

Effective Sustainability Performance Measurement for Transportation Agencies

October 4, 2012

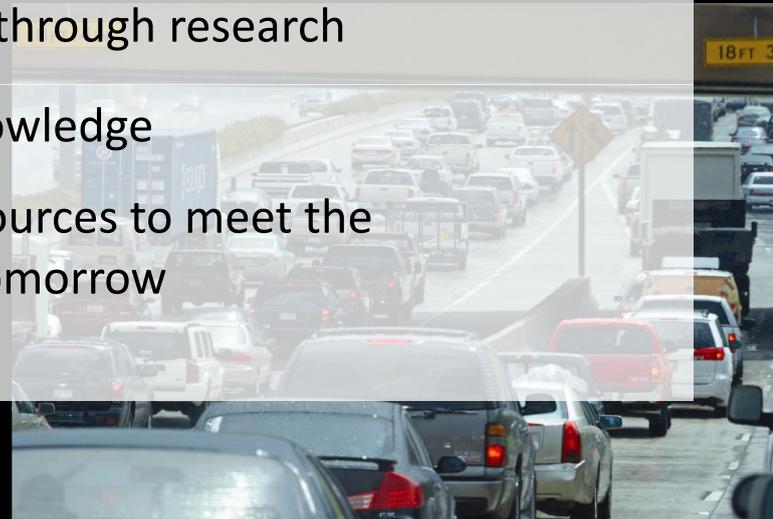
DBSA Knowledge Week

J. Zietsman Ph.D., P.E.
zietsman@tamu.edu

TTI Established in 1950

TTI Mission

- To solve transportation problems through research
- To transfer technology and knowledge
- To develop diverse human resources to meet the transportation challenges of tomorrow

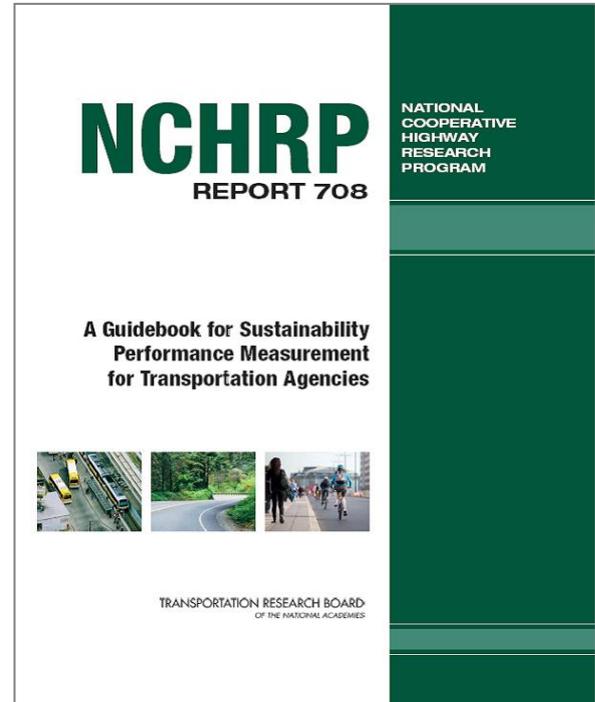




Research Products

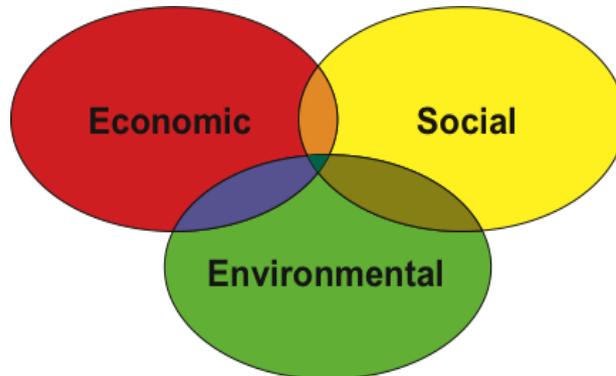
- NCHRP Report 708 – *Guidebook*
- Spreadsheet-based “compendium”
- Research report

<http://www.trb.org/Main/Blurbs/166313.aspx>



Overview of Sustainability

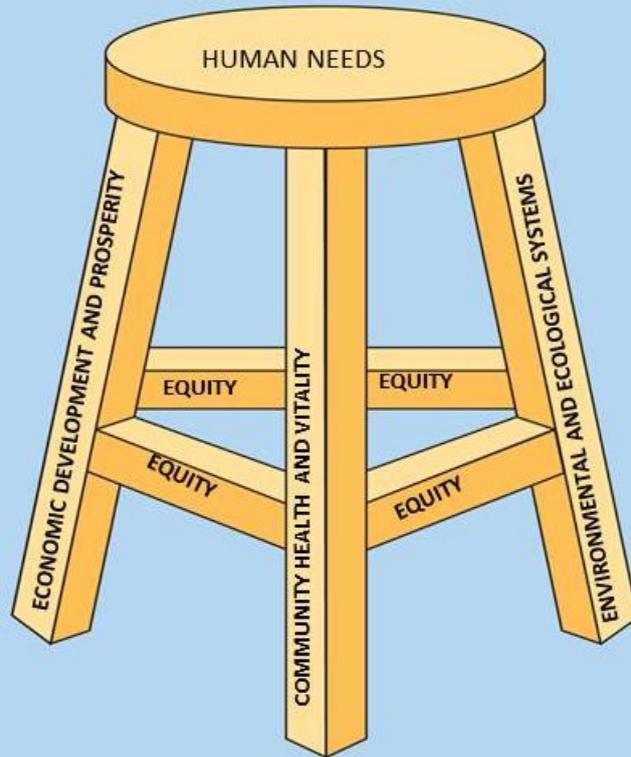
- ***“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”***
- **Sustainability dimensions – environmental, economic, social**

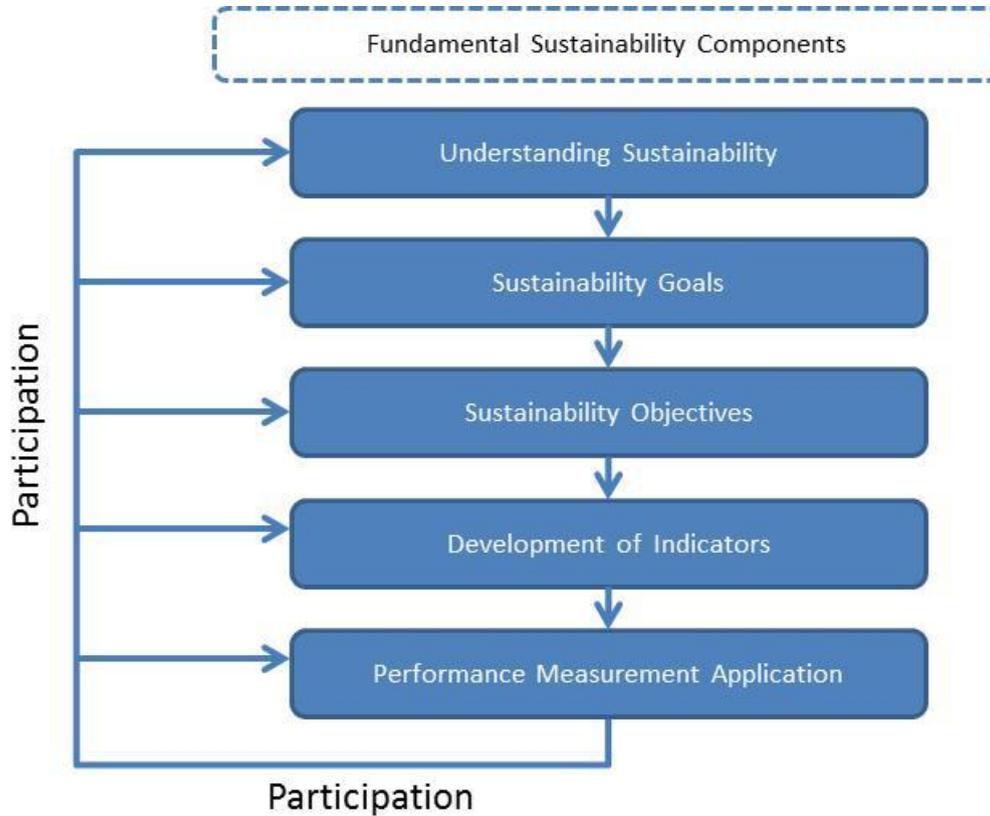




Principles of Sustainability – NCHRP Guidebook

- ***Sustainability entails meeting human needs for the present and future, while:***
 - *preserving and restoring environmental and ecological systems;*
 - *fostering community health and vitality;*
 - *promoting economic development and prosperity; and*
 - *ensuring equity between and among population groups and over generations.*







Sustainability Goals

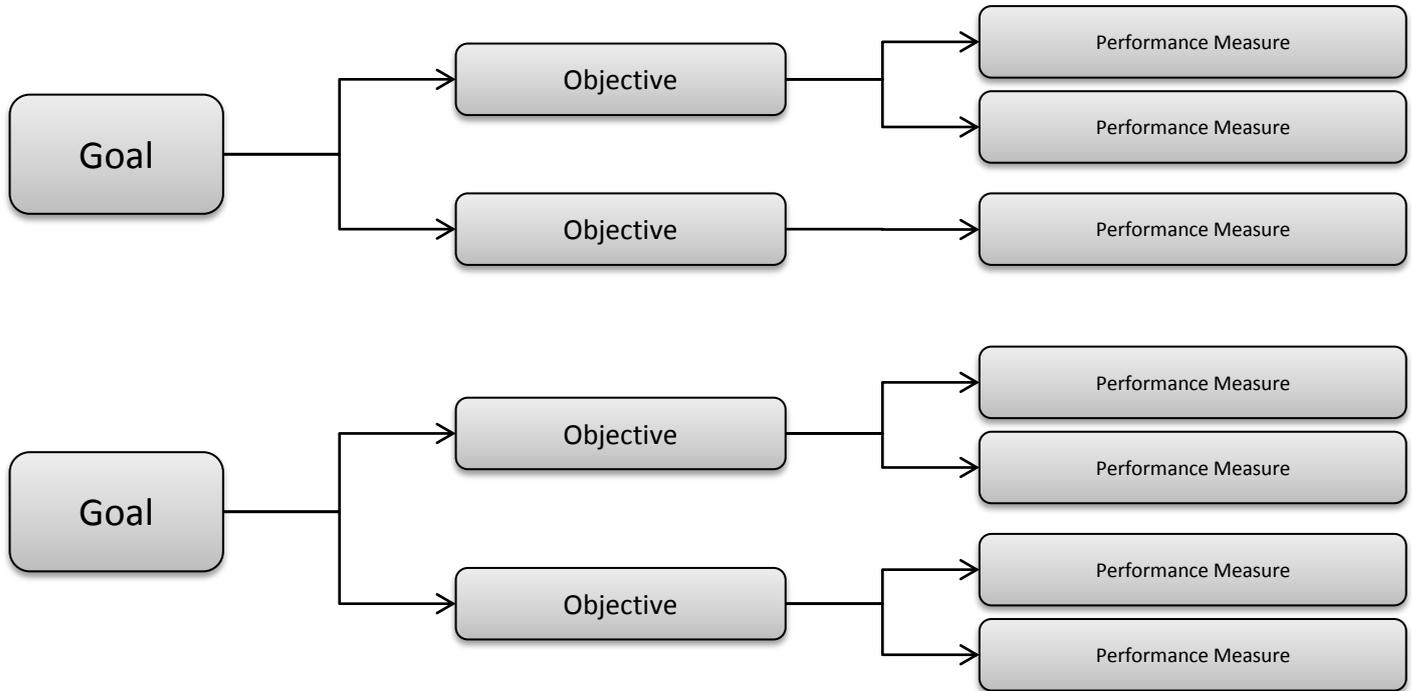
- 1. Safety**
- 2. Basic Accessibility**
- 3. Mobility**
- 4. System Efficiency**
- 5. Security**
- 6. Prosperity**
- 7. Economic Viability**
- 8. Ecosystems**
- 9. Waste Generation**
- 10. Resource Consumption**
- 11. Emissions and Air Quality**



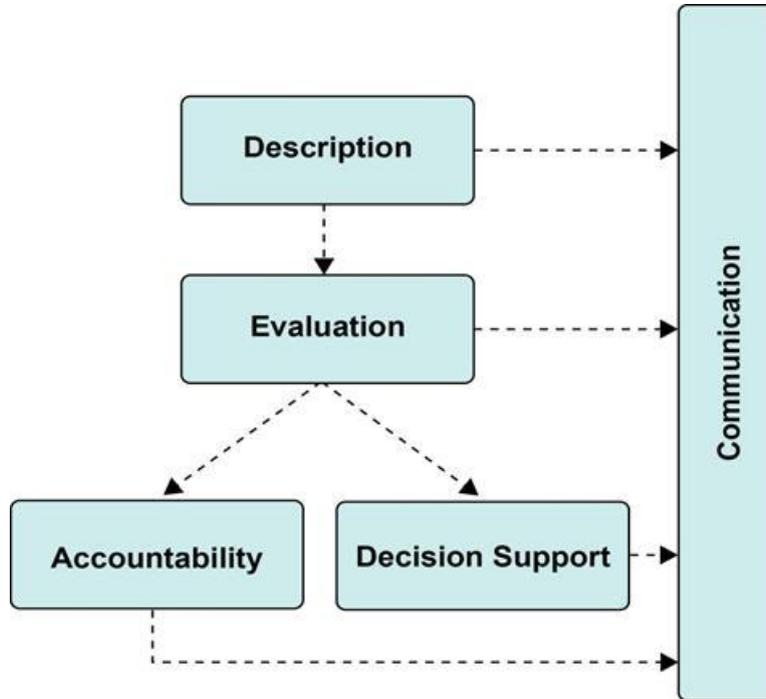
Linking Goals to the Principles

Goal	Principle			
	Environmental and Ecological Systems	Community Health and Vitality	Economic Development and Prosperity	Equity
Safety				
Basic Accessibility				
Equity/Equal Mobility				
System Efficiency				
Security				
Prosperity				
Economic Viability				
Ecosystems				
Waste Generation				
Resource Consumption				
Emissions and Air Quality				

Final Goal-Objective-Performance Measure Hierarchy



Performance Measurement Implementation



Using the Compendium

Clipboard	Font	Alignment	Number	Styles	Clipboard	Font	Alignment	Number	Styles								
B427																	
8/2/2012																	
RESET																	
EXPORT																	
Goal	Objective	Measure	Goal	Objective	Measure	Four As	Outcomes/Outputs/Products (FF)	Freight	Transit	Bike/Ped	Safety	Land Use	Environment	Planning/Community Health	Economy	Equity	Duplicate
1. Safety	Reduce the number and severity of crashes	Change in the number and severity of crashes	1	1	A	PLAN	N	OC			X			X			
1. Safety	Reduce the number and severity of crashes	Change in the number and severity of crashes by crash type and contributing factor	1	1	B	PLAN	N	OC			X			X			
1. Safety	Reduce the number and severity of crashes	Change in the number and severity of truck crashes	1	1	C	PLAN	N	OC	X		X			X			
1. Safety	Ensure safety considerations are addressed for all modes	Change in the number and severity of crashes by user type (e.g., pedestrian, bicycle, transit user, freight)	1	1		PLAN	N	OC	X	X	X			X			
1. Safety	Ensure safety considerations are addressed for all modes	Change in the number of grade crossing collisions/incidents	1	2	B	PLAN	N	OC	X		X			X			
1. Safety	Ensure safety is considered early in project planning	Change in percentage of projects where safety of a project was reviewed in each of the project development stages by a multidisciplinary review team	1	3	A	PLAN	N	P						X			
1. Safety	Ensure safety is considered early in project planning	Change in the percentage of projects implementing predictive methods of the AASHTO Highway Safety Manual	1	3	B	PLAN	N	P						X			
1. Safety	Ensure projects consider the 4Es (Engineering, education, enforcement, enforcement)	Change in the percentage of projects where non-infrastructure based safety countermeasures were selected as part of the project	1	4	A	PLAN	N	OP			X			X			
1. Safety	Develop projects incorporating the use of innovative TSM and ITS solutions that address human factors	Number of projects incorporating the use of innovative TSM and ITS solutions that address human factors	1	3	B	PROJ	N	P			X			X			
1. Safety	Apply a performance based safety improvement program	Number and proportion of projects evaluated on substantive safety versus nominal safety	1	10	A	PROJ	N	P			X			X			
1. Safety	Apply a performance based safety improvement program	Number and cost of projects that address safety concerns at the system, corridor, and local levels	1	10	B	PROJ	N	OP			X			X			
1. Safety	Develop projects with explicit safety considerations	Change in number of programmed projects with highest reduction in crashes out of all alternatives	1	11	A	PROJ	N	OC			X			X			
1. Safety	Reduce crash risk in work zones	Change in number of crashes per time unit within a particular work zone	1	12	A	CONS	N	OC			X			X			
1. Safety	Reduce crash risk in work zones	Change in number of crashes as a portion of total time of work zones by functional class, county, and district/region (where possible, distinguish between active and passive work zone time periods)	1	12	B	CONS	N	OC			X			X			
1. Safety	Reduce crash risk in work zones	Change in number and severity of work zone truck crashes	1	12	C	CONS	N	OC	X		X			X			
1. Safety	Reduce the risk of construction and maintenance personnel working in work zones along roadways	Change in number of crashes involving one or more construction and maintenance personnel and/or vehicles per time unit that the work zone exists	1	13	A	CONS	Y	OC			X			X			
1. Safety	Reduce the risk of construction and maintenance personnel working in work zones along roadways	Number of construction and maintenance personnel killed at work zones by functional class, county, and district/region	1	13	B	CONS	Y	OC			X			X			
1. Safety	Reduce the risk of construction and maintenance personnel working in work zones along roadways	Number of construction and maintenance personnel injured at work zones by functional class, county, and district/region	1	13	B	CONS	Y	OC			X			X			

Create and export

Apply filters



Definition of Transit Corridor



- Nodes
- Links
- Influence area (buffer zone)



Project Purpose

- **Common understanding of sustainability**
- **Tracking system for key measures**
- **Public information**
- **Decision making**



BRT Sustainability Goals

- **Reduce car dependence**
- **Mitigate traffic congestion**
- **Improve international mobility**
- **Increase livability**
- **Promote economic development**
- **Ensure system effectiveness and efficiency**
- **Promote equity**
- **Improve the environment**

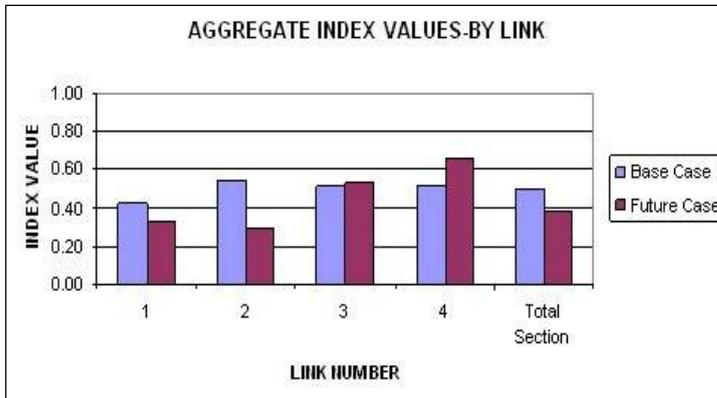
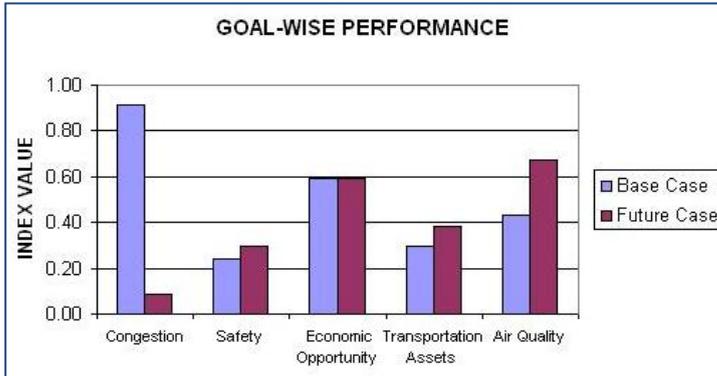


Mapping Goals to Principles

Goal	Principle			
	Environmental and Ecological Systems	Community Health and Vitality	Economic Development and Prosperity	Equity
Reduce car dependence		Yes		Yes
Mitigate traffic congestion	Yes	Yes	Yes	
Improve international mobility			Yes	
Increase livability		Yes		
Promote economic development			Yes	
Ensure system effectiveness and efficiency			Yes	
Promote equity				Yes
Improve the environment	Yes			

Goal	Objective	Indicator	Performance Measure	Unit	Measure Code
1. Reduce car dependence	1.1 Shift car users to RTS	RTS users who are car owners	1.1.1 Medium/High income users in RTS corridor influence area	Dimensionless	1.1.1
	1.2 Make RTS an attractive choice for the traveling public	Travel time by RTS compared to travel time by car	1.2.1 Ratio of travel times by car and by RTS along corridor	Percentage	1.2.1
	1.3 Increase the number of persons with access to RTS service	Residents in the proximity of an RTS station	1.3.1 No. of residents within the corridor influence area	Dimensionless	1.3.1
2. Mitigate traffic congestion	2.1 Improve mobility on RTS corridor	Reduce peak hour travel times	2.1.1 Travel Time Index on the RTS corridor	Dimensionless	2.1.1
	2.2 Shift single occupant car trips to RTS	Increase person-miles of travel without increasing vehicle-miles of travel	2.2.1 Ratio of daily person-miles of travel to VMT on the RTS corridor	Percentage	2.2.1
3. Improve international mobility	3.1 Provide connectivity across the border	Connect RTS and cross-border transit	3.1.1 Number of cross-border transit transfer points on corridor	Dimensionless	3.1.1
		Promote usage of RTS by cross-border travelers	3.1.2 Percent of RTS users who are international travelers	Percentage	3.1.2
4. Increase livability	4.1 Support pedestrian and bike modes	Provide pedestrian facilities	4.1.1 Sidewalk quality along the corridor	Good/Poor/Absent	4.1.1
		Provide bike lanes	4.1.2 length of bike lanes per corridor mile	miles/mile	4.1.2
	4.2 Promote mixed use development	Balance land uses	4.2.1 Land-use entropy Index per influence area	Dimensionless	4.2.1
	4.3 Promote safety and security	- Crashes	4.3.1 Severe crashes on corridor	Dimensionless	4.3.1
		- Lighting coverage	4.3.2 Lighting coverage for pedestrian from stops to O/D on the RTS corridor	Percentage	4.3.2
	- Emergency Phone coverage	4.3.3 Emergency Phone coverage on the RTS corridor	Percentage	4.3.3	
5. Promote economic development	5.1 Revitalize key nodes along RTS corridors	Support and diversify adjacent business	5.1.1 Number of jobs in corridor influence area	Dimensionless	5.1.1
		Increase property values	5.1.2 Value per unit area of commercial property in influence area	Dollars	5.1.2
		Promote commercial activity	5.1.3 Tax revenue generated from commercial establishments in influence area	Dollars	5.1.3
6. Ensure system effectiveness and efficiency	6.1 Generate revenue through RTS fares	Increase revenue from fares	6.1.1 Fare recovery ratio on the RTS project	Percentage	6.1.1
	6.2 Establish RTS and feeder system on schedule	The degree of completion of RTS and feeder system	6.2.1 The completion rate of RTS and feeder system according to schedule	Percentage	6.2.1
7. Promote equity	7.1 Create access to HUD-designated neighborhood areas	HUD-designated neighborhood areas served	7.1.1 HUD-designated neighborhood areas in each influence area	Dimensionless	7.1.1
		Critical destinations in influence area	7.2.1 No. of schools located in each influence area	Dimensionless	7.2.1
			7.2.2 No. of health centers in each influence area	Dimensionless	7.2.2
	7.3 Affordability of access	Travel cost vs. Income	7.3.1 The ratio of daily travel cost on RTS to the daily personal income	Percentage	7.3.1
7.4 Transit availability	Bus Service Quality	7.4.1 The RTS Level of Service		7.3.2	
8. Improve the environment	8.1 Reduce Pollutant Emissions	Daily emission of PM, CO and Ozone Precursor	8.1.1 Daily emission of PM per mile of the RTS corridor	mg/mile	8.1.1
			8.1.2 Daily emission of CO per mile of the RTS corridor	mg/mile	8.1.2
			8.1.3 Daily emission of Ozone Precursor per mile of the RTS corridor	mg/mile	8.1.3
	8.2 Reduce GHG Emissions	Daily emission of CO2	8.2.1 Daily emission CO2 per mile of the RTS corridor	mg/mile	8.2.1

TxDOT: Corridor-Level Application



US 281 – San Antonio



Conclusions

- **What we are doing is not sustainable**
- **The broad issue is here to stay**
- **NCHRP 708 provides a framework**
- **Make informed decisions**
- **Many reasons for doing it**
- **Don't wait for the future!**