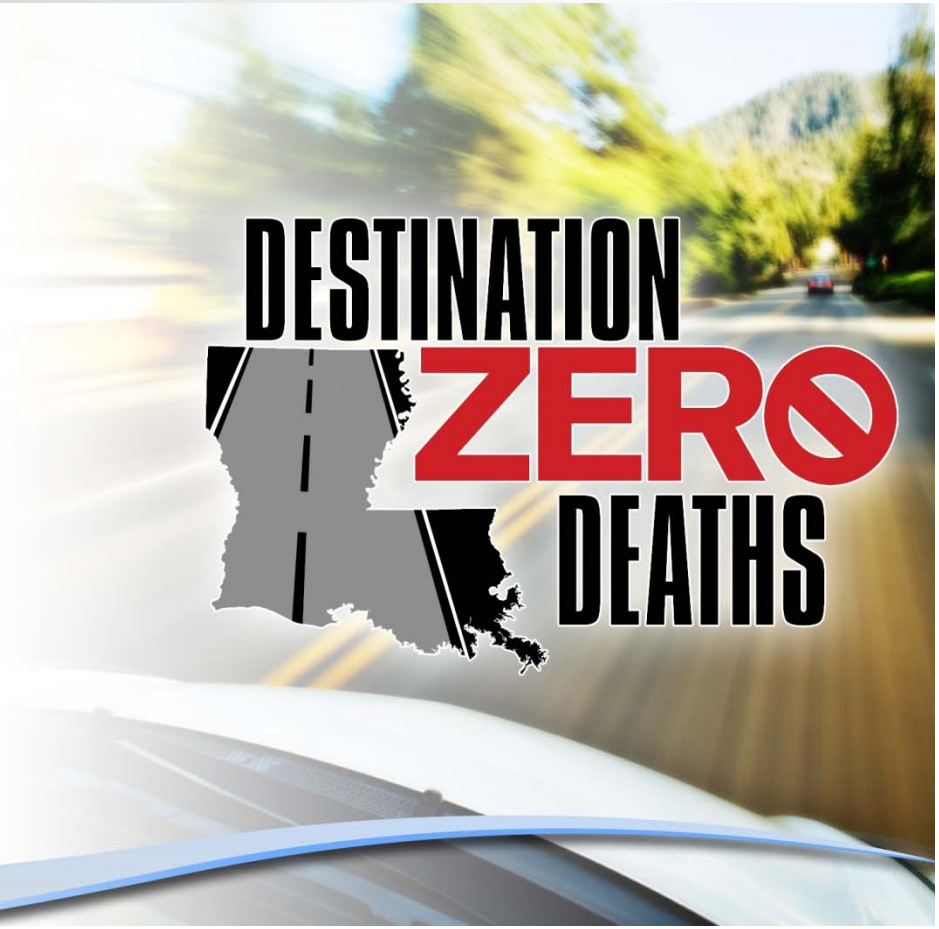
Traffic Engineer's Meeting

Cable Median Barrier Study



June 25, 2015

Introduction and Background

- **Cross-median crashes (CMC) → Fatal and Severe Inj.**

  Speed + Energy → Dangerous

- 8 Fatalities **- Bus vs. SUV+Tractor-Trailer**

Introduction and Background

- **Cable median barriers (CMB)**

Pros:

» **Reduce severity and potential for CMC**

» **More forgiving than concrete and guardrail**

» **Most cost-effective**

Cons:

» **Over rides and under rides**

» **Increased total crashes**

» **Maintenance**

Specifications

- **NS Concrete Strip (03/13)**
  - » Reinforced Concrete
  - » 5” thick
  - » 3” wide

- **NS Cable Barrier System (03/13)**
  - » High tension
  - » 4-cable pre-stretched
  - » 16’ max post spacing

Maintenance

- Independently done by the Districts
- DOTD Personnel and Contracts
- Slightly over half involve a crash report (Nationwide)
- +$380,000 from January-July, 2014 (DOTDP+C)

Objectives of the Cable Barrier Study

- Determine the need and potential for CMB in LA
- Identify candidate locations
- Prioritize for funding

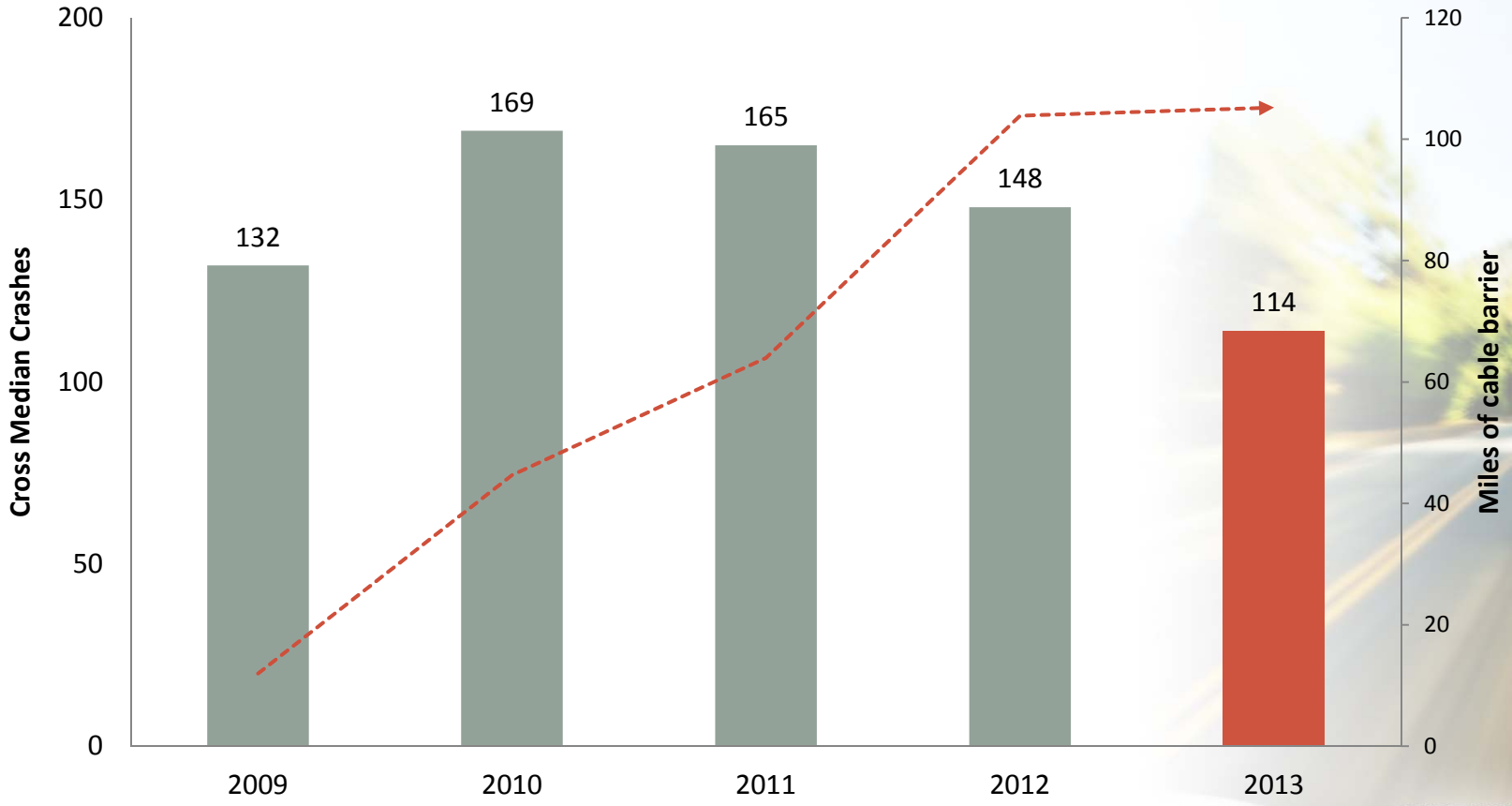
Completion of CMB

- **As of August, 2014:**
  - » **6 accepted projects → 105 miles**
  - » **4 let projects → 156 miles**
  - » **8 scheduled projects →247 miles**
  - » **Total = 508 miles**

Cable Median Barrier Projects

Project	District	Parish	Letting Date	Notice to Proceed	Acceptance date	Route Number	Control Section	Log-mile From	Log-mile to	Segment Length
H.003052	61	St. James	5/28/2008	8/28/2008	3/3/2009	I-10	450-12	0.00	6.84	6.84
							450-13	0.00	5.15	5.15
H.003448	62	St. Tammany	5/28/2008	8/18/2008	12/2/2009	I-12	454-04	0.00	32.68	32.68
H.003059	62	Tangipahoa	8/25/2010	9/28/2010	10/18/2011	I-12	454-03	0.00	18.79	18.79
						I-10	450-13	0.00	0.53	0.53
H.009013	61	E. Baton Rouge	6/15/2011	9/1/2011	12/17/2012	I-10	450-10	12.05	13.50	1.45
	61	Ascension				I-10	450-11	0.00	21.84	21.84
	62	St. John Baptist				I-10	450-13	0.53	12.78	12.25
	2	Jefferson				I-10	450-15	0.00	4.35	4.35
H.010071	2	Orleans	8/16/2012	12/5/2012	5/22/2013	I-610	450-34	0.51	0.78	0.27
						I-10	450-90	10.27	10.71	0.44
H.010272	8	Vernon	6/12/2013	8/15/2013	3/3/2014	LA 8	373-01	6.73	7.36	0.63
H.010675	4	Bossier	7/10/2013	9/17/2013	NA	I-20	451-02	0.00	18.56	18.56
		Webster				I-20	451-03	0.00	16.17	16.17
H.010684	4	Bienville	9/25/2013	2/01/2014	NA	I-20	451-04	0.00	17.39	17.39
		Caddo				I-20	451-01	0.00	19.44	19.44
H.010685	5	Madison	10/23/2013	2/03/21014	NA	I-20	451-08	0.00	32.88	32.88
		Richland				I-20	451-07	0.00	27.31	27.31
H.010712	2	Orleans	2/12/2014	6/20/2014	NA	I-10	450-90	0.00	24.26	24.26
H.010911	5	Lincoln	9/10/2014	NA	NA	I-20	451-05	0.00	27.33	27.33
		Ouachita		NA	NA	I-20	451-05	0.00	28.57	28.57
H.010680	61	Iberville	3/11/2015	NA	NA	I-10	450-07	0.00	14.80	14.80
		W. baton Rouge		NA	NA	I-10	450-07	0.00	12.65	12.65
H.010683	62	Tangipahoa	5/13/2015	NA	NA	I-55	452-90	13.85	51.37	37.52
H.010865	7	Calcasieu	6/10/2015	NA	NA	I-210	450-30	0.00	12.68	12.68
H.010962	3	Acadia	8/12/2015	NA	NA	I-10	450-04	0.00	27.14	27.14
		Lafayette		NA	NA		450-05	0.00	13.98	13.98
H.010864	7	Calcasieu	5/11/2016	NA	NA	I-10	450-91	9.60	27.50	17.90
		Jefferson Davis		NA	NA	I-10	450-03	0.00	22.36	22.36
H.011308	62	St. Tammany	6/8/2016	NA	NA	I-10	450-18	0.00	7.00	7.00
H.011278	62	Livingston	SFY 17-18	NA	NA	I-12	454-02	0.00	25.78	25.78

Cross Median Crashes



** CMCs on High-speed, controlled-access, rural, divided highway segments.

Study Size, Candidate Locations

Route	District	Length
I-10	3	37.2
I-10	7	39.4
I-10	61	32.9
I-10	62	12.7
I-12	62	18.2
I-20	5	53.4
I-210	7	10.6
I-220	4	14.4
I-310	2	7.3
I-49	3	42.2
I-49	4	40.7
I-49	8	92.2
I-55	62	37.5
I-59	62	12.0
LA 3132	4	10.2
US 167	8	9.7
US 190	62	2.2
US 90	2	33.8
US 90	3	3.9
US 90	61	3.2
	Total =	513.6

Route	Length
I-10	122.2
I-12	18.2
I-20	53.4
I-210	10.6
I-220	14.4
I-310	7.3
I-49	175.1
I-55	37.5
I-59	12.0
LA 3132	10.2
US 167	9.7
US 90	40.9
US 190	2.2
Total =	513.6

District	Length
2	41.1
3	83.3
4	65.3
5	53.4
7	50.0
8	101.9
61	36.1
62	82.5
Total =	513.6

** High-speed, controlled-access, rural, divided highway segments with no barriers, tree lines, etc.

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Implementation Approach
Crash Modification Factors

- **From 6 projects (105 miles)**
- **All crashes (not only CMCs) by severity**
- **Before → 3 yrs before start of construction**
- **After → 3 yrs after completion or max available**
- **AADT and length (weighted mean)**

** **Overlays, striping, pavement markings, and patching**

Implementation Approach
Crash Modification Factors

Countermeasure: Install cable median barrier (high tension)

CMF	SE	CRF (%)	Crash Type	Crash Severity	Roadway Type	Area Type
1.10	0.05	-10.46	All	All	Principal Arterial Interstate	Rural
0.71	0.14	29.33	All	Fatal	Principal Arterial Interstate	Rural
0.80	0.14	19.58	All	Serious	Principal Arterial Interstate	Rural
0.82	0.10	18.01	All	Moderate	Principal Arterial Interstate	Rural
0.95	0.05	5.12	All	Complaint	Principal Arterial Interstate	Rural
1.19	0.05	-19.44	All	PDO	Principal Arterial Interstate	Rural

Implementation Approach
Estimated Benefits

Crash data from 2009 - 2013

Est. Crash Reduction = *Crashes/yr - (Crashes/yr * CMF)*

Total Annual Monetary Value = $\sum_i (Estim.\,Crash\ Reduction_i * Avg.\,Cost_i)$

Where i:

Crash Type	Average Cost
Fatal	$1,270,370.00
Severe	$938,791.00
Moderate	$164,396.00
Complaint	$8,141.00
PDO	$3,292.00

Present Value of the benefits ($PV_{benefits}$)

- » Service life of 10 yrs
- » Rate of return of 4%

Implementation Approach
Estimated Costs

- **Construction costs + Maintenance Costs**

Construction Costs

» 10 let projects (261 miles)

» $136,400/mile

Maintenance Costs

» 6 completed projects (105 miles)

» DOTD Personnel + Contracts

» AADT and Length

» $0.21/year/mile/AADT

$$PV_{cost} = (L * \$136{,}400.47) + (L * AADT * \$0.21) * (P/A, 4\%, 10yrs)$$

Benefit-Cost

- **Benefit-Cost Ratio (BCR)**
  - » Economically Justified
  - » BCR > 1

$$\textit{BCR} = \frac{PV_{benefit}}{PV_{cost}}$$

- **Incremental Benefit-Cost Ratio (IBCR)**
  - » Ordered List
  - » Best economic investment
  - » Opportunity cost

Cost	5	20
Benefit	10	30
B/C	2	1.5

$$\textit{Incremental BCR} = \frac{(PV_{benefit\,2} - PV_{benefit\,1})}{(PV_{cost\,2} - PV_{cost\,1})}$$

IBCR Ranking

IBCR Rank	Scheduled Rank	Route	District	Length (miles)	$PV_{benefits}$	PV_{costs}	BCR	Fatal Crashes per year	Severe Crashes per year	Moderate Crashes per year	Complaint Crashes per year	PDO Crashes per year	Total Crashes per year
1	2	I-10	61	32.9	$ 33,995,145	$ 7,917,684	4.29	7.4	3.6	32.6	135.2	389.6	568.4
2	NA	I-49	3	42.2	$ 29,698,685	$ 8,029,132	3.70	5.2	4.4	36.2	118.8	322.2	486.8
3	5	I-10	3	37.2	$ 27,855,617	$ 8,066,463	3.45	4.4	5.8	29.2	94.0	273.6	407.0
4	1	I-20	5	53.4	$ 27,167,032	$ 10,655,234	2.55	5.0	4.0	32.0	112.6	380.2	533.8
5	3	I-55	62	37.5	$ 22,734,723	$ 6,722,227	3.38	6.2	1.4	11.8	77.0	228.0	324.4
6	6	I-10	7	39.4	$ 23,629,747	$ 8,514,787	2.78	4.4	4.0	23.4	100.6	306.6	439.0
7	NA	I-220	4	14.4	$ 14,576,367	$ 2,756,778	5.29	1.6	3.8	19.6	52.8	156.2	234.0
8	4	I-210	7	10.6	$ 12,467,661	$ 2,191,455	5.69	2.2	2.2	14.4	67.0	220.8	306.6
9	8	I-12	62	18.2	$ 11,336,711	$ 3,694,482	3.07	1.4	2.4	16.8	38.4	122.8	181.8
10	7	I-10	62	7.3	$ 8,815,418	$ 1,833,128	4.81	2.6	0.4	5.4	35.4	203.2	247.0
11	NA	LA 3132	4	10.2	$ 8,947,416	$ 2,165,895	4.13	0.8	3.0	11.0	40.0	138.8	193.6
12	NA	I-59	62	12.0	$ 6,917,123	$ 2,357,242	2.93	1.4	0.8	7.2	19.0	57.8	86.2
13	NA	I-49	4	40.7	$ 11,069,693	$ 6,948,578	1.59	2.0	2.2	9.4	31.2	119.0	163.8
14	NA	US 167	8	9.7	$ 4,716,607	$ 1,759,509	2.68	0.6	0.8	8.4	26.2	76.2	112.2
15	NA	I-310	2	7.3	$ 3,773,853	$ 1,539,786	2.45	1.0	0.2	3.0	18.4	63.4	86.0
16	NA	US 190	62	2.2	$ 1,426,407	$ 496,855	2.87	0.4	0.2	0.6	10.0	49.8	61.0
17	NA	I-10	62	5.3	$ 1,415,381	$ 1,104,039	1.28	0.4	0.0	1.6	11.0	41.4	54.4
18	NA	US 90	3	3.9	$ 817,168	$ 697,825	1.17	0.0	0.2	2.4	4.8	14.2	21.6
19	NA	US 90	61	3.2	$ 622,989	$ 572,145	1.09	0.2	0.0	0.2	4.8	8.8	14.0
20	NA	I-49	8	92.2	$ 12,778,144	$ 14,824,840	0.86	2.4	1.2	18.0	64.6	155.2	241.4
21	NA	US 90	2	33.8	$ 3,032,657	$ 5,920,730	0.51	0.6	0.2	6.0	53.8	135.2	195.8
			Total =	**513.6**	**$ 267,794,545**	**$ 98,768,814**	**2.71**	**50.2**	**40.8**	**289.2**	**1115.6**	**3463.0**	**4958.8**

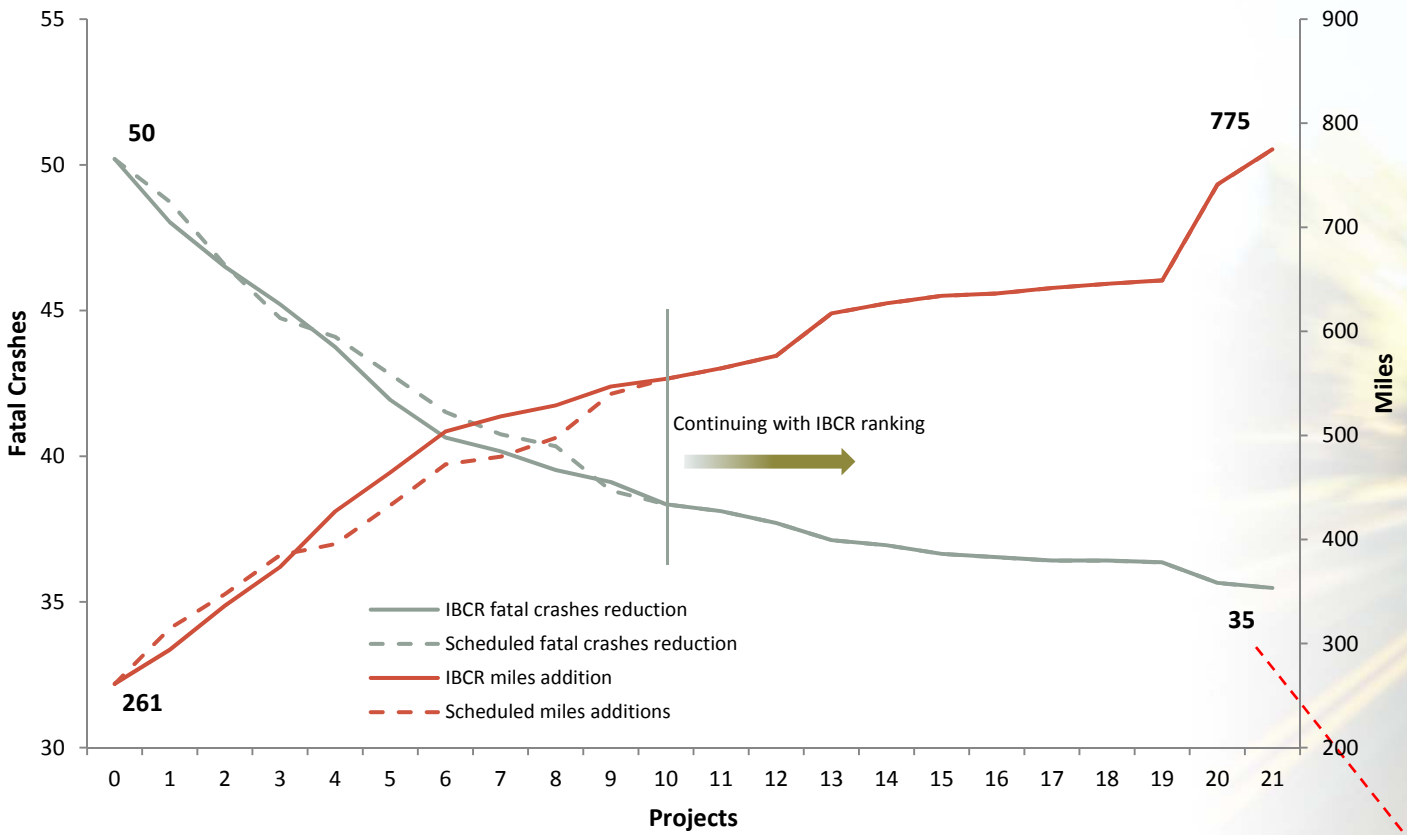
DESTINATION ZERO DEATHS

Proposed Ranking for Future Projects

IBCR Rank	Route	District	Length (miles)	$PV_{benefits}$	PV_{costs}	BCR	Fatal Crashes per year	Severe Crashes per year	Moderate Crashes per year	Complaint Crashes per year	PDO Crashes per year	Total Crashes per year
1	I-49	3	42.2	$ 29,698,685	$ 8,029,132	3.70	5.2	4.4	36.2	118.8	322.2	486.8
2	I-220	4	14.4	$ 14,576,367	$ 2,756,778	5.29	1.6	3.8	19.6	52.8	156.2	234.0
3	LA 3132	4	10.2	$ 8,947,416	$ 2,165,895	4.13	0.8	3.0	11.0	40.0	138.8	193.6
4	I-59	62	12.0	$ 6,917,123	$ 2,357,242	2.93	1.4	0.8	7.2	19.0	57.8	86.2
5	I-49	4	40.7	$ 11,069,693	$ 6,948,578	1.59	2.0	2.2	9.4	31.2	119.0	163.8
6	US 167	8	9.7	$ 4,716,607	$ 1,759,509	2.68	0.6	0.8	8.4	26.2	76.2	112.2
7	I-310	2	7.3	$ 3,773,853	$ 1,539,786	2.45	1.0	0.2	3.0	18.4	63.4	86.0
8	US 190	62	2.2	$ 1,426,407	$ 496,855	2.87	0.4	0.2	0.6	10.0	49.8	61.0
9	I-10	62	5.3	$ 1,415,381	$ 1,104,039	1.28	0.4	0.0	1.6	11.0	41.4	54.4
10	US 90	3	3.9	$ 817,168	$ 697,825	1.17	0.0	0.2	2.4	4.8	14.2	21.6
11	US 90	61	3.2	$ 622,989	$ 572,145	1.09	0.2	0.0	0.2	4.8	8.8	14.0
12	I-49	8	92.2	$ 12,778,144	$ 14,824,840	0.86	2.4	1.2	18.0	64.6	155.2	241.4
13	US 90	2	33.8	$ 3,032,657	$ 5,920,730	0.51	0.6	0.2	6.0	53.8	135.2	195.8
		Total =	**277.1**	**$ 99,792,491**	**$ 49,173,354**	**2.03**	**16.6**	**17.0**	**123.6**	**455.4**	**1338.2**	**1950.8**

Construction Costs ~ $38k

Scheduled Vs. Proposed (IBCR)



Questions?

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Highway Safety

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LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

DESTINATION ZERO DEATHS