

LECTURE 2

Introduction to Sustainability

What Is Sustainability?

Sustainability

encompasses a holistic consideration of economic, social, and environmental progress over the long term.

What Is Sustainability?

- The United Nations Brundtland Commission (1987) defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”
- Transportation agencies/the transportation sector should address sustainability within their specific transportation context

Sustainability Triple Bottom Line (TBL)

Sustainability has three primary focus areas:



Economy



Society



Environment

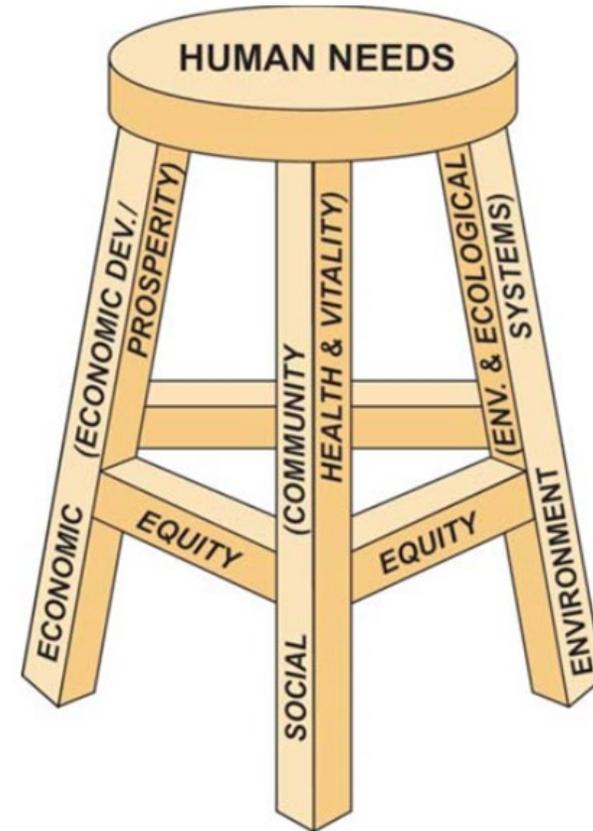
Sustainability Triple Bottom Line (TBL) (continued)

Transportation and TBL:

- **Economy** — depends on accessible and efficient movement of people and commerce
- **Society** — well-being depends on accessible and efficient transportation services, but transportation may intrude on community life
- **Environment** — does not benefit from transportation, so regulations are needed to mitigate negative impacts

Sustainability Principles and Equity

- **Fundamental principles of sustainability:**
 - Preserving and restoring environmental and ecological systems
 - Fostering community health and vitality
 - Promoting economic development and prosperity
 - Ensuring equity among population groups over generations
- **Equity connects each element of triple bottom line sustainability**



Source: NCHRP Report 708: A Guidebook for Sustainability Performance Measurement for Transportation Agencies. National Academies Press. <https://doi.org/10.17226/14598>

Impacts of Transportation

Energy consumption and climate change

- Transportation is a major consumer of energy, producing greenhouse gas emissions linked to climate change

Habitat

- Transportation affects adjacent habitat, impedes wildlife movement, and changes wildlife distribution

Water quality

- Transportation impacts water quality through temperature changes, erosion, sediment, and site pollutants

Hydrologic cycle

- Highway construction can affect stormwater runoff and the amount of water infiltrated back into the ground

Impacts of Transportation (continued)

Air quality

- Materials production, construction equipment, and fugitive dust can impact local air quality

Mobility and access

- Transportation may cause traffic congestion and road closures, affecting mobility and access for people and freight

Community

- Transportation may have local community impacts related to employment, mobility, access, inconvenience, and more

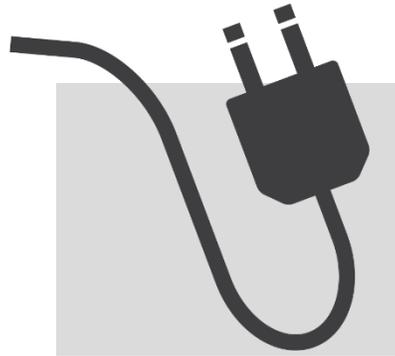
Non-renewable resources

- Transportation uses a significant amount of non-renewable natural resources

Sustainability and Emerging Transportation Trends



**Mobility
Transformation**



Electrification



Connectivity



Autonomy

Sustainability and Emerging Transportation Trends

Opportunities

- Safety and security via reduced crashes, especially through connectivity and autonomy
- Efficient and reliable travel via mitigation of road congestion through connectivity, autonomy, and mobility
- Increased transportation options for seniors, minors, disabled, and low-income residents through mobility and autonomy
- Climate change and sustainability via reduced vehicle ownership or single-occupancy vehicle mode share through mobility and reduced vehicle emissions through electrification
- Sustainable development via reduced parking demand and dense land development through mobility and autonomy

Challenges

- Ensuring equity in distribution of benefits in the emerging trends and their associated opportunities

Key Points



Sustainability has social, economic, and environmental dimensions

Must include human well-being with a healthy environment within a framework of time and money



Balancing of sustainability dimensions is necessary

It is a challenge to address all three dimensions simultaneously

Key Points (continued)



Sustainability is context sensitive

Situations vary, so there is no list of universal best practices



Sustainability elevates the value of human and environmental health in the long term

Historically, sustainability has been given lower priority when compared to first costs of a project

Key Points (continued)



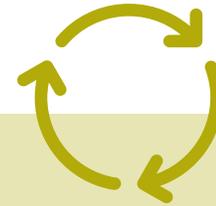
Sustainability implies improvement

Transportation stakeholders should seek constant improvement of existing practices to make progress



Sustainability goes beyond the bare minimum

Regulations and standard practice reflect the bare minimum requirements, so sustainability must improve upon that



Sustainability constantly evolves

What was once considered innovative ultimately becomes standard practice, so sustainability must improve upon itself

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