Appendices

Attachment A. Peer Exchange Participants
Attachment B. Participant Presentations
Attachment C. Example Sustainability Goals
Attachment D. Example Activities and Metrics
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Attachment A. Peer Exchange Participants

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Attachment B. Participant Presentations
A Brief Introduction to Sustainability at AASHTO’s Sustainability Peer Exchange

Opening Remarks
Washington, DC
May 28, 2009

Joshua Skov
Good Company
Eugene, OR

Overview

• Objectives of the gathering
• What is sustainability? And why?
Objectives of the gathering

- Hear a variety of DOT perspectives, experiences
- Breakout sessions
  - Best Practices: find out who’s doing what, identify barriers/pitfalls and what is needed to go farther
  - Defining and Communicating: define sustainability, discuss issues of communication and culture
  - Measuring and Tracking Success: discuss key measures and elements to measure, mechanisms for accountability and ensuring performance
- Final discussion
  - Report back
  - Brainstorm goals
  - Integrate cross-cutting insights

What is sustainability?

- Definition: Meeting the needs of the present generation without compromising the ability of future generations to meet their needs.
- Definition: Simultaneously addressing social, economic, and environmental needs and constraints (“triple bottom line”).
- 4,000,000 other possibilities in Google
…and why?

• But why “sustainability” as a buzzword?
  – Not just “environment”, a word we know?
  – Not just BMPs, a concept we’re familiar with?
• What is special about right now?
  – New “environmental” challenges related to human needs (e.g., climate change)
  – Transformation of the energy economy
  – Big human changes (e.g., aging population)

Thank you!

Feel free to contact me:

Joshua Skov
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(541) 341-GOOD (4663), ext. 211
The most widely used transportation application of this principle is based on the “Triple Bottom Line”:

Sustainability is . . .

“. . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

The comments that follow are based on the application of this concept to our work in transportation.

1. Transportation agencies provide goods and services that would not be fully provided in a pure free-market system, and therefore are largely provided by government. Roadways and related services generate benefits for everyone, in the form of mobility and access.

2. They also generate costs, for example pollution and noise, which are not in any one individual's self interest to pay. Just as government has a responsibility to provide the goods, it has a corresponding responsibility to mitigate the costs. Otherwise these costs pass on to future generations, violating the central principle of stewardship and sustainability.


4. Given these facts and findings, a commitment by transportation agencies to sustainability requires a project development process that looks something like this:

5. This framework suggests that, given a commitment to sustainability, agencies should build and rebuild differently. Future emphases should be on better managing travel and better integrating more modes of travel. Planning, integrating and investing in multiple modes of transportation with “intentionality” may be cost effective. This refers to the intentional integration of all appropriate modes of transportation into the agency’s planning, program and project delivery processes.
6. A commitment to the principle of economic sustainability will require agencies to look more broadly at the value of transportation investments. “Value” refers both to current and future costs and benefits, using life cycle analysis techniques. Federal and other tools and methods exist to support this kind of decision making process. One such method is “Least Cost Planning”. (“Least Cost Planning: Principles, Applications and Issues, FHWA, 1995) Ample data exist to use this kind of analysis. Based on such analysis, managing demand in many circumstances may be more cost effective than increasing the supply of transportation.

7. A commitment to economic sustainability also will require examination of the way we pay for transportation programs and services. Since roadway transportation is largely a public good, more advanced user-pay approaches best suit our need to manage auto use sustainably. On the other hand, public transportation might be financed best through broad based taxes.

8. A commitment to social and environmental sustainability will require continued integration of a context-sensitive solutions approach to project development. This approach is designed to identify key stakeholder issues, typically related to social and/or environmental values. Attention to preserving or enhancing these values helps assure achievement of these elements of the Triple Bottom Line.

9. In summary, as representatives of an agency of government, your bottom line is everyone’s bottom line. Any type of management, accounting or decision process that falls short of meeting this standard may also fall short of meeting the Triple Bottom Line principle of sustainability. The challenge is to innovate, and to share innovations through peer exchanges such as this.
Sustainability:
Program Development

May 28th, 2009

Joshua Proudfoot
Good Company
Eugene, OR

program elements

• management / governance
• assessment / performance measures
• planning
• education
• initiatives
management / governance

- executives
- councils
- managers

assessment / performance measurement

- audience & purpose
- qualitative - “state of”
  - policies / procedures
  - responsible parties
- quantitative - “how much of?”
  - footprinting
- data - available vs. perfect
planning

- goals
- timeframes
- strategies
- roles

education

- big picture
- for their role
- suggestion box
- cross pollination
program

initiatives

• by focus areas
• momentum building
• highest leverage
• most important
• direct control and shared control

Thank you!

Feel free to contact me:

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Summary:
1. Overview of the Structure of ODOT’s Sustainability Program
2. ODOT’s Definition of Sustainability
3. Sustainability Plan Volume 1: Setting the Context
4. Taking steps: ODOT’s Current Accomplishments in Sustainability
5. Next steps: ODOT’s Future Plans for Volume 2 and Volume 3 of the Sustainability Plan
The state of Oregon shall develop and promote policies and programs that will assist Oregon to meet a goal of sustainability within one generation – by 2025.

- Created Oregon Sustainability Board
- Created Institute for Natural Resources
- Identified goals for the State of Oregon

Oregon's economic recovery will be aided by establishing a commitment to lasting solutions that simultaneously address economic, environmental and community well-being. We should not continue to trade one essential aspect of well-being off against another, but we should take actions that will sustain Oregon's assets and put Oregon on the path to long-term prosperity in all aspects of life.

- Created Oregon Sustainability Board as a permanent, advisory board

• Assigned actions and goals for the Oregon Sustainability Board and state agencies:
  o Assist local governments and the private sector with the development of sustainability practices
  o Promote sustainable economic investment and development
  o Advance sustainability performance in state government

- Bills from 2009 legislative session coming soon...
Related ODOT Programs

- Office of Innovation and Private Partnerships
- Long-Term Planning
- Public Transit Division
  - Transportation Options
  - Bicycle and Pedestrian Program
- Rail Division
- Transportation and Growth Management Program

Coordination and Partnerships

- Oregon Sustainability Board
- Interagency Sustainability Working Group
- Oregon Global Warming Commission
  - Transportation and Land Use Committee
  - Modeling & GreenSTEP Subcommittees
- Governor’s Climate Change Integration Group
Defining Sustainability

Sustainability is using resources in a manner that enables people to meet their current needs while allowing for future generations to meet their needs.
Oregon Transportation Plan: Goal 4

“To provide a transportation system that meets present needs without compromising the ability of future generations to meet their needs from the joint perspective of environmental, economic and community objectives. This system is efficient and offers choices among transportation modes. It distributes benefits and burdens fairly and is operated, maintained and improved to be sensitive to both the natural and built environments.”

How does Sustainability relate to Climate Change?

Sustainability, in a broad sense, is the ability to maintain a certain process or state.

Mitigation for impacts of Climate Change involve strategies to reduce and conserve energy and material use.

Sustainability balances social, economic and environmental needs in the on-going process of achieving of ODOT’s goals. The reduction and conservation of carbon-emitting energy sources and materials are part of that process.
**ODOT’s Strategic Plan for Sustainability**

- Volume 1: *Setting the Stage*, the *Vision* for ODOT’s Sustainability
- Volume 2: Sustainability Management for ODOT’s *Internal Operations*
- Volume 3: Sustainability Management for Oregon’s *Transportation System*
- Green Roads: *Design and Construction* at the Project-level

**Introduction to Focus Areas**

(1) Health And Safety
(2) Social Responsibility
(3) Environmental Stewardship
(4) Land Use And Infrastructure
(5) Energy And Climate Change
(6) Material Resource Flows
(7) Economy
### Sustainability Lens

#### Sub-Area: Building Energy Use

<table>
<thead>
<tr>
<th>Long-Run Goal</th>
<th>Short-Run Goal</th>
<th>Performance Measures</th>
<th>Strategies</th>
</tr>
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<tbody>
<tr>
<td>• Electricity use reduction: 50% below 2000 levels*</td>
<td>• Electricity use reduction: 20% below 2000 levels by 2010 (all-agency goal)</td>
<td>• Total electricity use (kWh)</td>
<td>• Use of renewable energy in grid mix</td>
</tr>
<tr>
<td>• 100% of state government’s total electricity met by new renewable energy</td>
<td>• Natural gas: 20% reduction in use from 2005 baseline</td>
<td>• Total natural gas use (BTUs)</td>
<td>• Monitoring/ tracking of energy use</td>
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<tr>
<td>sources by 2025 (REAP), or sooner if directed by executive order</td>
<td>• 25% of state government’s total electricity needs will be met by new</td>
<td>• Renewable energy use as percentage of electricity grid mix</td>
<td>• Encourage efficiency measures &amp; conservation</td>
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<td>renewable energy sources by 2010 (REAP)</td>
<td></td>
<td>• Weatherization of windows and doors</td>
</tr>
</tbody>
</table>

#### Example from Volume 2

- **Sub-Area:** Building Energy Use
- **Long-Run Goal:**
  - Electricity use reduction: 50% below 2000 levels*
  - 100% of state government’s total electricity met by new renewable energy sources by 2025 (REAP), or sooner if directed by executive order
- **Short-Run Goal:**
  - Electricity use reduction: 20% below 2000 levels by 2010 (all-agency goal)
  - Natural gas: 20% reduction in use from 2005 baseline
  - 25% of state government’s total electricity needs will be met by new renewable energy sources by 2010 (REAP)
- **Performance Measures:**
  - Total electricity use (kWh)
  - Total natural gas use (BTUs)
  - Renewable energy use as percentage of electricity grid mix
- **Strategies:**
  - Use of renewable energy in grid mix
  - Monitoring/ tracking of energy use
  - Encourage efficiency measures & conservation
  - Weatherization of windows and doors
  - Energy retrofits for existing buildings
  - Switch lighting fixtures to LED’s or induction lighting
  - On-site generation where appropriate (esp. PVs and solar hot water)
  - Energy Star equipment
**Current Success: Greening the Fleet**

**Anti-idling Technology and Energy Savings**
- Anti-idling technology in all new and some older 10 yard, 5-yard, and 1 ton trucks
- Truck and message board lights using LED lights
- LED arrow board signs

**Alternative Fuels**
- In fiscal year 2007, 13% of diesel fuels ODOT purchased were B20
- Wide-range of biofuels in different temperatures to meet different types of machinery
- On track to meet Governor’s Goal of 25% alternative fuels by July 2010

**Alternative Vehicles**
- Replacing light fleet with hybrids or cars that use bio-diesel
- Pursing funding for electric cars and electric trucks

---

**Current Success: Facilities**

All new major facilities are built to Leadership in Energy and Environmental Design (LEED) Standards

The new Maintenance Yard in Baker City, District # 13, Region 5 is currently being built (in background picture).

- Solar panels
- LEED equivalence rating
- Exterior colors selected for head rejection/retention
- Premium quality electric motors for greatest efficiency
- R30 insulation and R17 insulated overhead doors
- Motion sensor lighting
- High efficiency water well pumps
- Commercial sand filter sewage treatment
- Biofilter site drainage treatment
**Current Success: Energy Use**

ODOT Region 1 retrofitted over 95% of its signals and flashers with power-saving LED lights

**Energy Savings:** equivalent to the power need for over 140 homes annually

Prior to the retrofit, ODOT’s Region 1 had an annual electric bill of over $1.2 million dollars

50% of the costs were from energy used for signal and flashers

**Cost Savings:** $110,000 per year

---

**Green Construction and Design**

Construction is both internal and external to ODOT

Currently, ODOT is practicing sustainability in:

- OTIA III Bridge Delivery Program
- Recycling and reuse of materials

More work to be done in 2009-2010

- Green Roads Research Partnership
- Subcommittee on green construction and design
**Volume 3: A Sustainable Transportation System**

**Accessibility** - the ability to reach desired goods, services, activities and destinations

**Efficient Mobility** - physical movement of persons or goods in a way that optimizes the transportation system

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**Sustainable Transportation**

“We have three challenges before us. First, we must identify the needs of a transportation system that meets the demands of a **21st century economy**. Second, we must do so in a way that complements our efforts to **reduce our carbon footprint**. Third, as we turn more and more to **alternate modes of transportation** - and less on fuel-run vehicles - we must also explore alternative ways to **fund** our transportation system in a way that is **sustainable** for the long-term.”

*Governor Ted Kulongoski, August 30, 2007*
Solar Highway Demonstration Project

☀ Third-party model
☀ 104 kW ground mounted solar array
☀ 594 175-watt DC solar panels
☀ Will produce 112,000 kWhs annually
Placed in Service December 19, 2008

Cleaner, Smaller, More Efficient Vehicles
Cost-effective Pricing

- Road User Fees
- Pay-as-you-drive Insurance

“Least Cost Planning”
Reinvigorate Rail

System Optimization
Oregon Transportation Investment Act (OTIA III) Bridge Program

- $1.3 billion package to repair or replace 365 bridges on the state highway system
- Context Sensitive and Sustainable Solutions (CS³) guides bridge program decision making
- Programmatic Permitting with Natural Resource Agencies = collaborative approach
- Environmental Performance Standards

Questions?

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Sustainability in NYSDOT Operations

- What should be in the program?
- What’s worked / what hasn’t - global?
- How far along is the Initiative?
- What’s worked / what hasn’t - NYSDOT

What should be in a sustainability program?
Atmospheric CO$_2$ has never been higher than 300 ppm in the last 400,000 years (and probably not much higher in the last 30 million years).
### SUSTAINABILITY METRIC

<table>
<thead>
<tr>
<th>ECONOMIC NEEDS: (PROFIT)</th>
<th>RATING (% BASE)</th>
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<tbody>
<tr>
<td>Is affordable, operates efficiently, offers choice of transport mode, and supports a vibrant economy</td>
<td>&lt;=.01% ~ +.01%</td>
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<tr>
<td>- Passenger (&quot;on time&quot; person miles traveled / $)</td>
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<th>ENVIRONMENTALLY SOUND manner (PLANET)</th>
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<td>Limits emissions and waste within the planet’s ability to absorb them, minimizes consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimizes the use of land and the production of noise</td>
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*What’s worked & what hasn’t? – big picture*
The National Environmental Policy Act of 1969

- **Sec. 101(a)** The Congress, .... declares that it is the continuing policy of the Federal Government.... to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations...

US VMT Growth Projected to Outpace CO2 Emissions Improvements...

Data source: EIA AEO 2007
Chesapeake Bay, Maryland - 36 million pounds of nitrogen from mobile and highway loads vs. 17 million from wastewater treatment plants.

Nationally, roads and related infrastructure comprise at least two-thirds of all paved surfaces.

Nationally, of 42,256 impaired waters, 28,000 are directly related to highway runoff.

The National Environmental Policy Act of 1969

- **Sec. 102(C)** include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on --
- (i) the environmental impact of the proposed action,
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The Env. Process

- Adversarial
- Project focused / Sub-optimized
- NEPA issues as surrogates
- Designed to "stop bad things"
- DOT's "get through the process"
- Little attention to the programmatic

Highway expansion in US

Lane miles increased by 0.26% /yr

VMT increased by 2% / yr

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Highway Projects 2002-2018

Highway expansion in NYS - Not

Lane miles increased by 0.07%

VMT increased by 10%
Among the energy end use sectors, transportation is the largest emitter of CO₂.
How far along is the initiative?
# GreenLITES Operations Certification Program

![NYS DOT Logo](image)

## Maintenance and Operations Plan for Program Update

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<tr>
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<th>Activity</th>
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- **TOTAL INFRASTRUCTURE:**
- **REMARKS:**

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**Maintenance and Operations Plan for Program Update**

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### Maintenance and Operations Plan for Program Update

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**Note:**
- All units are Capital Improvements intended to achieve S005 or S007.
- The facilities are part of the MOI Program.
- Facilities are funded through MOI.

---

### Facility Management Plan

- Facility Management includes:
  - Capital Improvements
  - Routine Maintenance
  - Operations and Administration

---

**Budget Details:**
- Total Budget: $XYZ
- Maintenance Budget: $ABC
- Operations Budget: $DEF

---

**Key Points:**
- Program objectives:
  - Increase efficiency
  - Reduce maintenance costs
- Program outcomes:
  - Improved facility performance
  - Enhanced staff satisfaction

---

**Action Plan:**
- Regular audits of facility performance
- Training programs for staff
- Implementation of new technology

---

**Contact Information:**
- Facility Manager: John Doe
- Email: john.doe@facilitymanager.com
- Phone: 555-123-4567
<table>
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<tr>
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**TOTAL INFRASTRUCTURE**

**MAINTENANCE**

- Maintenance and Operations Plan for Program Update
- Program Overview
- Asset Management
- Maintenance Strategies
- Workforce Development
- Equipment and Supplies
- Central Utility Materials
- Additional Program Information
## Maintenance and Operations Plan for Program Update

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**TOTAL INFRASTRUCTURE:**

**MAINTENANCE:**

*Note: The table and diagram represent a maintenance and operations plan for a specific program, detailing various activities with their respective units and costs.*
What’s worked & what hasn’t at NYSDOT

Progression of awareness /
Change of attitudes /
Change of policy /
Change of practice /
Change results

1998 “Environmental Initiative”
Peregrine Falcon nesting on Dunn Memorial Bridge
Mowing — “Quality Not Quantity”

- Other names:
- Planned mowing
- Orchestrated mowing
- Precision mowing
- Mowing as part of IRVM

One mower width cuts save habitat and dollars
Facilities Compliance Tracking

2004 “Blue & Green Highways”
- Survey tool
- Lists all possible stewardship opportunities
- Location info supplemented with mile markers or GPS
Sec. 101(a) The Congress, .... declares that it is the continuing policy of the Federal Government.... to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations...
EVOLUTION?

Decade
50's – Interstate Era
60's – Environmental Movement
70's – NEPA
80's – Permits
90's – Mitigation
00's – Streamlining
10's – Stewardship
20's – Green infrastructure
30's – Sustainability words
40's – Sustainable projects
50's – Sustainable systems

Awareness
Funding
Cooperation
Litigation - Not

CSS
Smart Growth
Transit Oriented Dev.
EcoLogical

Green Highways
Content for Discussion

1. What is Smart Transportation?
2. Change at PennDOT
3. Smart Transportation In Action
What is Smart Transportation?

Developed land in PA increased by 53.6%...
But our population only grew 3.4%

1.6 acres were developed for every person added to PA population!

Between 1990 and 2000....
• Comprehensive plans: Guiding policy documents that set long-range goals and objectives for a community.

• Zoning: Ordinances that assign allowable land uses, intensities, densities.

• Subdivision ordinances: Address the division and the required improvements for a site, including layout and dedication of new streets and utilities.

• Planning commissions: Appointed body that review development proposals and other land use issues. Commission decisions are advisory only; final decisions are still made by the local elected body.

### Four BASIC Land Use Tools (MPC)

<table>
<thead>
<tr>
<th></th>
<th>All 4 Tools</th>
<th>None of the Tools</th>
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</thead>
<tbody>
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<td>Southwest</td>
<td>31%</td>
<td>32%</td>
</tr>
<tr>
<td>Central</td>
<td>19%</td>
<td>37%</td>
</tr>
<tr>
<td>South-Central</td>
<td>61%</td>
<td>8%</td>
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<tr>
<td>Northeast</td>
<td>43%</td>
<td>27%</td>
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<tr>
<td>Southeast</td>
<td>87%</td>
<td>1%</td>
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</table>

Source: An Inventory of Planning in Pennsylvania, Penn State University, 2001
Smart Transportation is partnering to build great communities for future generations of Pennsylvanians by linking transportation investments and land use planning and decision-making.

Smart Transportation Themes

1. Money counts
2. Leverage and preserve existing investments
3. Choose projects with high value/price ratio
4. Safety always and maybe safety only
5. Look beyond level-of-service
6. Accommodate all modes of travel
7. Enhance local network
8. Build towns not sprawl
9. Understand the context; plan and design within the context
10. Develop local governments as strong land use partners
Fundamentally, Smart Transportation is about linking land use & transportation decisions/investments.

<table>
<thead>
<tr>
<th></th>
<th>Define State Mobility Plan</th>
<th>Develop LRTP</th>
<th>Select TIP Projects</th>
<th>Implement TIP Projects</th>
<th>Negotiate HOP Projects</th>
<th>Develop Comp Plans</th>
<th>Define Zoning &amp; Subdivisions</th>
<th>Determine Land Use</th>
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<tr>
<td>Other State Agencies</td>
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<td>MPO/RPOs</td>
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<tr>
<td>Legislators and Elected Officials</td>
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<td>Counties</td>
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<td>Municipalities</td>
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<td>Development Community</td>
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</tr>
<tr>
<td>General Public</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
2 Change at PennDOT

Change at PennDOT

Process

Knowledge

Partnerships

Rules
Culture Change

- **Inclusive; not top-down.** Engaging internal staff & external partners to develop the themes, principles, and objectives of the program.

- **Focus on why change is necessary.** We haven’t been doing things *wrong*, but our financial, environmental, social, and physical context has changed.

- **This is not a “flavor-of-the-month.”** It is the new way we *must* do business if we are to continue serving the people of Pennsylvania.
Top Myths About Smart Transportation…

1. It is more costly.
2. It always requires design exceptions, which = failure.
3. It is not concerned with safety.
4. FHWA is not onboard.
5. This is just another temporary initiative that will disappear with the next administration.
6. It does not apply to suburban or rural communities.
7. We cannot coordinate land use and transportation decisions.
8. It is just a way to save money (the inverse of #1)

Change: Knowledge

- 53 events logged by 9 districts reaching 3,295 people
- 37 events logged by Central Office reaching 2,671 people
- 31 training sessions reaching 950 DOT staff and 350 Consultants
- Land use 101 training for DOT staff focusing on the relationships of local governments and DOT on land use and transportation
- Ongoing outreach and training activities reaching diversity of audience
**Change: Knowledge**

- **Challenge:** Design values for transportation facilities are not flexible enough to fit different community contexts.

- **What We Did:** Adopted the Smart Transportation Guidebook
  - Replace Design Manual 2
  - Use flexible design on all projects
  - Increase coordination with local municipalities
  - Roadway design values based on land use contexts
  - Design to a desired operating speed
Change: Rules / Process

• **Challenge:** The current HOP process does not always result in the best outcomes for communities, developers, or PennDOT.

• **What We Did:** Defined a new HOP process
  - Increases local coordination
  - Sets timelines for reviews/approval
  - Applies flexible design to HOP projects
  - Provides alternative mitigation options

Change: Rules / Process

• **Challenge:** The project/program delivery process is cumbersome, takes too long, and does not always take a holistic, long-term perspective

• **What We’re Doing:** Defining a streamlined project/program delivery process
  - Link Mobility Plan, LRTPs and TIPs – and reduce delivery times
  - Develop Smart Transportation project selection criteria for TIPs & LRTPs
**Challenge:** Partnering with land use agencies have not always been a “standard practice”

**What We’re Doing:** Increased outreached and partnership efforts

- Engaging partners in defining the new project delivery process – Municipalities, MPOs/RPOs, Resource Agencies
- Early collaboration during HOP Process
- Partnerships with municipalities, MPOs and counties at workshops and training events
- Partnerships with 10,000 Friends, PSATS and other organizations

---

3

**Smart Transportation in Action**
Pennsylvania Community Transportation Initiative

• $60 million reimbursement program over two years
• Projects that demonstrate Smart Transportation principles
• Learning opportunities for PennDOT and our partners
• Received 403 applications for $604.7 million

PCTI Selection Criteria

• Links land use and transportation decisions
  • Consideration of land use issues
  • Collaboration with stakeholders
  • “Build towns, not sprawl”

• Implementation Success
  • Implementation Readiness
  • Leverage Other Funding
  • Consistency with Regional Plans

• Innovative and Applicability to other Places
Goals of Selected PCTI Projects include:

- Supporting Local Economic Development
- Encouraging Multi-modal Travel (through land use and transportation measures)
- Enhancing the Existing Transportation Network
- Improving Connectivity
- Supporting Transit-Oriented, Brownfield Developments

PCTI Project Example
Baltimore Pike and Newark Road,
New Garden Township
Baltimore Pike and Newark Road

- Comprehensive corridor study for Baltimore Pike and Newark Road
- Township understands the limitations of existing road system to support rapid growth
- 20 ongoing development projects along corridors
- Surge in both retail and light industrial development.
- Over 3.5 million square feet, (regional shopping center, church, elementary school, industrial park, business park, others)

Development impact mitigation was previously done in a development-by-development approach, which Township now understands is inadequate.

- Multi-municipal coordination: study to include areas in neighboring Avondale Borough, Kennett Township, West Marlborough
- Scope will include analysis and recommendations for access management, safety, traffic and transit
- Leveraging funds from multiple private sources and public moneys toward more thoughtful infrastructure improvement
Case Study
Route 6N, Edinboro

Route 6N, Edinboro

- Land use & transportation planning study
- PennDOT was part of land use decision-making process that will ultimately dictate transportation needs
- What the study looked into:
  - Existing Land Use Conditions
  - Growth Patterns & Trends
  - Future Land Use Plans
  - Access & Growth Management
  - Zoning & Subdivision Ordinances
  - Community Assets
Recommendations from the Study

- Enhance Pedestrian Circulation
- Enhance Bicycle Circulation
- Roadway Improvements
- System Upgrades
- Three-Lane Section
- Intersection Improvements
- Traffic Signals
- Roundabouts
- Turn Lanes
Downtown Erie Parking & Transit Study

- Study to explore solutions to Bayfront Parkway congestion through transit/land use measures
- Alternatives require partnership with local municipalities, transit providers, and parking authority

Parking Supply

Existing Transit

Study Recommendations

- Rethink parking supply arrangement—Utilize parking to support redevelopment
- Encourage transit use through targeted redevelopment—district approach to redevelopment
- Explore urban design and parking regulations that support transit use and redevelopment (i.e. revisit parking requirements and use of downtown appropriate site design standards)
Transit “Anchor” Strategy

- Public parking ramps on the “edges” of downtown
- Parking serves commuters & development
- Eliminate the Liberty Park-n-Ride and tighten up the shuttle route
- Utilize “anchor” garages to catalyze development in the Bayfront and 12th Street districts

Change at PennDOT
"The problems we have created cannot be solved with the same thinking that created them."


www.smart-transportation.com

We all know the world is changing rapidly around us. Every day, we see the prices increase at our local gas station, we read in the newspaper about global warming, we talk to our neighbors about traffic congestion or the slowing economy.

All of these trends are changing the needs and demands of our transportation system. To adapt to this changing world, the Pennsylvania Department of Transportation (PennDOT) is integrating a concept called "Smart Transportation" into the way we do business.

Smart Transportation simply asks us to understand and embrace our evolving financial, environmental, technological, and social contexts as we approach our transportation challenges. It is about consistently applying the most innovative tools and ideas to solve our new transportation challenges, while also helping to build great communities across Pennsylvania.

On this website, you will find a number of resources that will help you understand what we are trying to achieve, and how you can get involved with this effort. We are still constructing this website, and it will be continually updated as the Smart Transportation effort progresses. Please email us at smarttransportation@dot.state.pa.us with any comments or suggestions.

We look forward to everyone’s help as we seek to build a more efficient, affordable, and sustainable transportation system. Together, we can ensure that our communities remain great places for future generations of Pennsylvanians.
The Transit Authority of River City’s mission is to explore and implement transportation opportunities that enhance the social, economic and environmental well-being of the Greater Louisville community.

TARC At A Glance

- 16.4 million customers
- 12 million miles
- 52 routes in 5 counties
- 268 buses and trolleys
- 90 paratransit vehicles
- 690 team members
- 59,665 riders daily
Balancing Act

- Increase ridership
- Respond to demands to increase service
- Preserve existing service levels
- Replace / Maintain / Upgrade aging vehicles and infrastructure

Sustainability Strategies

- Create policies and programs to promote greater use of public transportation
- Shift TARC’s operations into a more sustainable energy and environmental strategy
Transit Toolbox – Today & Tomorrow

Service Delivery  Equipment  Infrastructure  Technology  Partnerships

Stretching Service, Resources
Complete Streets: This......

And not this....
For every mile traveled during rush hour, public transit is five times as fuel-efficient as private automobiles

TARC moves more than 50,000 people every weekday – that’s the equivalent of 42,000 cars

TARC reduces congestion in major traffic corridors, reducing travel time for both TARC riders and highway users

### TARC Improves the Environment

- APTA’s Sustainability Commitment
- Kilowatt Crackdown & Energy Star
- Environmental Management Systems for Maintenance Training
- Partnership for a Green City
- Member of Mayor’s Go Green Strategic Initiative
- Active Living Committee/Mayor's Healthy Hometown
Environment

**Hybrid Fuel Economy**

NEWER

22% better fuel economy

OldeR

41 - 57% better fuel economy

---

**ID as good as a pass partnerships**

- U of L
- Metro Louisville
- Chilton & Medley
- CNPE
- Humana
- Metro College/UPS
ARRA Projects: Maintenance Annex

- LEED certified building
- Graywater plumbing system
- Overall property runoff captured in bioswale
- Partial vegetative roof
- Low energy footprint
  - High tech HVAC system
  - Natural lighting
  - Open-air ventilation
  - Photovoltaic electricity to power bus lights
- Funded by $5.2 million American Recovery & Reinvestment Act (ARRA)

United We Ride – Coordinated Transportation

Affordable, Universal, Diverse, Accessible
TMCC System Concepts

Customer Needs:
- High Quality
- Reliable Service

Proposed Dixie-Preston BRT

Preston-Dixie Highway Bus Rapid Transit (BRT) Sketch Plan

- Proposed route
- Service to be implemented for commuters, students, and workers
- Service to be provided with limited stops
- Service to be provided with high frequency

Benefits:
- Reduced congestion
- Increased reliability
- Improved accessibility

Project Components:
- High density transit stops
- Pre-paid tickets
- Improved pedestrian access

Legend:
- Green: Bus stops
- Blue: Park & Rides
- Orange: Limited stops
- Gray: Regular stops
Why Support Transit?

• Offers relief from high fuel costs
• Provides access to jobs, health care, education
• Increases mobility for people with disabilities and older adults
• Reduces energy consumption
• Improves air quality
• Provides an alternative to driving
• Fosters Economic development
Southeastern Pennsylvania Transportation Authority

What is SEPTA?

- Largest transit system in Pennsylvania; fifth largest in nation
- Serves Bucks, Chester, Delaware, Montgomery and Philadelphia Counties (2,184 Square Miles, 3.9 Million Residents)
- Operates extensive bus, subway, light rail, and regional rail network
- Annual ridership exceeds 300 million trips
- Established from bankrupt private transit companies
What is SEPTA?

- Operates:
  - 117 Bus Routes
  - 8 Trolley (light rail) Lines
  - 3 Trackless Trolley Routes
  - 2 Subway/Elevated (heavy rail) Lines
  - 1 Interurban High-Speed Line (heavy rail)
  - 13 Regional Railroad (commuter rail) Lines
  - Shared Ride Service in the City of Philadelphia
  - ADA Paratransit service throughout the five-county region
  - Small bus circulator and shuttle services connecting fixed route operations to business, health and educational centers, as well as to park and ride facilities.

<table>
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<th>Revenue Vehicle Inventory</th>
<th>City Transit</th>
<th>Victory</th>
<th>Frontier</th>
<th>Railroad</th>
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<td>Bus</td>
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<td>106</td>
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<tr>
<td>Subway - Elevated</td>
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<td>-</td>
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<tr>
<td>Railroad</td>
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<td>-</td>
<td>349</td>
<td>349</td>
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<td>Demand Response (ADA &amp; SRP)</td>
<td>319</td>
<td>105</td>
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<td>Total Revenue Vehicles</td>
<td>1,914</td>
<td>299</td>
<td>106</td>
<td>349</td>
<td>2,668</td>
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Rail System Map

SEPTA Ridership

17 million additional trips in Fiscal Year 2008

Daily Ridership

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<tr>
<th>FY99</th>
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<th>FY01</th>
<th>FY02</th>
<th>FY03</th>
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<td>600</td>
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<td>760</td>
<td>800</td>
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</tbody>
</table>

© SEPTA Map may not be reproduced without permission.
Public Transportation & The Environment

- In comparison to the average car:
  - A bus with just 7 passengers is more fuel-efficient
  - A full bus is 6 times more efficient
  - A full train is 15 times more efficient
- If 1 in 10 Americans used public transportation regularly, U.S. reliance on foreign oil could be cut by more than 40%.
  
  Source: Clean Air Council & APTA

Public Transportation & The Environment

- Public transit produces 95% less CO per passenger mile than private vehicles.
- In Philadelphia, just 3.5% of CO emissions come from diesel-powered vehicles such as SEPTA’s standard buses. Whereas, gas-powered cars give off 63%.

  Source: Clean Air Council & APTA
SEPTA & Sustainability

- Sustainability is 1 of 7 key strategic objectives in the FY 2010-2014 Strategic Business Plan.
- SEPTA is a sustainability solution and an asset to the region.
  - Contributes to the environmental, social and economic sustainability of the region.

Environmental Sustainability

SEPTA Bus Fleet Emissions
Average Particulate Matter (PM) Emissions from SEPTA Transit Buses
Lbs per year X (000)
Environmental Sustainability

- Improvements in vehicle emissions due to:
  - Continued support to substantially reduce the age of the fleet
  - Replacement of older buses with new buses that utilize significantly improved emission controls
  - Retrofitting existing fleets with improved emission control
    - Example: particulate filters
  - Purchase of low-sulfur fuel for all buses
  - Introduction of hybrid buses that reduce fuel consumption and in turn reduce emissions

Environmental Sustainability

- Go Green Campaign
  - Clean Fuel Bus Program
    - Acquire 460 Hybrid-Electric Buses over the next four years
    - Replace diesel buses which are more than 12 years old
    - Serve all five Southeastern Pennsylvania Counties
    - Total Cost - $250 million
    - Cost Differential for Hybrid Purchase - $160,000 per bus
Environmental Sustainability

Clean Fuel Bus Program – cont’d:
- Benefits:
  - 14% improved fuel consumption
  - 56% decrease in nitrogen oxide, an ozone precursor
  - 96% decrease in particulate matter
  - Batteries provide acceleration and climbing power
  - Quieter operation
  - Improved drive system life

Environmental Sustainability

- Go Green Campaign – cont’d:
  - Silverliner V:
    - Acquire 120 new regional rail cars
    - Replace Silverliner II and III rail cars, which are 40 to 44 years old
    - Provide additional cars in response to current and projected ridership increases
    - Total project cost - $330 million
Environmental Sustainability

- Silverliner V – cont’d:
  - Benefits:
    - Regenerative Braking for Energy Efficiencies
    - Electronic Destination & Route Signage – Inside and Out
    - Automatic Voice Annunciation of Train Destination and Next Station
    - Control Center Announcements to Passengers
    - Door Closing Warning
    - Passenger Emergency Intercom

Environmental Sustainability

- Green Building Efforts at 1234 Market:
  - BOMA Philadelphia:
    - 2008 TOBY Award for Category - Government Building
  - Environmental stewardship:
    - Motion switches
    - LED fixtures
    - Steam regeneration
    - No-VOC paints
    - Daytime cleaning
    - Recycled carpeting
    - Recycling program
  - Seeking LEED certification
Environmental Sustainability

- Green Technologies System-Wide – Reduce, Re-use & Recycle Program:
  - Purchase of renewable energy
  - Just-in-time inventory
  - Conversion of lighting systems in subways, shops and signals
    - Systematic replacement of fluorescent lamps with LEDs
  - Installation of new boilers and chillers for fuel efficiency
  - Recycling program at stations and shops
    - Used catalytic oxidizers from buses to recover platinum
    - Waste oil from buses, trains and mechanical equipment
    - Waste fluorescent lamps to recover mercury
    - Scrap metals

- Green Technologies System-Wide – Reduce, Re-use & Recycle Program:
  - Use of renewable and recyclable materials
    - Antifreeze from buses is recycled and reused on site
  - Recycling of batteries from buses, trains and signals
  - Reclamation of water on vehicle washers
  - Tie disposal via cogeneration facility
  - Safe waste material disposal
  - Underground retention basins for storm water management
Environmental Sustainability

- Green Technologies System-Wide – Reduce, Re-use & Recycle Program:
  - On the Horizon:
    - Conduct system-wide energy audit to plan for projects with significant energy consumption reduction and to introduce innovative green technologies.
    - Implement training program for engineering and operations staff on environmental sustainability developments.
    - Revise design and construction contract documents to include green building elements and increased energy efficiency requirements.
    - Support City of Philadelphia’s Greenworks 2015 Plan to become the greenest city in the US, as well as county plans implemented by reducing region’s VMT.

Awareness Campaign

- Go Green Go SEPTA

- Each year SEPTA helps households save over $1.399 worth of gas. And less gas means less pollution.

- Riding SEPTA helps save 1.4 billion gallons of gas each year. And a little thing we call Earth.
Awareness Campaign

- Go Green Go SEPTA

ECOTISTICAL.

LESS CAR. MORE KARMA.

SO WHAT CAN I DO?

NEXT STOP: GREEN

Next Stop: SEPTA

Go Green Go SEPTA

www.SEPTA.org
Awareness Campaign

MEET THE ECO-HAPPY HYBRIDS OF SEPTA.

It’s true, SEPTA has the world’s largest fleet of hybrid buses not on the streets, but in the sky, yes, you are correct. SEPTA’s Hybrid Buses have the ability to switch between electric and diesel power. The electric mode is used for urban driving and the diesel mode for long-distance routes. The hybrid system allows the buses to run more efficiently and reduce emissions.

Awareness Campaign

WHY RIDING SEPTA ISN’T JUST ENVIRONMENTALLY CONSCIOUS, IT’S A NO-BRAINER.

SEPTA’s Hybrid Buses are not only efficient, but also good for the environment. They emit less pollution and reduce greenhouse gas emissions. This makes SEPTA a great option for those who want to reduce their carbon footprint.

THE POWER OF PUBLIC TRANSPORTATION.

In the United States, there are 3,500 transit agencies that offer public transportation services. SEPTA is one of the largest in the country. SEPTA’s fleet of hybrid buses is designed to be more fuel-efficient and reduce emissions. This helps to reduce the negative impact of public transportation on the environment.

Why it really matters.

SEPTA is not just about transportation, but also about reducing our carbon footprint. By using public transportation, we can reduce our carbon emissions and help protect our planet.

The cost of inaction? 30% economic damage and 50% environmental damage. It’s an attack on our everyday lives. SEPTA is committed to reducing our carbon footprint and improving the quality of life for everyone.

Why SEPTA.

SEPTA is committed to providing safe, reliable, and efficient transportation services. We are dedicated to reducing our carbon footprint and improving the quality of life for everyone. With SEPTA, you can make a difference and help protect our planet.
Questions & Answers

Thank you for your time.
Attachment C. Example Sustainability Goals

It should be noted that the goals included in Attachment C are examples only that were developed during participant brainstorming as an example exercise regarding how goals could be developed for an organization. This example exercise was meant to be relevant to either an agency’s internal operations, or how the agency manages the transportation system. The goals are not necessarily endorsed or supported by AASHTO or the participating organizations.

Social well being and responsibility

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>- All people have access to affordable transport</td>
<td>- ID gaps &amp; opportunities for connectivity (e.g. corridors, places) – build investments around these</td>
<td>- Transit stop within ¼ mile of all urban residences</td>
</tr>
<tr>
<td>- Transportation improves quality of life for people (reduce stress, etc)</td>
<td>- Compare programs &amp; projects against a set of sustainability metrics (overarching)</td>
<td>- DOT actions in concert with overall plan for achieving social well-being (who is developing the plan...) – DOTs ask the question (what would you like the DOT to do?)</td>
</tr>
<tr>
<td>- Seamless connectivity among modes</td>
<td></td>
<td>- Realizing the benefit of the investments</td>
</tr>
<tr>
<td>- All people have access to needed goods &amp; services (schools, medical, employment etc)</td>
<td></td>
<td>- Increase # of transit stops by X%</td>
</tr>
<tr>
<td>- Given climate change conditions – make sure system supports that access</td>
<td></td>
<td>- Have sustainability metrics reflected in decision-making</td>
</tr>
<tr>
<td>- Reliable transportation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Material flows and management

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Zero waste</td>
<td>- Effective management systems in place that can determine lowest life cycle cost</td>
<td>- 70% reuse</td>
</tr>
<tr>
<td>- Use/manage materials with lowest life cycle cost</td>
<td>- Knowledge transfer &amp; sharing of BMPs</td>
<td>- Program that promotes process for evaluation of new materials &amp; techniques</td>
</tr>
<tr>
<td>- Maximum performance of materials (longevity)</td>
<td>- Review &amp;revise specifications as needed to meet goals</td>
<td></td>
</tr>
<tr>
<td>- Reuse &amp; recycle all materials (on-site)</td>
<td>- Adopt and promote “buy local” policies</td>
<td></td>
</tr>
<tr>
<td>- Maximum use of local materials</td>
<td>- Institutionalize best practices depending on context (foster culture that allows experiments and innovation; safety into account)</td>
<td></td>
</tr>
<tr>
<td>- Paperless processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- No toxics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Energy, fuel and climate

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Zero GHG emissions</td>
<td>- Inventory &amp; vulnerability analysis of assets with look to climate change</td>
<td>- Continuum of movement from one fuel type to another (a plan) example – Renewable Fuel Standards (RFS) and Low Carbon Fuel Standard (LCFS)</td>
</tr>
<tr>
<td>- 100% renewable energy sources</td>
<td>- Understanding carbon footprints for decision making (related to GHG policy/goals) and prioritization</td>
<td>- Using carbon footprints for decision-making</td>
</tr>
<tr>
<td>- Least energy consumed per person trip made</td>
<td>- Reduce fossil fuel use by 25%</td>
<td></td>
</tr>
<tr>
<td>- Carbon negative projects (e.g. land management)</td>
<td>- Improving methods for measuring GHGs</td>
<td></td>
</tr>
<tr>
<td>- 100% green fleets (alt fuel, hybrid)</td>
<td>- Cap &amp; trade</td>
<td></td>
</tr>
<tr>
<td>- Eliminate vulnerability of existing assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Minimal carbon footprint</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Habitat / ecosystems / stormwater

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Species recovery; ESA not needed…</td>
<td>Participants did not have time to further this.</td>
<td>Participants did not have time to further this.</td>
</tr>
<tr>
<td>-Maintain contiguous habitat areas/corridors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Alignment with resource agency adaptation policies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Zero roadkill</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Economic efficiency

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Life cycle decision-making (analysis of assets)</td>
<td>-Begin process of decoupling energy &amp; transportation funding (careful of price signal elimination)</td>
<td>-Pricing</td>
</tr>
<tr>
<td>-Best life cycle contracting decisions</td>
<td>-Develop life cycle costing tools</td>
<td></td>
</tr>
<tr>
<td>-Internalize external costs - manage the externalities</td>
<td>-pilot funding sources</td>
<td></td>
</tr>
<tr>
<td>-Optimization of user cost vs. system cost (e.g. off-peak) – cost structure reflects it</td>
<td>-Economic signal sending</td>
<td></td>
</tr>
<tr>
<td>-Generate revenue stream adequate to sustain system</td>
<td>-Reduce congestion</td>
<td></td>
</tr>
<tr>
<td>-Transportation system maximizes economic development &amp; efficiency</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Health and Safety

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long Term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Zero Fatalities (human)</td>
<td>Participants did not have time to further this.</td>
<td>- Reduce fatalities on the national system by half by 2030</td>
</tr>
<tr>
<td>- No illness created by air quality issues</td>
<td></td>
<td>- Bicycle and pedestrian systems intentionally designed and managed at the corridor level</td>
</tr>
</tbody>
</table>

### Land Use

<table>
<thead>
<tr>
<th>Ultimate Goals</th>
<th>Short Term Goals</th>
<th>Long Term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Ensure transportation &amp; land use are fully integrated</td>
<td>Participants did not have time to further this.</td>
<td>Participants did not have time to further this.</td>
</tr>
<tr>
<td>- Revitalize the central city; promote TOD &amp; infill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Partnering to build communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- DOTs contribute to mixed-use, livable &amp; walkable communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- DOTs contribute to sustainable land use</td>
<td></td>
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</tr>
</tbody>
</table>
Attachment D. Example Activities and Metrics

It should be noted that the information included in Attachment D was developed during a peer exchange participant brainstorming session and is not necessarily endorsed or supported by AASHTO or the participating organizations. It should also be noted that in some cases, the activities listed are not necessarily linked to the sample measures listed by participants.

<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Activities</th>
<th>Sample Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social well-being and responsibility</td>
<td>-Congestion management</td>
<td>-Transit ridership</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Number of sidewalk and bicycle facility miles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Connectivity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Total expense of housing and transport</td>
</tr>
<tr>
<td>Material flows and management</td>
<td>-Recycling materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Asset management</td>
<td>-Total percent of recycled material</td>
</tr>
<tr>
<td>Energy, fuel and climate</td>
<td>-Congestion</td>
<td>-Greenhouse gas emissions</td>
</tr>
<tr>
<td></td>
<td>-System air quality performance analyses</td>
<td>-Fuel consumption per capita</td>
</tr>
<tr>
<td></td>
<td>-Asset management</td>
<td>-% Alternative fuel consumption</td>
</tr>
<tr>
<td></td>
<td>-Intelligent Transportation Systems</td>
<td>-Park and ride usage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Carpool/vanpool usage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Vehicle miles traveled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Travel time (bottleneck reduction)</td>
</tr>
<tr>
<td>Habitat and ecosystems</td>
<td>-Identification of sensitive areas</td>
<td>-Habitat connectivity</td>
</tr>
<tr>
<td></td>
<td>-Summary indices for sketch planning</td>
<td>-Acres of prime farmland or forest land</td>
</tr>
<tr>
<td></td>
<td>-Low impact development</td>
<td>-Native plant species</td>
</tr>
<tr>
<td></td>
<td>-Weather event management</td>
<td>-Number of stormwater treatments</td>
</tr>
<tr>
<td>Economic efficiency</td>
<td>-Congestion/reliability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Life cycle cost analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Travel times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Cost per ton shipped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Gross state product</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Toll transactions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Access to jobs and labor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Use of HOT and HOV lanes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Cost to maintain per vehicle mile traveled</td>
</tr>
<tr>
<td>Health and safety</td>
<td></td>
<td>-Fatality rates or numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Crash rates or numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Transit safety incidents (driver incident reports)</td>
</tr>
<tr>
<td>Land use</td>
<td>-Measure development inside and outside priority funding areas</td>
<td>-Number of local jurisdictions with land use plans</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Brownfield development (acres)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Jobs to housing ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Housing density</td>
</tr>
<tr>
<td>Topic Area</td>
<td>Activities</td>
<td>Sample Measures</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Social well-being and responsibility | -Construction impacts  
- Roadway siting and decisions  
- Noise  
- Work zone management  
- Visual impacts  
- Contracting | -Duration of construction  
- Number of residences or businesses impacted during construction  
- National Environmental Policy Act (NEPA) measures  
- DBE percentage | |
| Material flows and management     | - Reuse  
- Recycling  
- Hauling  
- Decisions about material types  
- Material sourcing and source location  
- Waste reduction  
- Pavement management and design | - Amount/percent of material recycled  
- Amount/percent of steel usage  
- Haul distance  
- Amount of waste (tipping fees)  
- Life cycle cost | |
| Energy, fuel and climate          | - Cut and fill  
- Equipment efficiency  
- Work zone management/routing  
- Traffic control technology  
- Construction management technology | - Type of equipment used  
- Idling time  
- Productivity (production/time period)  
- Fuel consumption  
- Energy consumption  
- Queuing and delay | |
| Habitat and ecosystems            | - Design infrastructure in context of climate change (sea rise, storm events, heat effects)  
- Stormwater ordinances/policies  
- Stormwater control | - Reduction of risk  
- Amount of impact to acres of habitat  
- Use of low impact development or other natural systems  
- Comparative cost  
- Amount of pollutants in runoff  
- Percent water treated | |
| Economic efficiency               | - Cut and fill  
- Hauling and sourcing  
- Capital or life cycle cost estimating  
- Construction impacts  
- Structural decisions | - Life cycle cost | |
| Health and safety                 | - Design criteria implementation  
- Access management  
- Predicted safety performance of alternatives  
- Management of pedestrians and cyclists during construction  
- Fuel choice during construction  
- Vehicular safety during construction  
- Worker safety  
- Evacuation routes | - Number or rate of crashes  
- Emergency response time | |
| Land use                          | - Access management  
- Collaboration with local jurisdictions on land use and zoning  
- Land use decisions relating to material sources | - Number of access points retained (project-level)  
- Construction duration  
- Business impact  
- Presence of intergovernmental agreements  
- Aggregate source availability | |
<table>
<thead>
<tr>
<th>Topic Area</th>
<th>Activities</th>
<th>Sample Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social well-being and responsibility</strong></td>
<td><strong>System:</strong> -Beautification programs -Recreation -Access management -Traveler information -Contracting -Noise -ADA access <strong>Internal:</strong> -ADA for employees -Ergonomics -Employee wellness programs -Equal opportunity/diversity programs -Workforce development</td>
<td><strong>System:</strong> -Number of pedestrians -Number of ADA facilities -Recreation access -Environmental justice numbers -Small business contracts (#) -Hits of traveler phone lines or websites -Percent population covered by 511 systems <strong>Internal:</strong> -OSHA recordables -Employee wellness surveys -Wellness fairs (#) -Monitoring employee longevity (knowledge retention)</td>
</tr>
<tr>
<td><strong>Material flows and management</strong></td>
<td><strong>System:</strong> -Use of recycled materials (concrete, asphalt, steel, aggregates, treated lumber, fly ash, industry byproducts, shredded tires) <strong>Internal:</strong> -Choice of de-icers/sand -Adopt-a-Highway programs -Roadkill management -Sweepings -Vacitor waste -Paint choice -Environmental Management Systems</td>
<td><strong>System and Internal:</strong> -Tons of recycled materials -Comparison to baseline -Percent materials substituted</td>
</tr>
<tr>
<td><strong>Energy, fuel and climate</strong></td>
<td><strong>System:</strong> -Intelligent Transportation Systems -Pricing (congestion pricing, cordon pricing, carbon taxes, HOT lanes) -Signal optimization -Incident response management -Demand management <strong>Internal:</strong> -LED lights -Fleet fuel efficiency and particulate controls -Building energy efficiency -Fleet and facility management systems</td>
<td><strong>System:</strong> -Travel times and delay -Greenhouse gas emissions -Incident response clearance times -Vehicle miles traveled <strong>Internal:</strong> -Greenhouse gas emissions -Fuel use -Energy use -Percent biofuels used for fleet -Percent hybrids used for fleet -Number of LEED accredited buildings -Number of LED retrofits or signal retimings</td>
</tr>
<tr>
<td><strong>Habitat and ecosystems</strong></td>
<td><strong>System:</strong> -Vegetation management -Mowing practices -Watershed stormwater impacts -Wildlife corridors/migration -Soil conservation -Habitat enhancements -Wetlands mitigation <strong>Internal:</strong> -Yard landscaping -Stormwater controls -Environmental management systems -Compliance with regulations</td>
<td><strong>System:</strong> -Acres of habitat, wetlands impacted -Tons of pollutant load -Quantity of stormwater retention -Number of wildlife crossings -Species biodiversity -Mowing time -Survey of resource agencies -Amount untreated runoff -Water supply <strong>Internal:</strong> -Maintenance of stormwater facilities -Compliance with regulations -Number of BMPs used</td>
</tr>
</tbody>
</table>
| Economic efficiency | System:  
- Pricing  
- Life cycle management of assets (e.g. pavement preservation)  
- Congestion management  
- System optimization  
- Public/private partnerships  
- Incentive-based contracts  
- Integration with regional/state economic plans  
- Incorporating maintenance costs into design decisions  
**Internal:**  
- Best life cycle value contracting  
- Partnerships on bulk purchasing  
- Green collar jobs; training workforce for the new economy  
- Incentive-based contracts | System and Internal:  
- Travel time  
- Delay  
- Cost  
- Numbers of contracts  
- Lowest life cycle cost |
| Health and safety | System:  
- Active transportation (cycling and walking)  
- Reducing crashes  
- Safety management systems (rumble strips, guardrail, striping, signage)  
- Safety belt wearing campaigns  
- Driver training  
- Emergency management systems  
- Traffic law enforcement  
- Perceived security (e.g. on transit)  
**Internal:**  
- Work zone traffic control  
- Employee training  
- Protective/safety equipment and programs  
- Staff wellness programs  
- Showers, changing rooms for employees  
- Healthy food choices | System:  
- Number of fatalities  
- Number of injuries  
- Number of states with safety belt or helmet laws  
Internal:  
- Number employees trained in safety  
- Amount of regulated chemicals or toxics  
- OSHA violations (#) |
| Land use | System:  
- Access management/driveway management  
- Surplus property  
- Impact of design and construction decisions on maintenance and operations needs  
**Internal:**  
- DOT facility site location | System:  
- Coordination process with local agencies  
- Integrated planning process (yes/no)  
- Existence of state and local law  
Internal:  
- New offices sited downtown or along transit  
- Process for building siting with criteria |