



Sustainability in Highway Construction

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WASHTO
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Sustainability in Highway Construction

- The Case for Sustainability
- “Sustainable Highway” ...an Oxymoron?
- What Options are Available?
- Can We Afford It?
- Some Challenges
- Some Solutions

The Case for Sustainability

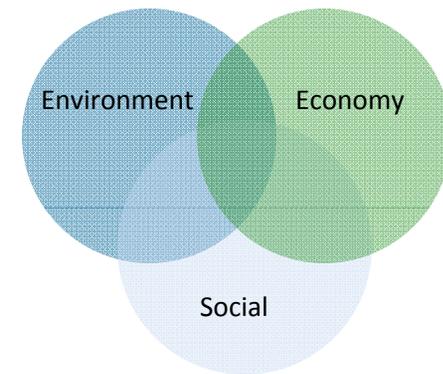
- What is it?
- Why do we need it?
- Is it a passing fad?

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The Case for Sustainability

- What is it?
 - Sustainability integrates
 - Environmental,
 - Economic, and
 - Societal

drivers in ways that allow us to meet our needs without compromising the ability of future generations to meet their needs.



The Case for Sustainability

- What is it?
 - Sustainability is essentially,
If life as we know it is going to continue indefinitely on planet Earth, don't eat the seed corn!

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The Case for Sustainability

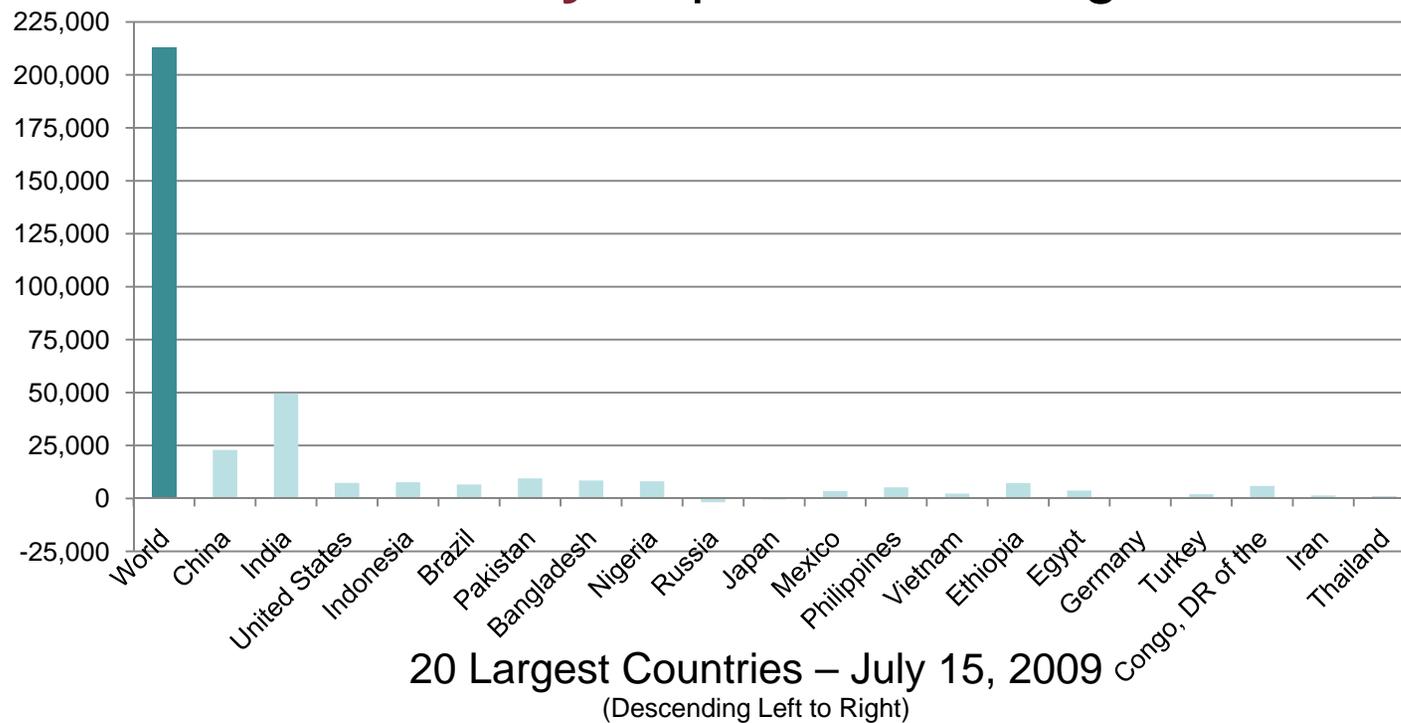
- What is it?
- Why do we need it?



The Case for Sustainability

Why do we need it?

Daily Population Change



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The Case for Sustainability

Why do we need it?

- Finite amounts of virgin resources.

In 2007 the world economy consumed:

- 2.4 Billion tons of iron ore.
- 2.8 Billion tons of cement.
- 1.4 Billion tons of aggregates (USA only).
- 1.3 Trillion gallons of crude oil.

And we did that while flying through space on a spacecraft that has finite amounts of each!

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The Case for Sustainability

Why do we need it?

1. Increasing population.
2. Finite amounts of virgin resources.
3. The 7th Generation

So our great-grandchildren's great-grandchildren can be more concerned about their *quality of life* than their *survival*.

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The Case for Sustainability

- What is it?
- Why do we need it?
- Is it a passing fad?

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The Case for Sustainability

- What is it?
- Why do we need it?
- Is it a passing fad?

Is the population going to level off or decline any time soon?

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The Case for Sustainability

- What is it?
- Why do we need it?
- Is it a passing fad?

Is the pent up demand for a higher standard of living in emerging economies going to decrease?

The Case for Sustainability

- What is it?
- Why do we need it?
- Is it a passing fad?

Are the total amounts of virgin raw materials on the planet going to miraculously increase?

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The Case for Sustainability

- What is it?
- Why do we need it?
- Is it a passing fad?

NO



“Sustainable Highway” ...an Oxymoron?

- It is arguable that nearly every highway improvement contributes to added sprawl, energy use and GHG emissions.
- How can anything that does all that be part of being “sustainable”?

“Sustainable Highway” ...an Oxymoron?

- The answer involves another series of questions.
 - In the foreseeable future will we the people:
 - Eliminate population growth in the USA?
 - Give up the right to live where we choose?
 - Give up the freedom of owning and using personal transportation?
 - Abandon our rural homes (leaving them vacant) and move into cities?

“Sustainable Highway” ...an Oxymoron?

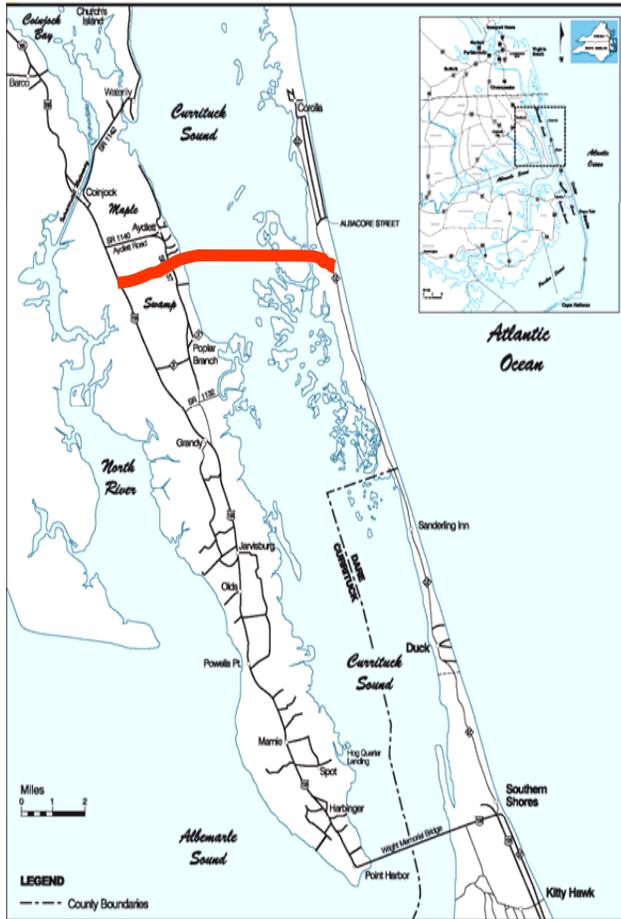
I submit that the answer to each of the above questions is also:

NO

And, since we're not going to eliminate the need for roads and roadway improvements any time soon, for the benefit of future generations we'd better start building them as sustainably as possible.

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What Options are Available?



A Current Example:

Mid-Currituck Crossing

Owner: North Carolina
Turnpike Authority

Finance / Construction:
ACS / Dragados

Design: Lochner-MMM
Solid Waste Sub: GBB

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What Options are Available?

Undergoing Serious Consideration at Mid-Currituck:

- Zero Waste to the Landfill
- Stormwater Infiltration
- Precast Concrete
- Roundabouts
- LED Signals and Streetlights
- Renewable Energy
- Low-Maintenance Landscaping

What Options are Available?

- Zero Waste to the Landfill
 - Recycle Existing Materials on the Project
 - Salvage Existing Materials for Reuse
 - Minimize Construction Debris

What Options are Available?

- Zero Waste to the Landfill
 - Recycle Existing Materials on the Project
 - Crushed Concrete for Base (common)
 - Crushed Concrete for Concrete Aggregate (better)
 - Asphalt to HMA at the Plant (becoming common)
 - Asphalt to Foamed Asphalt Base on Site (cheaper)
 - Clean Wood Scraps to Landscape Mulch on Site

What Options are Available?

- Zero Waste to the Landfill
 - Recycle Existing Materials on the Project
 - Salvage Existing Materials for Reuse
 - Deconstruct instead of “Wrecking ball & haul”
 - Beams & Dimension Lumber
 - Doors, Window Frames & Molding
 - Copper, Steel & Iron Pipe
 - Copper & Aluminum Electrical Wire
 - Bricks & Concrete Blocks
 - Porcelain

What Options are Available?

- Zero Waste to the Landfill
 - Recycle Existing Materials on the Project
 - Salvage Existing Materials for Reuse
 - Minimize Construction Debris
 - Eliminate single-use forms
 - Design to match standard material dimensions

What Options are Available?

- Stormwater Infiltration
 - Grassy Swales
 - Porous Pavements
 - Porous Concrete
 - Porous Asphalt
 - Interlocking Pavers
 - Open-cell Grids
 - Reinforced Grass

What Options are Available?

- Precast Concrete
 - Higher strength-to-weight ratio than Cast-in-Place.
 - Fewer virgin resources than for Cast-in-Place.
 - Reusable forms.

What Options are Available?

- Roundabouts
 - Eliminate signal capital costs.
 - Eliminate signal maintenance costs.
 - Reduce accident severity.
 - Right-of-Way is readily available at Mid-C.
 - Operate normally when the power is out.
 - Allow for narrower bridges.

What Options are Available?

- LED Signals
 - 90% less energy than incandescent bulbs.
 - 6X the lamp life of incandescent bulbs.
- LED Streetlights
 - 50% less energy for the same light output.
 - 7X the lamp life of high-pressure sodium.
 - Focused light.

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What Options are Available?

- Renewable Energy
 - Wind
 - River Currents
 - Solar (potential at Mid-Currituck)

What Options are Available?

- Renewable Energy
 - Solar (at Mid-Currituck)
 - Supplemental power source for the toll office facility.
 - Supplemental power source for the toll booths.

What Options are Available?

- Renewable Energy
 - Solar (beyond Mid-Currituck)
 - Starting to show up at airports.
 - Starting to show up along highway rights-of-way.

Think about all the publicly-owned right-of-way in urban freeway interchanges that could be used for solar panels...right next door to the users!

What Options are Available?

- Low-Maintenance Landscaping
 - Save & reuse the topsoil.
 - Minimize the need for irrigation.
 - Specify native plant species.

Can We Afford It?

- The skeptic:

“When virgin resources become really scarce maybe future generations will make reuse/recycle decisions for economic reasons, but in today’s economy that would be too expensive.”

What if you discovered you were wasting money by not doing it now?

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Can We Afford It?

- A recent stormwater project:
 - King County, WA Public Works,
Military Rd S at 272nd St Intersection
 - Porous Pavements and Rain Gardens were chosen for the price, not for the technology or for being “green,” and saved an estimated \$44,000 over conventional stormwater collection and treatment.
 - More could probably have been saved. Based on two years of performance King Co staff now believes they over-designed and over-constructed the subgrade.

Can We Afford It?

- An upcoming stormwater project:
 - King County, WA Public Works,
NE Woodinville-Duvall Rd at Mink Rd NE:
 - The initial project concept included a constructed wetland, but the adjacent owner did not want to sell the necessary property.
 - The County switched to a Rain Garden to handle the stormwater at half the estimated cost.
 - Constructed Wetland Estimate: -----\$160,000
 - Rain Garden Estimate: -----\$80,000

Can We Afford It?

- A recent demolition and disposal project:
 - Nashville Thermal Transfer Corporation
 - Demolish an existing Waste-To-Energy plant
 - 200 ft. concrete stack
 - Waste receiving facility
 - Waste-handling crane
 - Goal: Minimize costs by recycling/reusing as much of the existing material as possible.

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Can We Afford It?

Thermal Demo Summary Materials Movement & Reuse/Recycle Rate

<u>Activity / Item</u>	<u>Tons</u>
Auction (Recycled/Reused)	1,093
Demo Steel, Including Rebars & Structural	4,394
Crushed Concrete Aggregate Produced	50,007
Demolition Debris to Landfill	983
Asbestos (Removed/Disposed at Landfill)	21
Scrapped Metal from Auction & UST's	118
Railroad Ties	7
Crushed Asphalt Produced	<u>9,747</u>
Total Weight, All Materials	66,370
Total Weight, Recycled/Reused Materials	65,366
% Recycled/Reused (total tons)	98.5%



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Can We Afford It?

Overall Dismantlement Project Costs Nashville Thermal WTE Plant

Original Year 2000 Demo Estimate	-----	\$2,400,000
Final Project Costs:		
– UST	-----	\$ 128,000
– Asbestos Removal	-----	\$ 86,000
– Fencing	-----	\$ 13,000
– Demolition	-----	\$ 775,000
– Cover Dirt & Seeding	-----	<u>\$ 96,000</u>
– Subtotal Cost	-----	\$ 1,098,000
– Internet Auction Income	-----	<u>(\$ 983,000)</u>
Actual Net Total Dismantlement Cost	-----	-\$115,000



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Can We Afford It?

For reasons having to do with both sustainability and cost,

Can we afford not to?

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Some Challenges

- Preconceived notions
 - Aversion to trying something new. (“We’ve always done it this way.”)
 - “Recycled” has a shorter lifespan than new.
 - “Used” is second class, new is always better.
 - Taxes are always an issue so lowest capital cost trumps lowest life cycle cost.
 - The spec book won’t let us use recycled.

Some Solutions

- Aversion to trying something new.
 - Get over it!

Think about how we'd be building highways today if our predecessors had been unwilling to try anything new.

When the virgin resources are depleted we'll have to change. Why not start changing now and leave some of our virgin resources for that seventh generation to work with?

Some Solutions

- “Recycled” has a shorter life span.
 - Sometimes that’s true. So what?!
 - Asphalt has a shorter lifespan than concrete. Do we always choose concrete?
 - Untreated wood has a shorter lifespan than treated wood. Do we always choose treated wood?

Before dismissing recycled for a reason that we don’t consider being above all else for other materials, do an analysis of life expectancy, cost, virgin materials saved, GHG emissions, etc.

Some Solutions

- “Used” is second class, new is always better.
 - Infrastructure is not automatically inferior just because the materials in it had a previous life.

Some Solutions

- Taxes are always an issue so lowest capital cost trumps lowest life cycle cost.
 - “What will it cost in my term of office?” can be a tough obstacle, to be sure.

This will take ongoing education, first making the case to our elected officials, and then enlisting their help to reach news media and the public.

To paraphrase Einstein...We will not become a sustainable society if we continue to do things the way we do them now.

Some Solutions

- The spec book won't let us use recycled.
 - This is a serious obstacle in many places.
 - Specifications are often written around virgin material properties.
 - “If it's not on the pre-approved list, it's no good.”

If the concrete we just broke up exceeded 3,000 psi and the roadway cylinders we made with it consistently break above 3,000 psi, do we really care that most of the aggregate was previously existing concrete?

Some Solutions

- Start thinking “sustainability” at every stage of the project, from Planning through Operations and Maintenance.

It's the right thing to do for all the right reasons.

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- To help get that thinking started organizations all over the country are engaged in efforts like Green Roads.
- Lochner has been working with a number of our clients nationally to put together a four-stage measurement tool we call “STEED.”
 - Sustainable Transportation Engineering and Environmental Design.

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- STEED considers the three drivers of sustainability:
 - Economic Needs
 - Environmental Needs
 - Societal Needs

- And it measures a project at four stages:
 - Planning
 - Environmental
 - Design
 - As-Built

This four-stage measurement is to help show if the original intentions were met, and if not, during which stage things either improved or deteriorated. The goal is to learn and apply the lessons to future projects.

Conclusions

- Sustainability in highway construction is the right thing to pursue.
- The need to act sustainably isn't going to go away.
- We can and should save virgin materials for their highest and best uses.
- We can recycle/reuse existing materials to their highest and best use...and it's not as landfill cover.
- We can afford to do many of the things I've identified today within our existing budgets.

Sustainability...

- It's coming soon to a project you'll be working on.
- It's coming in a relatively short time to every project you'll be working on.
- It's the right thing to do for all the right reasons.
- GET ON BOARD!

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Thank you!

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The logo for Lochner, featuring the word "LOCHNER" in a bold, white, sans-serif font. The text is positioned on the left side of a horizontal banner that has a background of blurred green grass blades.

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