

## Incorporating Sustainability into TxDOT's Transportation Decision- Making: Interactive Workshop

Workshop Introduction

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## Introductions

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## Course Guidance

- Start and end times
- Scheduled breaks and lunch
- Put cell phones on vibrate/off
- Share thoughts and experiences

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### Target Audience

- New and experienced staff at TxDOT divisions and districts dealing with transportation planning
- Staff from MPOs and other non-TxDOT agencies involved in the transportation planning process

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### Workshop Objectives

- Develop an understanding of sustainability and the use of performance measurement in transportation decision-making
- Learn how sustainability objectives can be linked to TxDOT's strategic plan goals
- Learn how to identify and describe sustainability performance measures and how they tie to sustainability objectives

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### Workshop Objectives

- Learn the concepts of evaluating, weighting, and scaling sustainability performance measures
- Learn how to work with the Sustainability Enhancement Tool (SET) and apply it to urban and rural corridors
- Understand the output from the calculator tool and the role it can play in decision-making

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### Course Outline - Morning

- Workshop introduction
- Lesson 1: Strategic goals and Sustainability
- Lesson 2: Performance Measures
- Lesson 3: Introduction to Sustainability Enhancement Tool (SET)
- Lesson 4: Data Requirements for SET

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### Course Outline- Afternoon

- Lesson 5: Example Corridor Application
- Lesson 6: Interactive Exercise
- Final Comments and Evaluation

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### Course Materials

- Participant's notebook
  - Slides
- CD
  - Sustainability Enhancement Tool (SET)
  - User's manual
- Handouts and interactive exercise materials

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### Additional Resources

- Project 0-5541
  - Project summary report 0-5541-S
  - Report 0-5541-1

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## Strategic Goals and Sustainability

### Lesson 1

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## Lesson 1 Objectives

- At the end of this lesson, you will be able to:
  - Describe the concept of sustainability as it relates to transportation planning
  - Explain the importance of strategic planning and how sustainability can tie into TxDOT's strategic goals
  - Recognize the need for appropriate sustainability evaluation tools to aid in the transportation planning process

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## Sustainability

- Often viewed as a “buzz word” and an abstract concept
- *What do you understand by the term sustainability?*
- *How can it factor into your work as a transportation professional?*

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## Sustainability and Transportation

- Sustainable development:
  - “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”
- Sustainable transportation – embodies this principle in the transportation sector
- Dimensions
  - Environmental stewardship
  - Economic development
  - Social equity
  - Transportation system effectiveness

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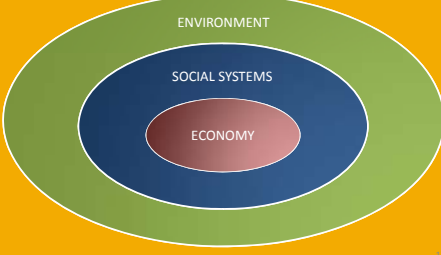
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## Sustainability Dimensions



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## Defining Sustainable Transportation

- For this project:
  - “Provision of safe, effective, and efficient access and mobility into the future while considering economic, social, and environmental needs”

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## Why Is This Relevant to TxDOT?

- Concerns about environmental and socio-economic impacts and issues
- Funding shortfalls
- Need to get it “right” the first time
- There is a need for tools/methodologies that consider sustainability from TxDOT’s perspective

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## Strategic Planning

- Provides the overall direction for transportation agencies
- States the agencies’ priorities (goals) and can be further broken down into objectives and actions that can be taken to achieve the goals and objectives
- Performance measures can be used to track progress toward achieving the goals

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## TxDOT’s Strategic Plan

- TxDOT’s 2009-2013 Strategic Plan Goals:
  - Reduce Congestion
  - Enhance Safety
  - Expand Economic Opportunity
  - Improve Air Quality
  - Preserve the Value of Transportation Assets

Available at:  
[http://www.txdot.gov/about\\_us/strategic\\_plan.htm](http://www.txdot.gov/about_us/strategic_plan.htm)

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### Sustainability and TxDOT Goals (1)

Dimension	Goals
Social	Reduce Congestion
	Enhance Safety
Economic	Expand Economic Opportunity
	Preserve Value of Transportation Assets
Environmental	Improve Air Quality

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### Sustainability and TxDOT Goals (2)

*How can TxDOT work toward achieving the strategic goals in a more sustainable manner?*

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### Sustainability Objectives

- Link strategic goals to sustainability



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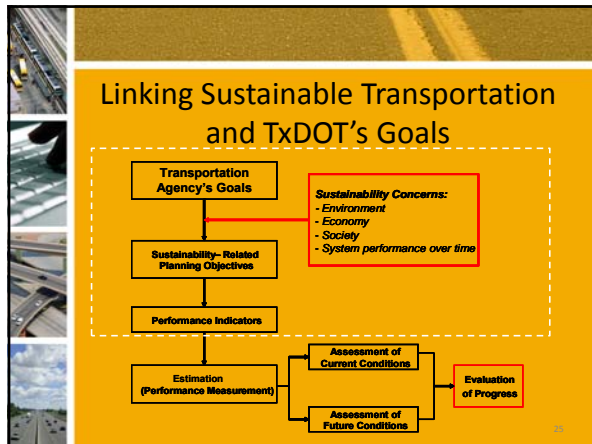
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### Lesson 1 Objectives

- You are now able to:
  - Describe the concept of sustainability as it relates to transportation planning
  - Explain the importance of strategic planning and how sustainability can tie into TxDOT's strategic goals
  - Recognize the need for appropriate sustainability evaluation tools to aid in the transportation planning process

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## Performance Measures

Lesson 2

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## Lesson 2 Objectives

- At the end of this lesson, you will be able to:
  - Describe the concept of performance measurement
  - List the characteristics of good performance measures
  - Identify and describe sustainability performance measures

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## Lesson 2 Objectives

- Describe the sustainable transportation performance measures developed for TxDOT
- Explain how the performance measures are evaluated, scaled, weighted, and aggregated to obtain an overall performance index value

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### Performance Measures

- Indicators become performance measures when compared with standards or objectives
- Measurable quantities that help assess progress toward goals (*example: safety → crashes*)
- Translate data into succinct information

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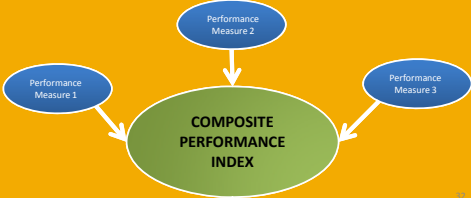
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### Index

- Quantified performance measures can be aggregated and weighted to produce composite measures known as indices



```
graph TD; PM1([Performance Measure 1]) --> CPI([COMPOSITE PERFORMANCE INDEX]); PM2([Performance Measure 2]) --> CPI; PM3([Performance Measure 3]) --> CPI;
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### Uses of Performance Measurement

- Track system performance or trends
- Evaluate alternatives
- Project selection
- Internal and external communication

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### Characteristics of a Good Performance Measure

Attribute	Explanation
Acceptable	The general community must assist in identifying and developing the performance measures.
Accurate	Must be based on accurate information, of known quality and origin.
Affordable	Must be based on readily available data or data that can be obtained at a reasonable cost.
Appropriate level of detail	Must be specified and used at the appropriate level of detail and level of aggregation for the questions it is supposed to answer.
Have a target	Must have a target level or benchmark against which to compare it.
Measurable	The data must be available, and the tools need to exist to perform the required calculations.
Relevant	Must be applicable and compatible with overall goals and objectives or considerations and issues.
Sensitive	Must detect a certain level of change that occurs in the transportation system.
Show trends	Must be able to show trends over time and provide early warnings about problems and irreversible trends.
Understandable	Must be understandable and easy to interpret, even by the community at large.

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### Sustainable Transportation Performance Measures

- Must reflect characteristics of a good performance measure
- Must reflect sustainability concerns – also look at changes over time
- *Interactive Exercise*

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### Sustainability Measures for TxDOT

- TxDOT's Strategic Plan Goals
  - Reduce Congestion
  - Enhance Safety
  - Expand Economic Opportunity
  - Improve Air Quality
  - Preserve the Value of Transportation Assets

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Sustainability Objectives	
TxDOT Goal	Sustainability-Related Objective
Reduce congestion	Improve mobility on highways
	Improve reliability of highway travel
Enhance safety	Reduce crash rates and crash risk
	Improve traffic incident detection and response
Expand economic opportunity	Optimize land-use mix for development potential
	Improve road-based freight movement
Preserve the value of transportation assets	Maintain existing highway system quality
	Reduce cost and impact of highway capacity expansion
	Leverage non-traditional funding sources for highways
	Increase use of alternatives to single-occupant automobile travel
Improve air quality	Reduce adverse human health impacts and comply with ambient air quality standards
	Reduce greenhouse gas emissions

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Sustainability Measures (1)		
TxDOT Goal	Sustainability-Related Objective	Performance Measure
Reduce congestion	Improve mobility on highways	Travel time index
	Improve reliability of highway travel	Buffer index
Enhance safety	Reduce crash rates and crash risk	Annual severe crashes per mile
	Improve traffic incident detection and response	Percentage lane-miles under traffic monitoring/surveillance
Expand economic opportunity	Optimize land-use mix for development potential	Land-use balance
	Improve road-based freight movement	Truck throughput efficiency

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Sustainability Measures (2)		
TxDOT Goal	Sustainability-Related Objective	Performance Measure
Preserve the value of transportation assets	Maintain existing highway system quality	Average pavement condition score
	Reduce cost and impact of highway capacity expansion	Capacity addition within available right of way
	Leverage non-traditional funding sources for highways	Cost recovery from alternative sources
	Increase use of alternatives to single-occupant automobile travel	Proportion of non-single-occupant travel
Improve air quality	Reduce adverse human health impacts and comply with ambient air quality standards	Air Quality Index
	Reduce greenhouse gas emissions	Daily CO <sub>2</sub> emissions

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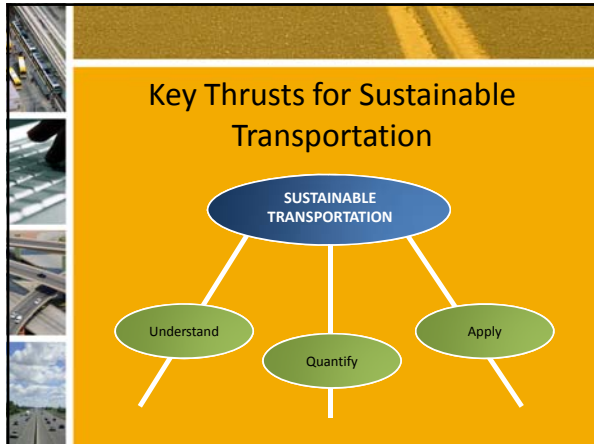
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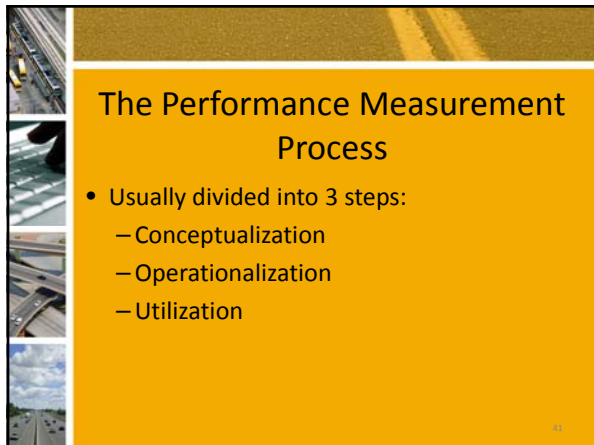
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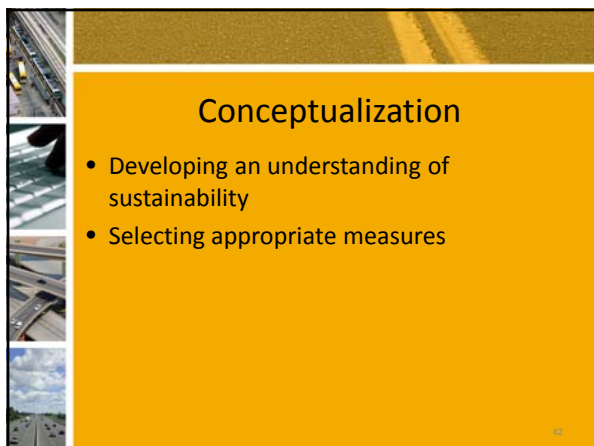
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## Operationalization

- Quantifying the performance measures
- Implementing a performance measurement system to evaluate the measures

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## Utilization

- Final step - results of performance measurement are used to aid in planning and decision-making.

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## Quantifying Performance Measures

- Multi-Attribute Utility Theory (MAUT) approach

Quantify the Measures

→

Identify "Best" and "Worst" Values

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Scale the Measures

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Assign Weights

→

Aggregate

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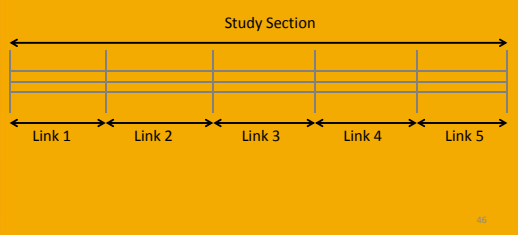
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## Scope: Highway Corridors

A highway (section) can be subdivided into smaller segments (links)



Study Section

Link 1 Link 2 Link 3 Link 4 Link 5

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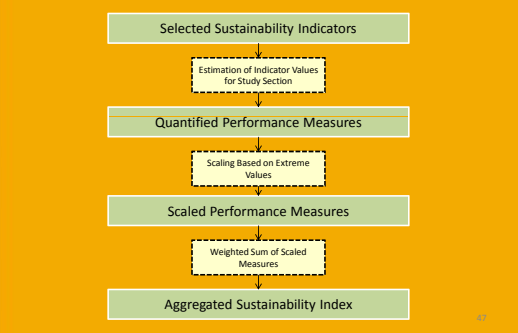
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## Summary of Performance Measurement Process



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graph TD
    A[Selected Sustainability Indicators] --> B[Estimation of Indicator Values for Study Section]
    B --> C[Quantified Performance Measures]
    C --> D[Scaling Based on Extreme Values]
    D --> E[Scaled Performance Measures]
    E --> F[Weighted Sum of Scaled Measures]
    F --> G[Aggregated Sustainability Index]
  
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## Scaling

- Benchmarks – “best” and “worst” case values
- “Best” – scaled value =1
- “Worst” – scaled value =0
- Quantified measure - interpolated between these extremes

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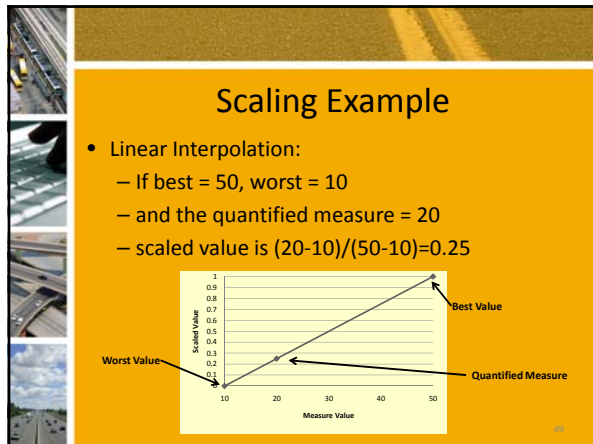
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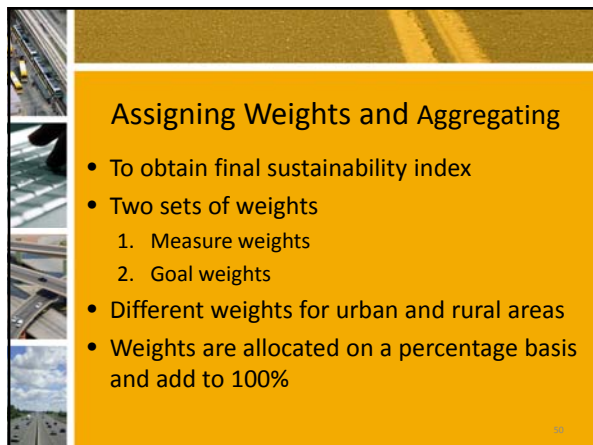
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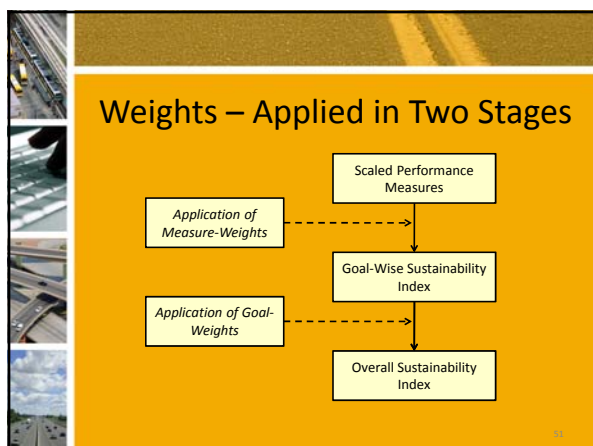
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### Default Measure Weights

Goal No.	Performance Measure	Measure-Weight (%)	
		Urban	Rural
1	Travel Time Index	60	30
	Buffer Index	40	70
2	Annual severe crashes per mile	80	90
	Percentage lane miles under traffic monitoring/surveillance	20	10
3	Land use balance	50	10
	Truck throughput efficiency	50	90
4	Average pavement condition score	20	20
	Capacity addition within available ROW	20	20
	Cost recovery from alternative sources	40	50
	Proportion of non single-occupant travel	20	10
5	Air Quality Index	85	85
	Daily CO <sub>2</sub> emissions	15	15

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### Default Goal Weights

Goal No.	Goal	Goal-Weight (%)	
		Urban	Rural
1	Reduce Congestion	25	10
2	Enhance Safety	30	40
3	Expand Economic	10	10
4	Preserve the Value of Transportation Assets	10	30
5	Improve Air Quality	25	10

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### Lesson 2 Objectives

- You are now able to:
  - Describe the concept of performance measurement
  - List the characteristics of good performance measures
  - Identify and describe sustainability performance measures

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## Lesson 2 Objectives

- Describe the sustainable transportation performance measures developed for TxDOT
- Explain how the performance measures are evaluated, scaled, weighted, and aggregated to obtain an overall performance index value

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## Break

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## Introduction to Sustainability Enhancement Tool (SET)

### Lesson 3

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## Lesson 3 Objectives

- At the end of this lesson, you will be able to:
  - Describe the basic layout and setup of the Sustainability Enhancement Tool (SET)
  - Negotiate the worksheets within the SET
  - Explain the primary input and output features of the SET software

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## SET – Overview

- Developed to implement the performance measures and evaluation methodology in a user-friendly platform
- Spreadsheet calculator in MS-Excel™ with accompanying user's manual

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## Objectives of the SET

- User-friendly
- Menu-driven
- Clear data entry fields and data requirements
- Perform all computations automatically
- Provide for a variable number of links and future analysis scenarios
- Allow for visual comparison of results
- Produce a visually appealing executive summary

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## Performance Measures

TxDOT Strategic Plan Goal	Measure No.	Performance Measure
Reduce congestion	1a	Travel time index
	1b	Buffer index
Enhance safety	2a	Annual severe crashes per mile
	2b	Percentage lane-miles under traffic monitoring/surveillance
Expand economic opportunity	3a	Land use balance
	3b	Truck throughput efficiency
Preserve the value of transportation assets	4a	Average pavement condition score
	4b	Capacity addition within available right of way
	4c	Cost recovery from alternative sources
	4d	Proportion of non single-occupant vehicle travel
Improve air quality	5a	Air Quality Index
	5b	Daily CO <sub>2</sub> emissions

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## Main Features

- One “base” scenario against up to three “future” scenarios
- Study section can be subdivided into maximum of 10 links
- Data Inputs
  - Required inputs and optional inputs
  - For base case and future case(s)
  - Data element entry form – to assemble data

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## SET Components

- Menu
- Instructions
- Data Entry
- Miscellaneous Calculation Sheets
- Calculated Data
- Summary Sheets

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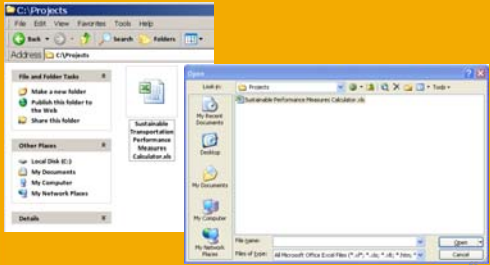
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## Getting Started (1)

- Locating the calculator – saved as an Excel file




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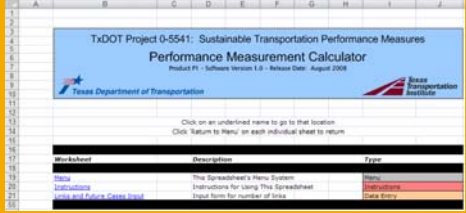
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## Getting Started (2)

- Initial View




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Getting Started (3)

- Initial setup – number of links and number of future case scenarios

Return to Home

Number of Links and Future Cases

How many links does this roadway have?

How many future cases do you wish to see?

Create Forms

Reset Forms

Show Additional Data

Hide Additional Data

10

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16


A B C D E F G H

- # Getting Started (4)
- Additional menu items
- 
- TxDOT Project 0-5541: Sustainable Transportation Performance Measures  
Performance Measurement Calculator  
Release V1, October 2008, August 2009
- Texas Department of Transportation
- Click on an individual value to go to that location.  
Click "Return to Menu" in each individual sheet to return.
- | Worksheet                                   | Description                                 | Type         |
|---|---|--------------|
| Introduction                                | Introduction to the Spreadsheet             | Introduction |
| Instructions for Using the Spreadsheet      | Instructions for Using the Spreadsheet      | Instructions |
| Data Entry for Number of Jobs               | Enter data for Number of Jobs               | Data Entry   |
| Data Entry for Value Added in Manufacturing | Enter data for Value Added in Manufacturing | Data Entry   |
| Data Entry for Value Added in Construction  | Enter data for Value Added in Construction  | Data Entry   |
| Data Entry for Value Added in Retail        | Enter data for Value Added in Retail        | Data Entry   |
| Calculations for Value Added                | Calculations for Value Added                | Calculations |
| Calculations for Value Added K2             | Calculations for Value Added K2             | Calculations |
| Value Added K2 Input Data                   | Value Added K2 Input Data                   | Data Entry   |
| Summary of Performance Measures             | Summary of Performance Measures             | Summary      |
| Summary of Jobs                             | Summary of Jobs                             | Summary      |
| Summary of Value Added                      | Summary of Value Added                      | Summary      |
| Data Entry for Value Added in Retail        | Data Entry for Value Added in Retail        | Data Entry   |

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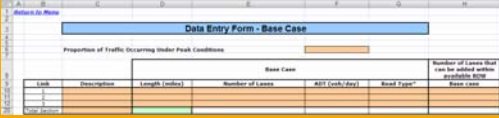
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## Data Entry

- One sheet for each scenario - base, future(s)



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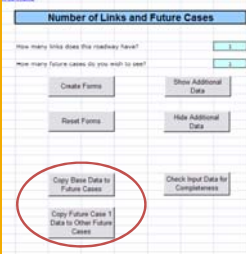
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## Data Copy Function

- Can copy data in the base sheet onto future sheets



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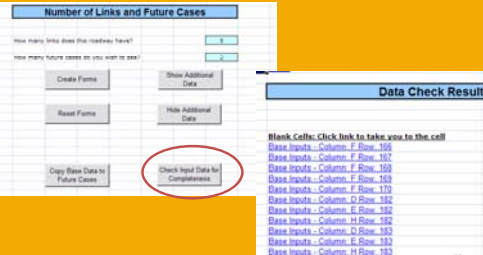
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## Data Check Function

- Checks for completeness of input data



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## Outputs

- Performance measure calculation worksheets
- Output data summary sheets
- Executive summaries

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## Measure Calculation Worksheets

- Show detailed calculations

Measure Calculations - Base Case					
This worksheet contains no input data. You do not need to change any information in this worksheet.					
Scenario: Scenario 1 - Level 2 Data Index					
Link	Description	Length (miles)	Number of Lanes	ADT (veh/day)	Postcode
1	121st Street	0.05	4	111,000	
2	122nd Street	0.05	4	111,000	
3	123rd Street	0.05	4	111,000	
4	124th Street	0.05	4	111,000	
5	125th Street	0.05	4	111,000	
6	126th Street	0.05	4	111,000	
7	127th Street	0.05	4	111,000	
8	128th Street	0.05	4	111,000	
9	129th Street	0.05	4	111,000	
10	130th Street	0.05	4	111,000	
11	131st Street	0.05	4	111,000	
12	132nd Street	0.05	4	111,000	
13	133rd Street	0.05	4	111,000	
14	134th Street	0.05	4	111,000	
15	135th Street	0.05	4	111,000	
16	136th Street	0.05	4	111,000	
17	137th Street	0.05	4	111,000	
18	138th Street	0.05	4	111,000	
19	139th Street	0.05	4	111,000	
20	140th Street	0.05	4	111,000	
21	141st Street	0.05	4	111,000	
22	142nd Street	0.05	4	111,000	
23	143rd Street	0.05	4	111,000	
24	144th Street	0.05	4	111,000	
25	145th Street	0.05	4	111,000	
26	146th Street	0.05	4	111,000	
27	147th Street	0.05	4	111,000	
28	148th Street	0.05	4	111,000	
29	149th Street	0.05	4	111,000	
30	150th Street	0.05	4	111,000	
31	151st Street	0.05	4	111,000	
32	152nd Street	0.05	4	111,000	
33	153rd Street	0.05	4	111,000	
34	154th Street	0.05	4	111,000	
35	155th Street	0.05	4	111,000	
36	156th Street	0.05	4	111,000	
37	157th Street	0.05	4	111,000	
38	158th Street	0.05	4	111,000	
39	159th Street	0.05	4	111,000	
40	160th Street	0.05	4	111,000	
41	161st Street	0.05	4	111,000	
42	162nd Street	0.05	4	111,000	
43	163rd Street	0.05	4	111,000	
44	164th Street	0.05	4	111,000	
45	165th Street	0.05	4	111,000	
46	166th Street	0.05	4	111,000	
47	167th Street	0.05	4	111,000	
48	168th Street	0.05	4	111,000	
49	169th Street	0.05	4	111,000	
50	170th Street	0.05	4	111,000	
51	171st Street	0.05	4	111,000	
52	172nd Street	0.05	4	111,000	
53	173rd Street	0.05	4	111,000	
54	174th Street	0.05	4	111,000	
55	175th Street	0.05	4	111,000	
56	176th Street	0.05	4	111,000	
57	177th Street	0.05	4	111,000	
58	178th Street	0.05	4	111,000	
59	179th Street	0.05	4	111,000	
60	180th Street	0.05	4	111,000	
61	181st Street	0.05	4	111,000	
62	182nd Street	0.05	4	111,000	
63	183rd Street	0.05	4	111,000	
64	184th Street	0.05	4	111,000	
65	185th Street	0.05	4	111,000	
66	186th Street	0.05	4	111,000	
67	187th Street	0.05	4	111,000	
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69	189th Street	0.05	4	111,000	
70	190th Street	0.05	4	111,000	
71	191st Street	0.05	4	111,000	
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73	193rd Street	0.05	4	111,000	
74	194th Street	0.05	4	111,000	
75	195th Street	0.05	4	111,000	
76	196th Street	0.05	4	111,000	
77	197th Street	0.05	4	111,000	
78	198th Street	0.05	4	111,000	
79	199th Street	0.05	4	111,000	
80	200th Street	0.05	4	111,000	
81	201st Street	0.05	4	111,000	
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85	205th Street	0.05	4	111,000	
86	206th Street	0.05	4	111,000	
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180	300th Street	0.05	4	111,000	
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185	305th Street	0.05	4	111,000	
186	306th Street	0.05	4	111,000	
187	307th Street	0.05	4	111,000	
188	308th Street	0.05	4	111,000	
189	309th Street	0.05	4	111,000	
190	310th Street	0.05	4	111,000	
191	311st Street	0.05	4	111,000	
192	312nd Street	0.05	4	111,000	
193	313rd Street	0.05	4	111,000	
194	314th Street	0.05	4	111,000	
195	315th Street	0.05			



## Executive Summaries

- Goals
- Links
- Measures
- Graphs

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## Executive Summary - Goals

- Summarizes goal-wise index values and the change from base case for entire corridor

Goal	Congestion	Safety	Economic Opportunity	Transportation Assets	Air Quality	All Goals Combined
Base Case	0.91	0.24	0.59	0.30	0.43	0.30
Future Case 1	0.10	0.30	0.59	0.38	0.87	0.38
Future Case 1 Change	-89.01%	22.34%	-0.00%	27.00%	54.84%	-23.74%

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## Executive Summary - Links

- For comparison of different links

Link	Summarized Index Values		
	Base Case	Future 1	Future 2
1	0.46	0.95	0.44
2	0.29	0.28	0.44
3	0.39	0.33	0.43
Fatal Section	0.43	0.38	0.44

Measure	Summarized Performance Measure Values by Link		
	Base	Future 1	Future 2
1a Improve mobility on highways	1.10	1.01	1.10
Link 1	1.10	1.47	1.47
Link 2	1.10	1.40	1.26
Link 3	1.10	1.01	1.26
1b Improve reliability of highway travel	0.26	0.84	0.93
Link 1	0.26	0.83	0.83
Link 2	0.24	0.84	0.84
Link 3	0.40	0.84	0.83
2a Reduce crash rates and crash risk	10.35	10.87	10.39
Link 1	10.83	10.72	10.72
Link 2	10.14	10.76	10.87
Link 3	10.07	11.05	11.01

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## Executive Summary- Measures

- Indicates changes in scaled measure

### Executive Summary - Measures

This worksheet contains no input data. You do not need to change any information included on this page.

Measure No. and Description	Base	Future 1	Future 2	Future 3
1a Improve mobility on highway	1.00	0.35	0.40	0.70
1b Improve reliability of highway travel	1.00	0.35	0.40	0.67
2a Reduce crash rates and crash risk	1.00	0.25	0.25	0.25
2b Improve traffic incident detection and response	1.00	0.05	0.05	0.05
3a Optimize land use mix for development potential	1.00	0.50	0.50	0.50
3b Optimize road space freight movement	0.25	0.05	0.05	0.40
4a Maintain existing highway system capacity	1.00	0.70	0.80	0.70
4b Reduce road and impact of highway network congestion	1.00	0.90	0.10	0.10
4c Increase and maintain existing capacity for highway	1.00	0.90	0.00	0.00
4d Increase use of alternative to single occupancy vehicles travel	1.00	0.20	0.20	0.40
5a Reduce vehicle travel time, energy and comply with ambient air	1.00	0.50	0.50	0.50
5b Reduce greenhouse gas emissions	1.00	0.05	0.05	0.10

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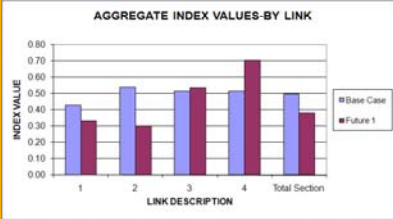
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## Graphs (1)

- Overall index – by link
- Goal-wise index for complete section

### AGGREGATE INDEX VALUES-BY LINK



Link Description	Base Case	Future 1
1	0.40	0.35
2	0.55	0.30
3	0.50	0.55
4	0.50	0.70
Total Section	0.50	0.40

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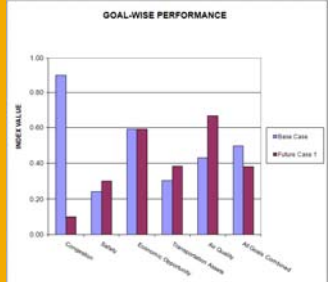
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## Graphs (2)

### GOAL-WISE PERFORMANCE



Goal	Base Case	Future Case 1
Congestion	0.90	0.10
Safety	0.25	0.30
Economic Competitiveness	0.60	0.60
Transportation Access	0.30	0.40
Air Quality	0.65	0.65
Air Quality Considered	0.50	0.40

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### Lesson 3 Objectives

- You are now able to:
  - Describe the basic layout and setup of the Sustainability Enhancement Tool (SET)
  - Negotiate the worksheets within the SET
  - Explain the primary input and output features of the SET software

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## Data Requirements for SET Operation

Lesson 4

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## Lesson 4 Objectives

- At the end of this lesson, you will be able to:
  - Describe the basic data required to operate the SET
  - Use the data element entry form to assemble both required and optional input data
  - Identify potential data sources and make appropriate assumptions where necessary

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## Data Assembly

- Data element entry form
  - Required and optional data inputs
- Identify base and future year for analysis

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### Corridor Set-Up

- Identify roadway limits
- Sub-divide into links
  - On basis of
    - major geometric characteristics
    - traffic volume differences
    - count locations
    - major intersecting roadways
  - Data are input by link

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### Basic Link Data

- Link description
- Link length
- Number of lanes – base and future
- Roadway type – base and future
  - Freeway
  - Urban street
  - Rural highway

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### Traffic Volumes

- ADT for each link – base and future
  - Basis for crash estimation, congestion estimation, emissions estimation
- ADT split – peak and off-peak

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### Traffic Volumes: Possible Data Sources

- TxDOT corridor analyses
- Regional travel demand models
- Traffic counts + application of a growth factor for future
- TxDOT road-highway inventory database
- Extrapolate or average out between locations if necessary

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### Pavement Condition

- Goal – preserve value of transportation assets
- TxDOT PMIS database
- Score is from 1-100

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### Pavement Condition: Possible Data Source

- TxDOT maintenance division
- Future case, assume higher score if
  - New lanes added
  - Regular maintenance/improvements expected
  - Otherwise, lower score accordingly

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## Truck Percentages

- Truck throughput – measure of economic opportunity

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## Truck Percentages: Possible Data Sources

- Truck counts as a part of traffic studies
- Road-highway inventory network database
- Federal Highway Administration's (FHWA) Freight Analysis Framework
- Future: percentage based on reasonable assumptions, maybe unchanged if no further development is expected

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## Traffic Monitoring and Surveillance

- Addresses safety goal
- Urban areas
  - Is the link covered by a Traffic Monitoring Center (TMC)?
  - Will it be in the future?
- Rural Areas
  - Other monitoring facilities/cameras can be considered to apply
  - Use a consistent definition for base and future

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## Posted Speed Limits

- Used for congestion/travel time estimation
- Might change in future in case of a major upgrade, otherwise remains same

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## Air Quality Data

- Two components – non-attainment status, emissions rates
- Non-attainment status as per the National Ambient Air Quality Standards (NAAQS)

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## Non-Attainment Status

- Non-attainment for the county location based on NAAQS
  - Ozone
  - Carbon Monoxide
  - Particulate Matter
- Non-attainment level for each for current conditions
- Future input not required
- *Possible data source*
  - Texas Commission on Environmental Quality (TCEQ) Website

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### Emissions Rates

- Emissions are calculated based on volumes, speed, and statewide emissions rates
- SET contains default base and future rates for Texas
  - Can be changed to local rates if known



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### Land Use

- Addresses the economic opportunity goal
- Considers area in ½ mile zone to either side of link
- Input percent coverage
  - Residential
  - Industrial/Commercial
  - Institutional/Public/Unoccupied



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### Land Use: Possible Data Sources

- Parcel-based Geographic Information System (GIS) data
- General visual survey/land survey data can be used
- Future
  - Parcel data can denote future development
  - In highly urban areas, may remain unchanged



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### Lane Additions in ROW

- Addresses future expansion potential
- “Value of Transportation Assets” goal
- Number of lanes that can be added in available right of way (ROW)

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### Lane Additions in ROW: Possible Data Sources

- Geographic Information Systems (GIS)
- Aerial views (googlemaps, etc.)
- Visual survey
- Future cases
  - Using the ROW for future lane additions reduces availability
  - Plan to acquire more ROW to compensate – can be input into SET

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### High Occupancy Vehicle Travel

- Proportion of non-single occupant vehicle (SOV) travel measure
- Includes high occupancy vehicle (HOV) lane ridership and regular autos with occupancy >1

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### High Occupancy Vehicle Travel: Possible Data Sources

- General purpose lane occupancy – local travel surveys or National Household Travel Survey (NHTS) data
- If high occupancy vehicle (HOV) lanes exist on a link – occupancy restrictions and number of vehicles are needed
- Future case – reasonable assumptions made based on the analysis scenario and local knowledge

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### Transit Availability and Ridership

- Proportion of non-single occupant vehicle (SOV) travel measure
- Considers bus and rail service paralleling each link

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### Transit Availability and Ridership: Possible Data Sources

- Service coverage/frequency of local agency
- National Transit Database – agency statistics can be used to estimate daily occupancy and number of vehicles
- If total daily ridership is known, split the inputs
- Future case
  - New service may be introduced on some links
  - Occupancy, frequency may increase - make appropriate assumptions

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### Cost Recovery from Alternative Sources

- Addresses the value of transportation assets goal
- For analysis purpose, non-TxDOT sources are considered as alternative funding
- Definition can be changed, as long as it is consistent for base and future

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### Cost Recovery from Alternative Sources - Assumptions

- Base case
  - Proportion of capital expenditure to date – most probably =0
  - O&M expenditure coverage – for most recent year
- Future case
  - If future expansions involve alternate sources of capital, consider it as percentage of total expenditures, not just for the improvement
  - O&M expenditure coverage – for the last year of analysis

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### Optional Input Data

- Additional details to refine crash estimation
  - Intersections
  - Grade
  - Lane width
  - Median types
  - Shoulder widths
  - Driveway density

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## Lesson 4 Objectives

- You are now able to:
  - Describe the basic data required to operate the SET
  - Use the data element entry form to assemble both required and optional input data
  - Identify potential data sources and make appropriate assumptions where necessary

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## Lunch

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## Example Corridor Application

### Lesson 5

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## Lesson 5 Objectives

- At the end of this lesson, you will be able to:
  - Identify and assemble input data for specific corridors
  - Apply the SET to analyze highway corridors

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## Example Application: US -281

- From I-410 (near downtown) to Bexar/Comal County line
- Base Case: Conditions as of 2005
- Future Case: Projected for 2025



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## Example Application: US -281



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## Example Application: US -281

- Section divided into four links
- Currently 6-lanes closer to downtown, 4-lanes closer to county line
- For future, 6-lanes throughout
- Higher ADT on links 1 and 2, significant increases in future
- Links 1 & 2 analyzed as freeways
- Links 3 & 4 analyzed as rural highways for base case, freeways for future case

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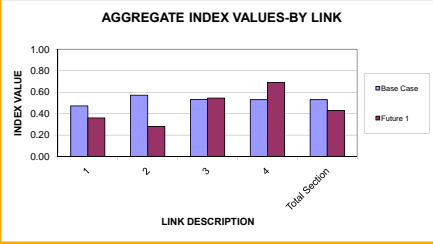
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## Results: Graphs



LINK DESCRIPTION	Base Case	Future 1
1	0.50	0.35
2	0.60	0.30
3	0.55	0.55
4	0.55	0.70
Total Section	0.55	0.45

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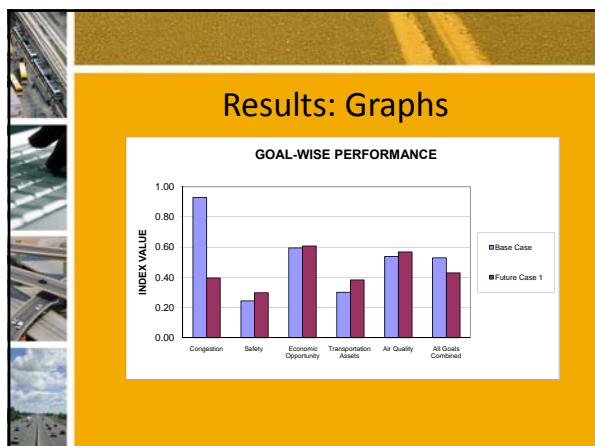
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Measure	Base	Future 1	Trend
1a-Improve mobility on highways	0.96	0.49	▼
1b-Improve reliability of highway travel	0.88	0.25	▼
2a-Reduce crash rates and crash risk	0.30	0.22	▼
2b-Improve traffic incident detection and response	0.00	0.61	▲
3a-Optimize land use mix for development potential	0.99	0.94	▼
3b-Improve road-based freight movement	0.20	0.27	▲
4a-Maintain existing highway system quality	0.89	0.95	▲
4b-Reduce cost and impact of highway capacity expansion	0.32	0.13	▼
4c-Leverage non-traditional funding sources for highways	0.00	0.27	▲
4d-Increase use of alternatives to single-occupant automobile travel	0.29	0.29	▼
5a-Reduce adverse human health impacts and comply with ambient air quality standards	0.53	0.64	▲
5b-Reduce greenhouse gas emissions	0.59	0.17	▼

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- ### Additional Comments
- The SET allows for flexibility in inputs
  - Variety of data sources can be used
  - Applicable to rural and urban scenarios
  - Appropriate assumptions made when data are not available

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## Lesson 5 Objectives

- You are now able to:
  - Identify and assemble input data for specific corridors
  - Apply the SET to analyze highway corridors

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## Interactive Exercise

Lesson 6

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## Lesson 6 Objectives

- At the end of this lesson, you will be able to:
  - Input data into the SET
  - Perform an evaluation using the SET
  - Describe output from the SET for decision-making

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## Exercise Materials

- SET calculator (Excel file)
- User's manual
- Example calculator (with filled-in data)
- *Handouts for interactive exercise*

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### Interactive Exercise

- Example demonstration
- Analyze fictional corridor in Dallas, Texas
- Compare base case with alternate future scenarios
- *Further details provided in handout*

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### Lesson 6 Objectives

- You are now able to:
  - Input data into the SET
  - Perform an evaluation using the SET
  - Describe output from the SET for decision-making

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### Break

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### Workshop Objectives

- Develop an understanding of sustainability and the use of performance measurement in transportation decision-making
- Learn how sustainability objectives can be linked to TxDOT's strategic plan goals
- Learn how to identify and describe sustainability performance measures and how they tie to sustainability objectives

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### Workshop Objectives

- Learn about the concepts of evaluating, weighting, and scaling sustainability performance measures
- Learn how to work with the Sustainability Enhancement Tool (SET) and apply it to urban and rural corridors
- Understand the output from the calculator tool and the role it can play in decision-making

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### Sustainable Transportation Performance Measures Calculator: Interactive Workshop

Final Comments and Evaluation

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