Planners, Analysts, Policymakers	2-6

- Mode shift is key to assessing mass transit
- Bicycle and Pedestrian projects have safety indices, and models to calculate
- Bicycle and Pedestrian projects have “critical mass” levels at which they become much safer

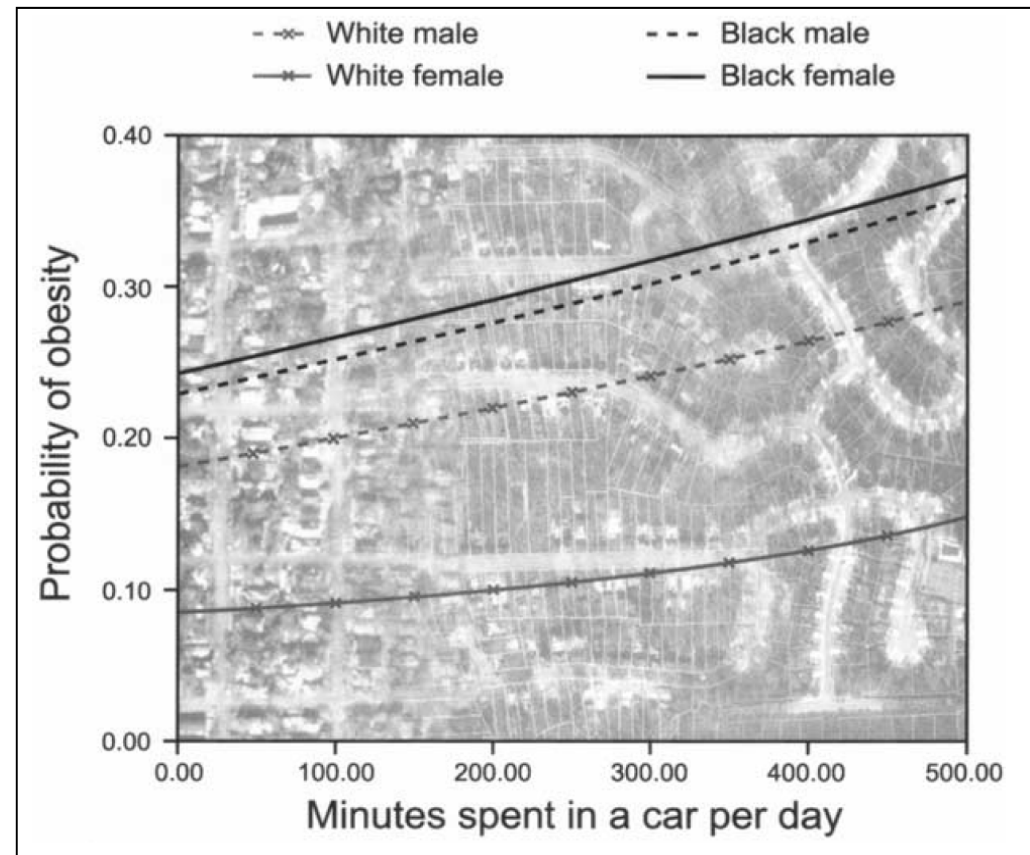


Data Source: Injury Facts, by National Safety Council, 2013.



Exercise Increase

- Relationships between land use mix, multi-modal communities, time in car, active transit, obesity, multiple diseases, and longevity have been established
- The Health Economic Assessment Tool (HEAT) for Cycling and Walking was developed by WHO to quantify health (and other) benefits

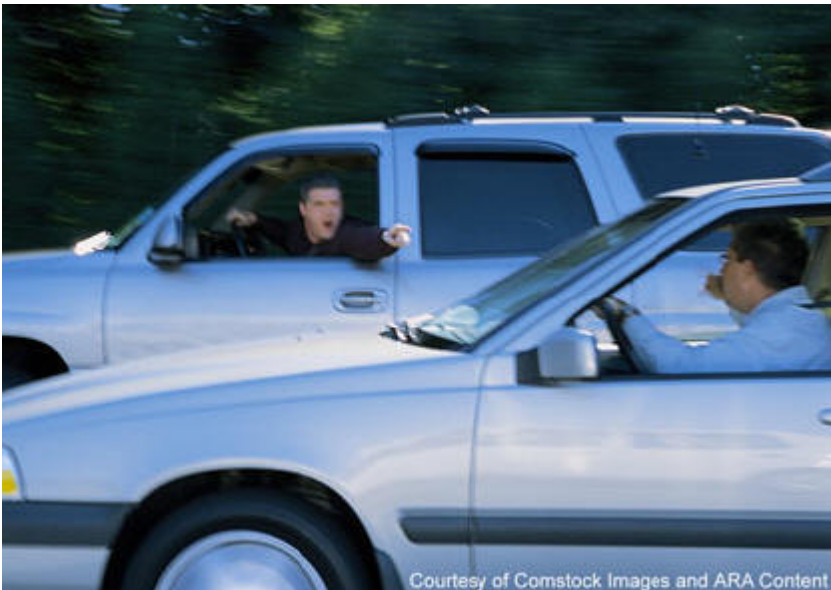


Source: Frank et. al., Obesity Relationships with Community Design, Physical Activity and Time Spent in Cars, 2004



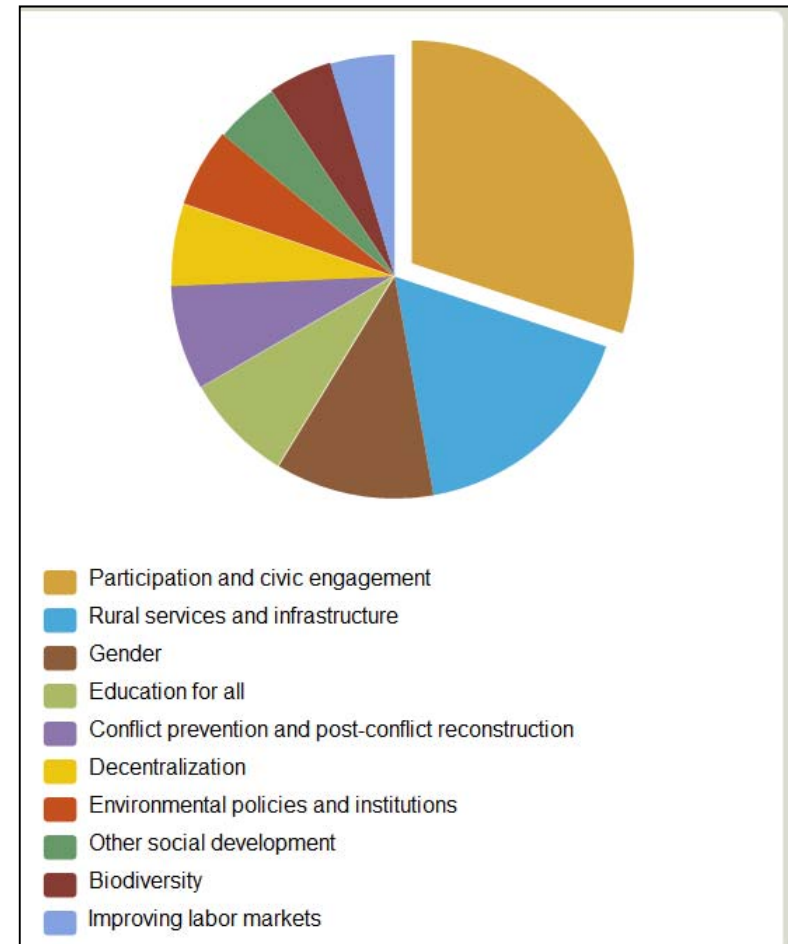
Why Assess Social Impacts?

- Many “developed” nations are unhappy and unstable despite strong economies and healthy environments
- In many places, the local society is deteriorating even more quickly than the environment
- Most happiness studies show that human interaction is the #1 driver of happiness
 - Human interaction is highly interrelated to the transportation system



Why Assess Social Impacts?

- Powerful interest groups based upon social impacts
- Foundations very interested in social impacts
- Much of development bank funding goes towards social projects



World Bank projects funded by theme, 2013. www.worldbank.org



Accessibility

- Rate access to three services
 - Basic services (health care, education, child care, public safety)
 - Quality-of-life destinations (shopping, recreation, worship, and cultural centers)
 - Markets (employers, employees, suppliers, and customers)
- Four measures of accessibility
 - Change in travel time to given location
 - Change in travel costs to given location
 - Change in number of choices to given location
 - Change in market reach for businesses
- Interviews, focus groups, surveys, and site analysis can detect much that models miss
- Weighted accessibility values estimated by gravity models
- Transportation demand models forecast changes in aggregate travel time and distance



Travel Time Savings

- Overarching Goal: Minimize the number of hours people are spent isolated in congested traffic
 - Time spent on alternative modes of transportation isn't as socially (or economically or environmentally) destructive
- Travel demand models can usually minimize travel time
 - Savings calculated as difference between pre-project infrastructure and post-project
- Also important to reduce *variability* in travel time
- Well established methods determine the value of travel time savings (VTTS), based on income, comfort level, multi-tasking



Community Cohesion

- “Community cohesion” is used to describe patterns of social networking within a community
 - Impact with least systematic assessment methodology (with no models)
- Attributes of a pro-cohesion project:
 - Doesn’t require relocation of residents or businesses
 - Overcomes a physical barrier, or at least doesn’t divide a highly-cohesive neighborhood with a physical barrier
 - Reduces traffic noise, dust, and hazards that prevent people from socializing outside
 - Protects cohesion of a poor neighborhood, since the poor are more dependent on their immediate community

- Increased choice of modes is key to an equitable transportation system
- Bicycle and Pedestrian “compatibility Indices” are different than “safety indices” because they take convenience factors into account
- “Barrier Effect” must be assessed for roads and rails
 - Quantified in terms of additional travel delay experienced by age-specific pedestrians and cyclists

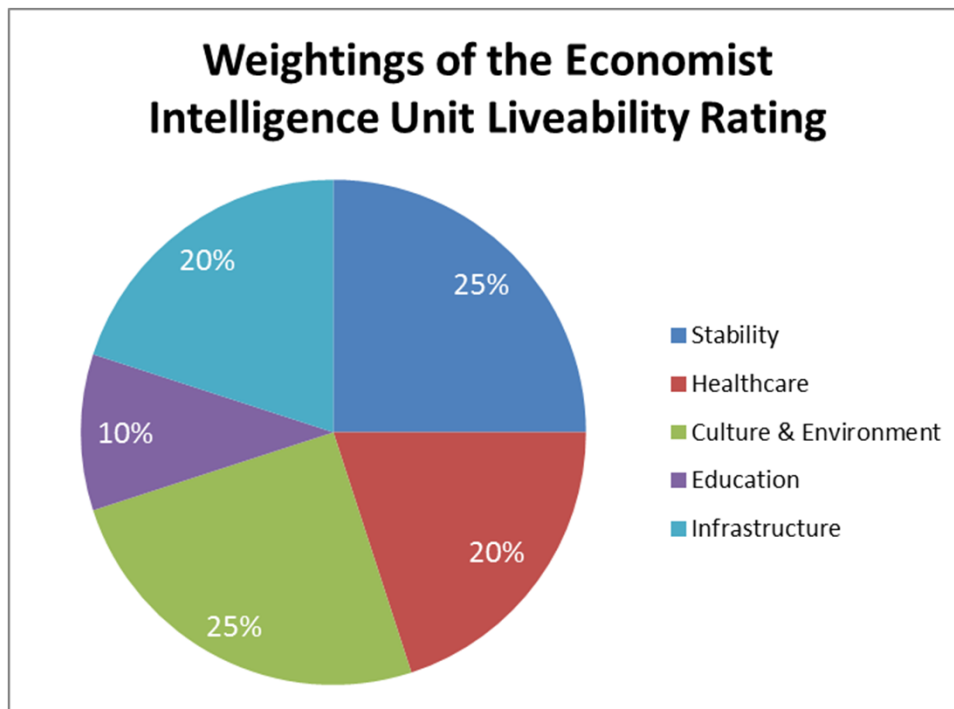
Table 5.2. Modes that are particularly important for specific user groups
(A = primary mode; B = potential mode)

Mode	Non-Drivers	Low-Income Person	Disabled Person	Commuters
Walking	A	A	B	B
Bicycle	A	A	—	B
Taxi	A	B	B	—
Fixed-route transit	A	A	B	A
Paratransit	B	A	A	B
Automobile	—	B	B	A
Ridesharing	B	A	B	A

Source: Guidebook for Assessing Social & Economic Effects of Transportation Projects, Transportation Research Board, 2001

Impact Prioritization

- Most countries [reactively] focus on problematic areas of development
- Livability Indexes and Gross National Happiness ratings are more proactive



Source: Economist Intelligence Unit 2013, www.eiu.com



Figure 1: The nine domains and 33 indicators of the GNH index

Source: A Short Guide to Gross National Happiness Index, Center for Bhutan Studies 2012



Using Currency as a Common Metric

Some environmental, health, and social “externalities” have well-established quantification methods

- Time savings (based largely on salary)
- Road safety, air pollution, and lack of exercise (based on health care costs or risk payments in the case of mortality)
- Accessibility (based on willingness to pay)



Using Currency as a Common Metric

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Conclusion

- DIA Identifies and evaluates the link between low carbon transport and other development objectives
- One reason to do DIA is to incorporate new partners that may not otherwise be interested in climate protection
- Numerous economic, health, environmental, and social impacts have well established ways to assess impacts
- The studies, guides, and tools available for assessments depend on the impact
- Prioritizing impacts is up to the country, but some systems are being developed
- Impacts are increasingly being converted to currency in order for broad comparison



Contacts and Information Resources

Website	Speaker	LEDS Contacts
<p>www.ledsgp.org</p> 	<p>Caley Johnson NREL</p> <p>Caley.johnson@nrel.gov +1 (303)275-3607</p> 	<p>LEDS GP Transport Working Group http://ledsgp.org/sector/transport</p> <p>LEDS GP DIA Working Group http://ledsgp.org/analysis/impacts</p> 