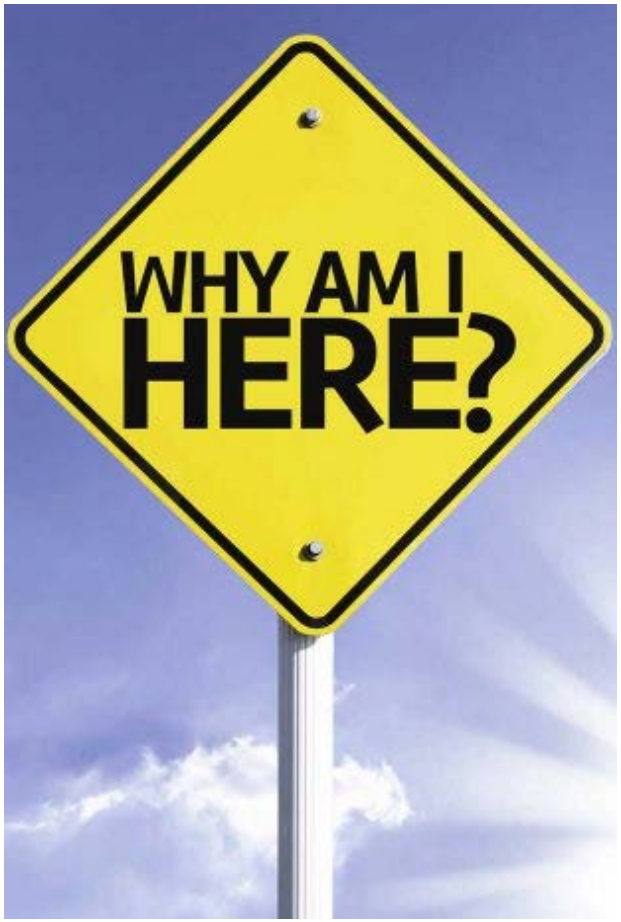
Environmental Product Declarations
The new normal?

Curt Turgeon | State Pavement Engineer

Office of Materials and Road Research

DEPARTMENT OF TRANSPORTATION



MnDOT Pavement Engineer

- Bituminous
- Concrete
- Pavement Design
- Pavement Management
- Advanced Materials and Tech

How did I get here?

BIG BOOK received

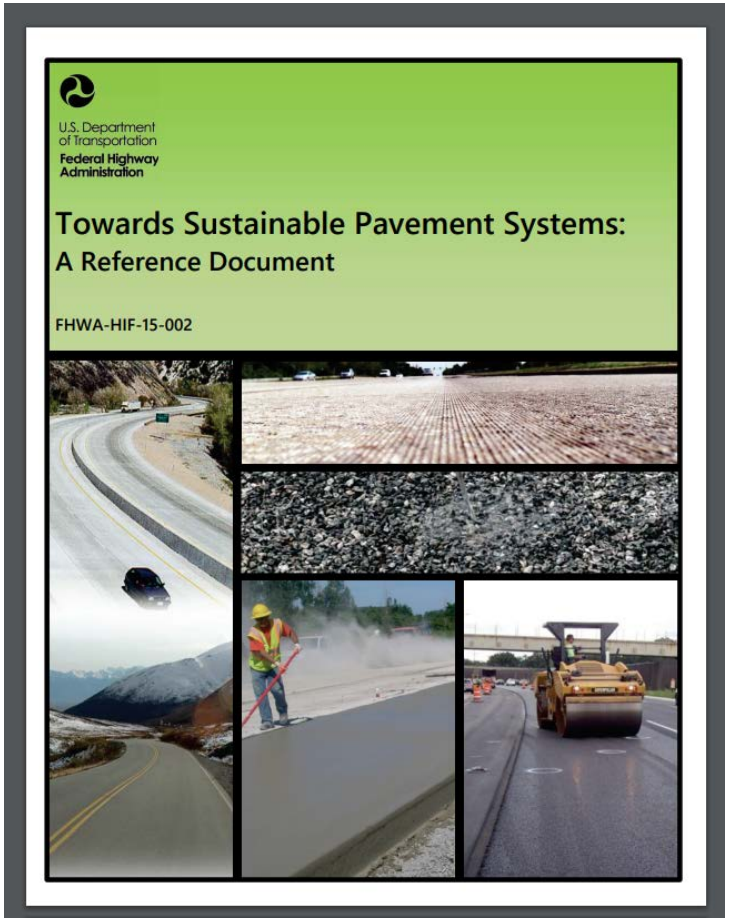
Working Group Member contacted MnDOT Sustainability Director

Determined that FHWA was looking for new TWG members for next five year cycle.

MnDOT Sustainability Report - Construction GHG values.

Chair AASHTO Committee on Materials and Pavements Tech Subcommittee on Quality Assurance and Environmental

Definitely learn something



Hurdle #1- Engineer Preconceived Notions

- Me – Sustainable pavement projects consume few resources while providing immediate impact (smoothness). For example – micromill and thin asphalt surface treatment or diamond grind concrete
- Group – Sustainable pavement projects should focus on maximizing the life of the fix. Consume resources in an efficient manner that leads to fewer resources needed in the future.
- *Are these mutually exclusive?*

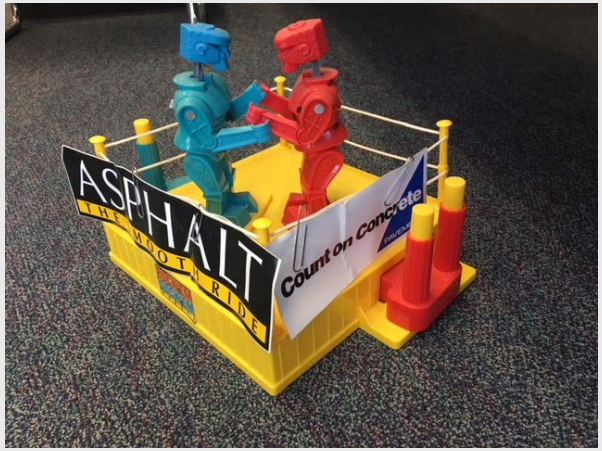
Hurdle #2 -The Battle of the Industries

Minnesota Asphalt Pavement Association

https://www.asphaltisbest.com/

CONCRETE PAVING ASSOCIATION OF MINNESOTA
CPAM

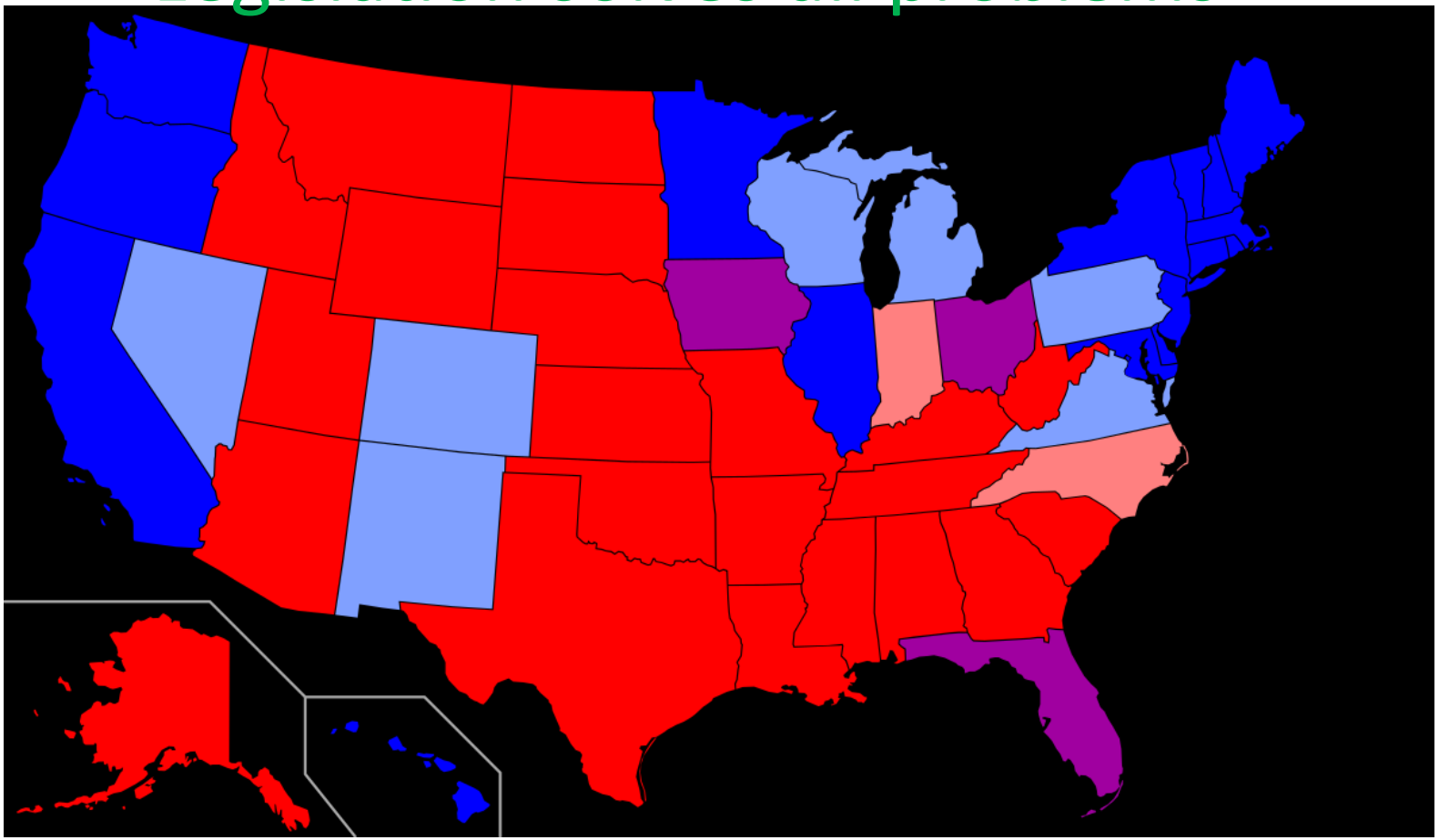
http://www.concreteisbetter.com/



Life Cycle Cost Analysis – Cost of Ownership over the life of asset

Hurdle #3 - Politics

Legislation solves all problems



Things Clicked

- Fall of 2017 FHWA Sustainable Pavements Technical Working Group meet.
  - #3 Politics: California passes limited law requiring Environmental Product Declarations
  - #2 Industry: National Asphalt Pavement Association releases Emerald Eco-Label Program for EPD calculation. National Ready Mixed Concrete Association has EPD calculator in place for 4 years. American Concrete Pavement Association ready to use NRMCA approach.
  - #1 Engineering: I have no idea how to incorporate sustainability into any of our decision processes. Few people in Minnesota have heard of EPDs

Simply Put

- Politicians are acting
- Industry is ready to go (at it)
- Engineering is lagging

What do we know (or think we know) ?

PAVEMENT MANAGEMENT SYSTEM

Conditions	Repairs	Costs
• Age • Layers - thicknesses • Cracking • Rutting • Faulting • Smoothness • Predicted Performance Curves	• Reconstruction • Asphalt Overlay • Thin • Medium • Thick • Concrete Overlay • Concrete Repair • Reclaim • Chip Seal • Crack Seal • • • • Nothing	$1.1 million/ lane mile Less than $50k/lane mile FREE

- We understand pavement fixes and their expected performance they relate to costs in dollars and cents

- We do not understand the relationship of pavement fixes and their expected performance as they relate to environmental impacts.

The First Step in Understanding Environmental Costs

- **Product Category Rules PCR** - Establishes a unit of measure (ton, cubic yard, each) and rules for calculating the environmental impacts for that item.
- **Environmental Product Declarations EPD** - List of impacts from the item. "Nutrition Label" for the item.
- **Life Cycle Assessment LCA** – NEED TO BE CAREFUL HERE. Establishes beginning and end of life cycle being considered. Most often Cradle to Gate.

Here's One Now

Emerald ECO LABEL

An Environmental Product Declaration for Asphalt Mixtures

Company

Payne and Dolan, Inc. is an asphalt mixture producer.

Payne and Dolan, Inc. Control 20 Waukesha Plant

N6 W23034 Bluemound Rd

Waukesha, WI

Product Description

This EPD reports the impacts for 801418, a Dense-Graded Superpave asphalt mixture which can be incorporated as part of the structure for a roadway, parking lot and recreational pavement and meets mix specifications provided for its application.

This asphalt mixture is categorized as a hot mix. This asphalt mixture was produced within a temperature range of 280.0 to 320.0 °F.

Environmental Product Declaration NAPA VERIFIED

Declaration Number: 14.20.67 v8

Date of Issue: Mar 14, 2019 **Period of Validity:** Jan 31, 2022

This declaration is an environmental product declaration in accordance with ISO 14025:2006[1] Type III environmental performance labels and European Committee for Standardization (CEN) EN 15804:2012[2], which transparently describes the potential environmental impacts of the described product caused during the identified stages. The data specific to this product can be found on page 3 of this document.

https://asphaltepd.org/published/WI/

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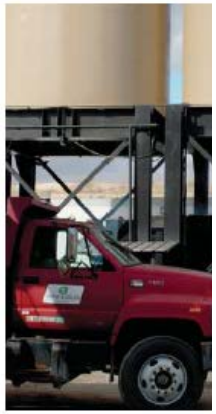

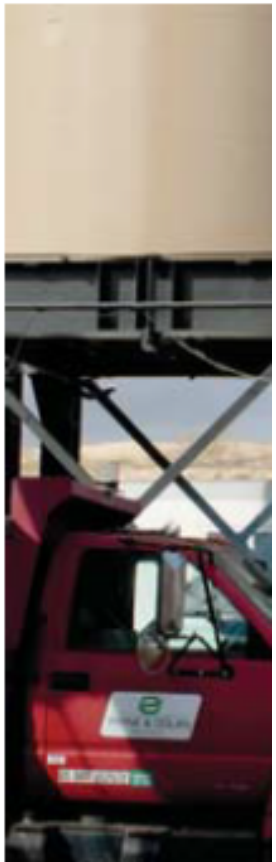

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2 EN 15804-2012 Sustainability of Construction Works, Environmental Product Declarations, Core rules for the product category of construction products

3, 4, 5 Product Category Rules for Asphalt Mixtures, Version 1.0 dated 1/31/2017 Page 8, 10-12, 16-19

DECLARED PRODUCT	801418, an asphalt mix for Dense-Graded Superpave
DECLARATION OWNER	Payne and Dolan, Inc. James Me (262) 524- jmertes@
PROGRAM OPERATOR	NAPA NATIONAL ASPHALT PAVEMENT ASSOCIATION National A 6406 Ivy L Greenbelt 301-731-4 www.Asp
LCA AND EPD TOOL DEVELOPER	trisIGHT Trisight 906-370-4 www.trisi
INDEPENDENT VERIFIERS	WAP SUSTAINABILITY CONSULTING WAP Sust 855-452-2 www.wap The data and declarations produced by the EPD tool was externally, independently verified in accordance with ISO14044, and ISO14025, and the referenced PCR.
PRODUCT CATEGORY RULE	Product Category Rules for Asphalt Mixtures Version 1.0 dated 1/1/2017, www.AsphaltPavement.org/PCR
THE PCR REVIEW	theRightenvironment PCR confirmed by PCR Review Panel Led by Joep Meijer The Right Environment Ltd. Co. 512-821-1809 www.therightenvironment.net

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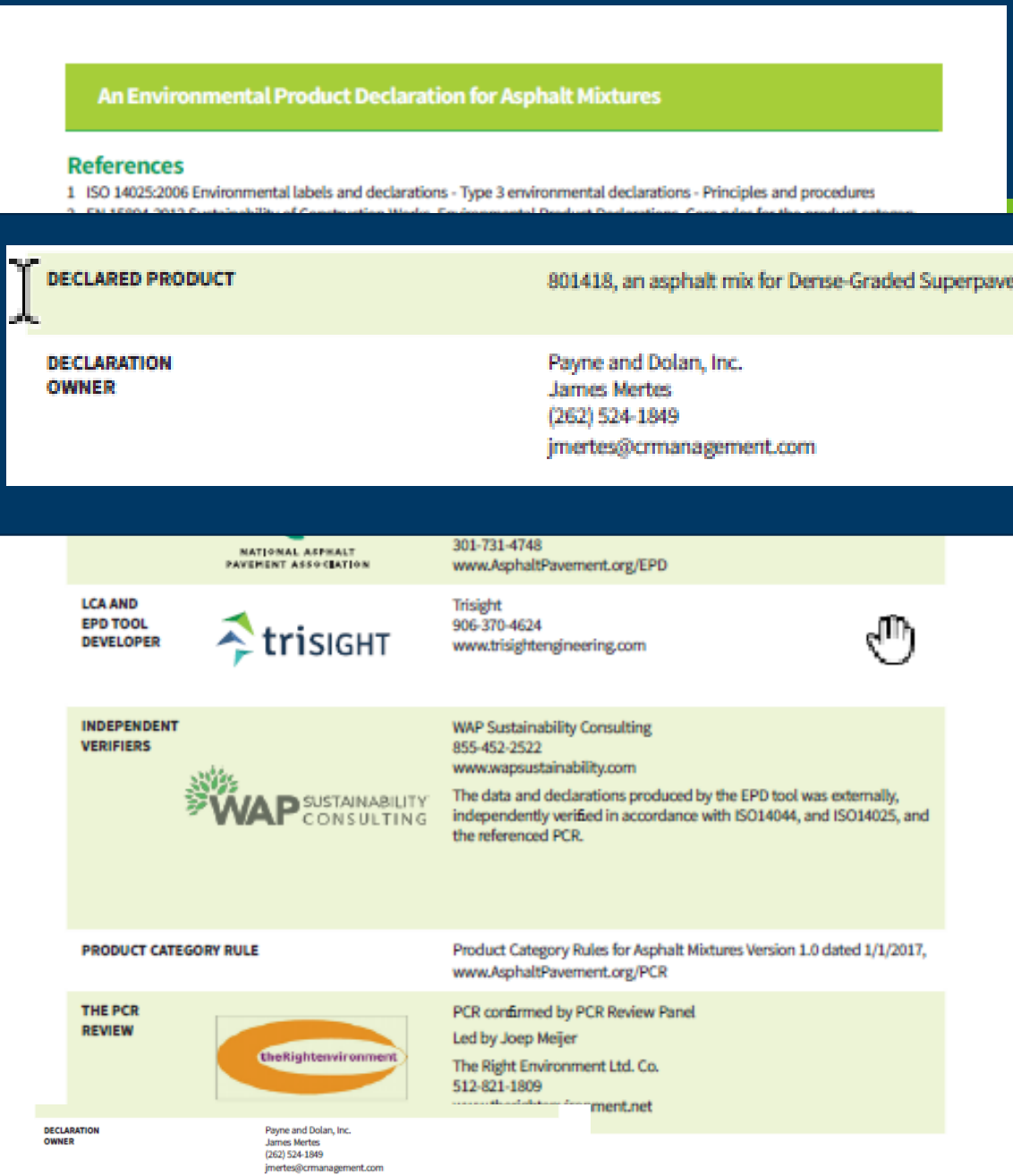

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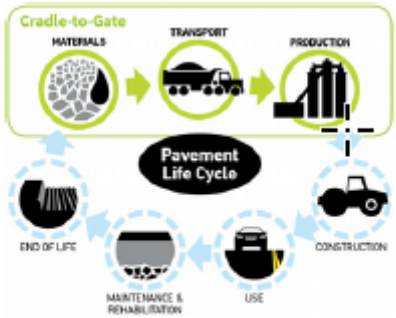
PAGE 2

Life Cycle Assessment

DECLARED UNIT

The declared unit is 1 short ton of an asphalt mixture (UNSPSC Code 30111509: Asphalt Based Concrete) as defined as "a plant-produced composite material of aggregates, asphalt binder, and other materials."[1]



The three green icons represent the cradle-to-gate data used to create the Emerald Eco-Label Environmental Product Declaration (EPD) for asphalt pavement mixtures.

LIFE CYCLE PHASES

This EPD covers the raw material supply, transport, and production life cycle phases (A1-A3). It does not include construction (placement and compaction), use, maintenance, rehabilitation, or the end-of-life life cycle phases (phases A4, A5, B1-7, and C1-4).[4]

Materials (A1): This stage includes raw material extraction, refining, and energy production.

Transport (A2): This stage includes transport of raw materials to the asphalt plant.

Production (A3): This stage comprises all plant operations involved in the production of asphalt mixtures. Data for this stage is plant-specific.

LIFE CYCLE INVENTORY

This EPD was created using plant-specific data for asphalt mix production of the manufacturing life cycle phase. Potential variations due to asphalt mixture design, supplier locations, manufacturing processes, efficiencies, and fuel use are accounted for in this EPD. All other upstream data sources were prescribed and are publicly available and freely accessible to ensure transparency and comparability. Use of the prescribed data sources ensures comparability among the EPDs developed by limiting any variability due to differences in the upstream data within the system boundaries.[5]

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accounted for.

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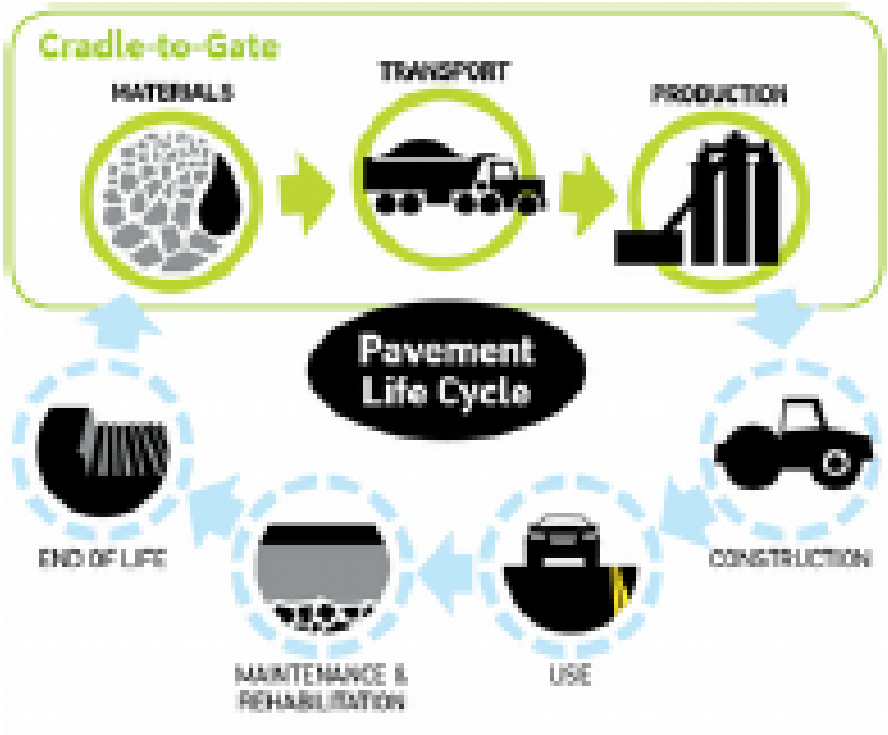

Page 3

Results of the LCA – Resource Use

PARAMETER	UNIT	A1	A2	A3
PERE	MJ, net calorific value	0.794	0	48.3
PERM	MJ, net calorific value	0	0	0
PERT	MJ, net calorific value	0.794	0	48.3
PENRE	MJ, net calorific value	0	247	338
PENRM	MJ, net calorific value	1.55e+03	0	0
PENRT	MJ, net calorific value	1.55e+03	247	338
SM	Kg	102	0	0
RSF	MJ, net calorific value	0	0	0
NRSF	MJ, net calorific value	0	0	0.0449
FW	M3	0	0	0.0189

PERE Use of renewable primary energy excluding renewable primary energy resources used as raw materials

PERM Use of renewable primary energy resources used as raw materials

PERT Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)

PENRE Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials

PENRM Use of non renewable primary energy resources used as raw materials

PENRT Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials)

SM Use of secondary materials

RSF Use of renewable secondary fuels

NRSF Use of non renewable secondary fuels

FW Net use of fresh water

Results of the LCA – Output Flows and Waste Categories

PARAMETER	UNIT	A1	A2	A3
HWD	Kg	MND*	MND*	0
NHWD	Kg	MND*	MND*	0
RWD	Kg	MND*	MND*	0
CRU	Kg	0	0	0
MFR	Kg	0	0	0
MET	Kg	0	0	0
EEE	MJ, net calorific value	0	0	0
EET	MJ, net calorific value	0	0	0

HWD Disposed-of hazardous waste

NHWD Disposed-of non-hazardous waste

RWD Disposed-of radioactive waste

CRU Components for reuse

MFR Materials for recycling

MET Materials for energy recovery

EEE Exported electrical energy

EET Exported thermal energy

Module Not Disclosed: Insufficient data available to calculate this value

Page 4

Results of the LCA – Environmental Impact, TRACI

PARAMETER	UNIT	A1	A2	A3
Global Warming Air, incl. Biogenic Carbon	[kg CO2-Equiv.]	16.8	2.73	20.9
Ozone Depletion Air	[kg CFC 11-Equiv.]	3.56e-09	1.15e-10	3.53e-11
Acidification	[kg SO2-Equiv.]	0.0986	0.0157	0.0385
Eutrophication	[kg N-Equiv.]	0.0057	0.00101	0.00151
Smog Air	[kg 03-Equiv.]	1.75	0.5	0.832
Abiotic Depletion for Fossil Resources	[MJ surplus energy]	MND*	MND*	MND*

Results of the LCA – Environmental Impact, CML

PARAMETER	UNIT	A1	A2	A3
Global Warming Potential	[kg CO2-Equiv.]	17.1	2.75	20.9
Ozone Layer Depletion Potential	[kg R11-Equiv.]	2.42e-09	1.05e-10	3.22e-11
Acidification Potential	[kg SO2-Equiv.]	0.0829	0.0115	0.0333
Eutrophication Potential	[kg Phosphate-Equiv.]	0.00923	0.00264	0.00444
Photochem. Ozone Creation Potential	[kg Ethene-Equiv.]	0.0102	0.000493	0.00171
Abiotic Depletion	[kg Sb-Equiv.]	MND*	MND*	MND*
Abiotic Depletion for Fossil Resources	[MJ surplus energy]	MND*	MND*	MND*

**Module Not Disclosed: Insufficient data available to calculate this value*

What's Next?

- #1 NRMCA
- #2 Athena Sustainablity Materials Institute
- #3 Carbon Leadership Forum
- #4 Granite Construction
- #5 Long Trail Sustainability

https://www.nrmca.org/sustainability/EPDProgram/Downloads/GraniterockEPD2018-11-30.pdf

Multiple Plants Using the Same Mix Designs

Table 1: Plants Represented in the EPD					
Facility	**321-Santa Cruz**	**331-Salinas**	**341-Sand City**	**361 – San Jose**	**381-Redwood**
Street	303 Coral St.	400 Work St.	1755 Del Monte Blvd.	11711 Berryessa	355 Blomquist St.
City	Santa Cruz	Salinas	Seaside	San Jose	Redwood City
State	California	California	California	California	California
Zip	95060-2106	93091	93955	95133-1012	94063-2701
Plant Type	Central Mix	Transit Mix	Transit Mix	Central Mix	Central Mix

Environmental Product Declaration

Graniterock
Ready-Mixed Concrete

According to ISO 14025

Table 10a: Calculated Results for Plant 361 A1-A3 per yd3

Indicator	Strength		GWP	ODP	AP	EP	POCP	PEC	NRE	RE	NRM	RM	CBW	CWW	TW	CHW	CNHW
Mix Name	PSI	# Days	kg CO2	kg CFC-11	kg SO2	kg N	kg O3	MJ	MJ	MJ	kg	kg	m3	m3	m3	kg	kg
670297	3000	28	228.67	5.39E-06	0.71	0.25	14.90	1540.13	1510.40	29.73	1760.54	1.53	0.14	0.14	3.43	0.01	1.72
87296	3000	28	233.17	5.50E-06	0.72	0.26	14.97	1553.69	1523.55	30.13	1644.80	1.57	0.15	0.14	3.58	0.01	1.77
670311	3000	28	233.97	5.53E-06	0.72	0.26	15.10	1565.25	1534.91	30.34	1734.63	1.57	0.14	0.14	3.53	0.01	1.77
57T500	3000	28	155.44	4.57E-06	0.67	0.18	13.00	1269.71	1244.46	25.25	1688.35	1.10	0.14	0.14	2.65	0.03	0.99
67T50P	3000	28	154.72	4.55E-06	0.67	0.17	12.97	1263.96	1238.87	25.10	1672.40	1.10	0.14	0.14	2.72	0.03	0.98
72604	3000	28	256.56	6.08E-06	0.78	0.29	16.19	1689.58	1656.61	32.97	1740.95	1.73	0.14	0.14	3.82	0.01	1.97
80300	3000	28	259.76	6.18E-06	0.78	0.29	16.09	1692.80	1659.31	33.49	1661.43	1.77	0.15	0.14	3.79	0.01	2.01
72609	3500	28	235.48	5.54E-06	0.73	0.26	15.28	1578.35	1548.01	30.33	1722.96	1.58	0.13	0.14	3.62	0.01	1.78
670363	3500	28	241.70	5.71E-06	0.74	0.27	15.53	1612.30	1581.05	31.25	1769.01	1.63	0.13	0.14	3.59	0.01	1.83
57T550	3500	28	167.88	4.97E-06	0.71	0.19	13.70	1348.90	1321.73	27.17	1687.99	1.20	0.13	0.14	2.74	0.03	1.09
57B590	3500	28	231.04	5.42E-06	0.72	0.26	15.18	1564.91	1535.02	29.88	1776.67	1.54	0.12	0.14	3.40	0.01	1.73
670357	3500	28	217.41	5.10E-06	0.69	0.24	14.41	1480.44	1452.17	28.26	1727.64	1.44	0.13	0.14	3.34	0.01	1.62
578606	3500	28	234.80	5.53E-06	0.73	0.26	15.22	1576.73	1546.33	30.40	1742.50	1.57	0.13	0.14	3.45	0.01	1.77
578604	4000	28	249.34	5.89E-06	0.77	0.28	16.00	1661.95	1629.79	32.16	1808.77	1.68	0.13	0.14	3.61	0.01	1.89
83774	4000	28	325.56	7.81E-06	0.94	0.37	19.33	2062.68	2021.37	41.31	1755.65	2.24	0.15	0.14	4.52	0.02	2.57
666713	4000	28	294.77	7.10E-06	0.85	0.33	17.12	1860.43	1822.48	37.95	1458.02	2.04	0.15	0.14	3.89	0.02	2.34
83798	4000	28	301.52	7.19E-06	0.89	0.34	18.27	1933.87	1895.57	38.30	1715.66	2.06	0.15	0.14	4.29	0.02	2.36
672414	4000	28	261.74	6.22E-06	0.79	0.29	16.44	1720.98	1687.27	33.71	1777.17	1.77	0.13	0.14	3.75	0.01	2.00
57T605	4000	28	180.09	5.38E-06	0.75	0.21	14.42	1429.32	1400.21	29.11	1693.94	1.30	0.14	0.14	2.84	0.03	1.18
57T600	4000	28	128.16	4.24E-06	0.65	0.15	12.28	1172.97	1149.52	23.45	1597.62	0.94	0.13	0.14	2.32	0.04	0.71
572657	4000	28	252.43	5.97E-06	0.77	0.28	16.00	1671.96	1639.39	32.57	1743.67	1.70	0.13	0.14	3.57	0.01	1.92
572600	4000	28	235.36	5.54E-06	0.73	0.26	15.33	1584.67	1554.23	30.44	1774.91	1.57	0.13	0.14	3.48	0.01	1.77
670414	4000	28	234.61	5.53E-06	0.73	0.26	15.20	1574.01	1543.65	30.35	1730.00	1.57	0.13	0.14	3.48	0.01	1.77
67G607	4000	28	180.16	5.39E-06	0.75	0.21	14.47	1431.09	1402.00	29.09	1688.38	1.30	0.13	0.14	2.91	0.04	1.18
57G665	4000	28	204.51	5.93E-06	0.80	0.23	15.33	1547.88	1516.05	31.82	1668.72	1.48	0.13	0.14	3.02	0.03	1.41
678657	4500	28	251.45	5.95E-06	0.77	0.28	15.98	1666.30	1633.90	32.41	1743.27	1.69	0.13	0.14	3.62	0.01	1.91
571650	4500	28	325.08	7.81E-06	0.95	0.37	19.45	2072.38	2030.88	41.50	1910.92	2.24	0.13	0.14	4.33	0.02	2.55
57T750	5000	28	180.31	5.46E-06	0.76	0.21	14.42	1436.20	1406.78	29.42	1575.78	1.31	0.14	0.14	2.78	0.04	1.18
57T751	5500	28	232.16	6.77E-06	0.89	0.27	16.95	1732.97	1697.18	35.79	1705.33	1.69	0.13	0.14	3.26	0.04	1.62
571800	6000	28	393.57	9.52E-06	1.11	0.45	22.54	2447.53	2397.72	49.80	1948.20	2.74	0.13	0.14	4.90	0.02	3.14

Just the 3000 psi mixes from one plant

Table 10a: Calculated Results for Plant 361 A1-A3 per yd3			
Indicator	Strength		GWP
Mix Name	PSI	# Days	kg CO2
670297	3000	28	228.67
87296	3000	28	233.17
670311	3000	28	233.97
57T500	3000	28	155.44
67T50P	3000	28	154.72
72604	3000	28	256.56
80300	3000	28	259.76

- % Fly Ash
- % Slag
- Air Entrained ??
- W/C

Just the 3000 psi mixes from two plants

Table 10a: Calculated Results for Plant 361 A1-A3 per yd3				Plant 341
Indicator	Strength		GWP	GWP
Mix Name	PSI	# Days	kg CO2	kg CO2
670297	3000	28	228.67	244.54
87296	3000	28	233.17	249.25
670311	3000	28	233.97	249.83
57T500	3000	28	155.44	170.21
67T50P	3000	28	154.72	169.41
72604	3000	28	256.56	272.85
80300	3000	28	259.76	275.58

MN Legislative Language

"which information shall be taken into consideration in making a contract award"

Some people would like to create hard caps based upon EPD data to weed out the dirty producers

FUTURE

INDUSTRY AND AGENCIES NEED TO WORK TOGETHER TO PRODUCE AND EXAMINE LOCAL EPD DATA SO WE CAN EDUCATE OTHERS WHO WANT TO CREATE REGULATIONS

THANK YOU

- QUESTIONS?

- Minnesota
  - 2019
    - HF 2203
    - HF 2204
  - 2020
    - HF 3702

California Enacted
"Buy Clean Act"

States Considering:
Washington
Oregon
Colorado
Minnesota

Thank you again!

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Minnesota Pavement Engineer

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