DIAMOND GRINDING

AN OVER VIEW OF PAVEMENT PERFORMANCE IN TEXAS

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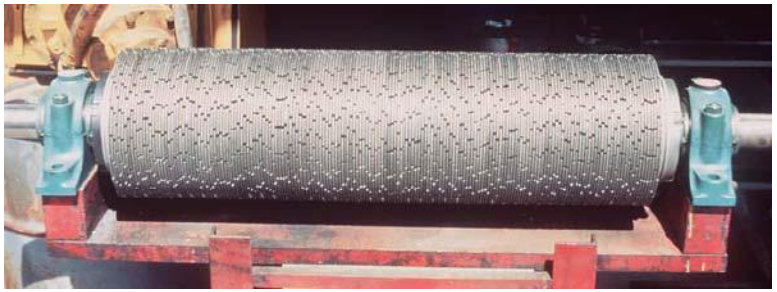
5/31/2013

Outline

- Introduction
- Individual Case Studies
  - IH35, US287, US69, and US96
- Pavement Performance Statistical Analysis
  - Ride quality
  - Skid
- Summary

Diamond Grinding

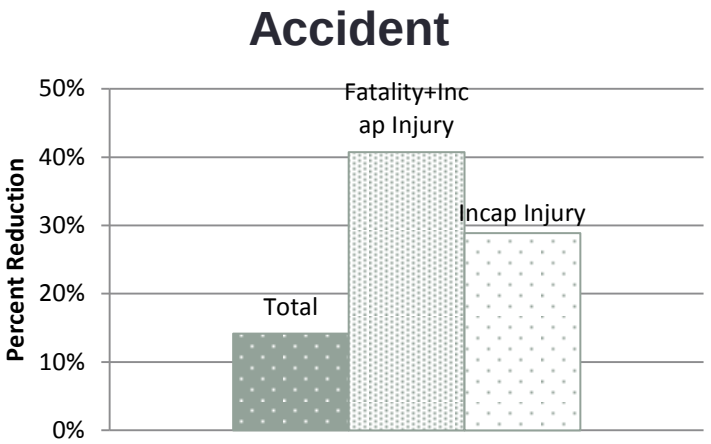
- DG is concrete pavement restoration technique
- DG works by removing a very thin layer off the top of a pavement
- DG was used to improve pavement functionality such as smoothness and skid resistance, etc.
- DG has been used in pavement field for over half a century in the U.S.
- 750,000+ square yard areas were diamond ground on Texas highways in 2012

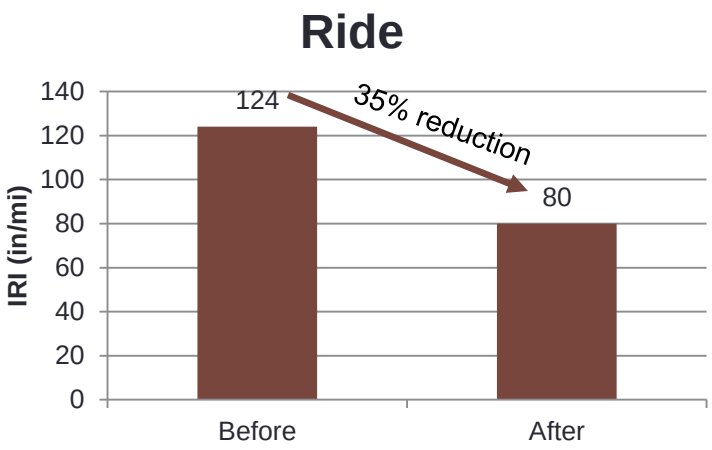


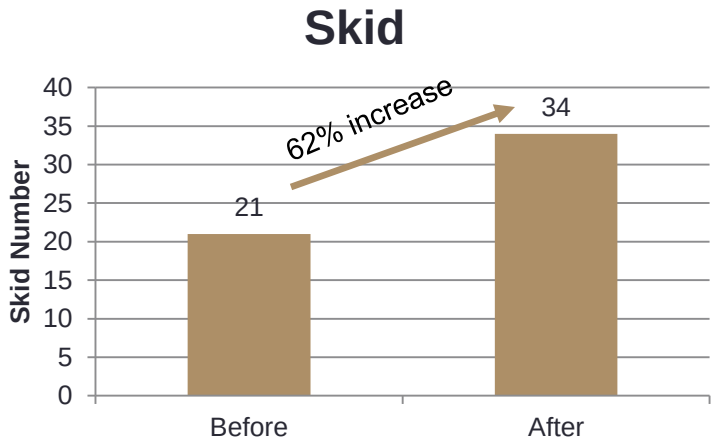
Case Study 1 @ IH35

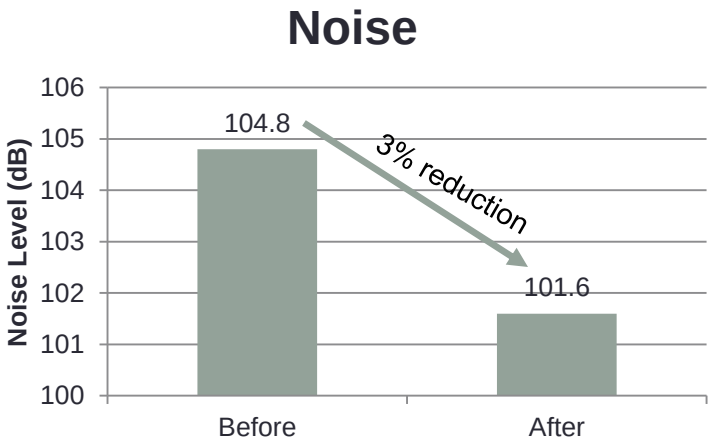
- Location
  - Fort Worth district, IH35 W
- Pavement type
  - CRCP
- Treatment
  - DG in 2011 & 2012
  - Purpose: Improve skid resistance
- Performance index
  - Crash accident (source: crash report information system, CRIS)
  - Skid (source: project 5-9046)
  - Noise (source: project 5-9046)
  - Ride quality (source: project 5-9046)

Case Study 1 @ IH35: Results





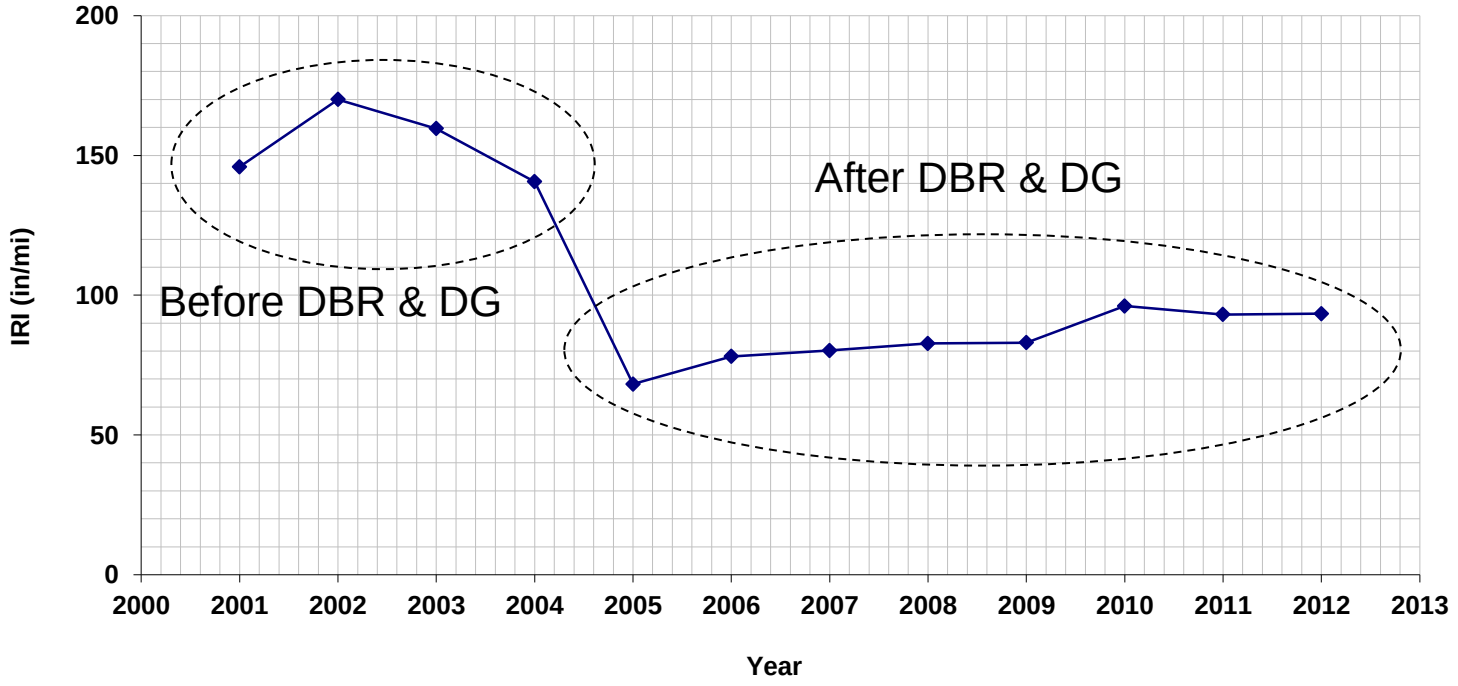




Case Study 2 @ US287

- Location
  - Childress district, US287
- Pavement type
  - JCP (13” JCP over 9” lime treated subgrade)
- Treatment
  - DG & Dowel Bar Retrofit (DBR) in 2004
  - Purpose: fix faulting at joint
- Performance index
  - Ride quality (source: pavement management information system, PMIS)

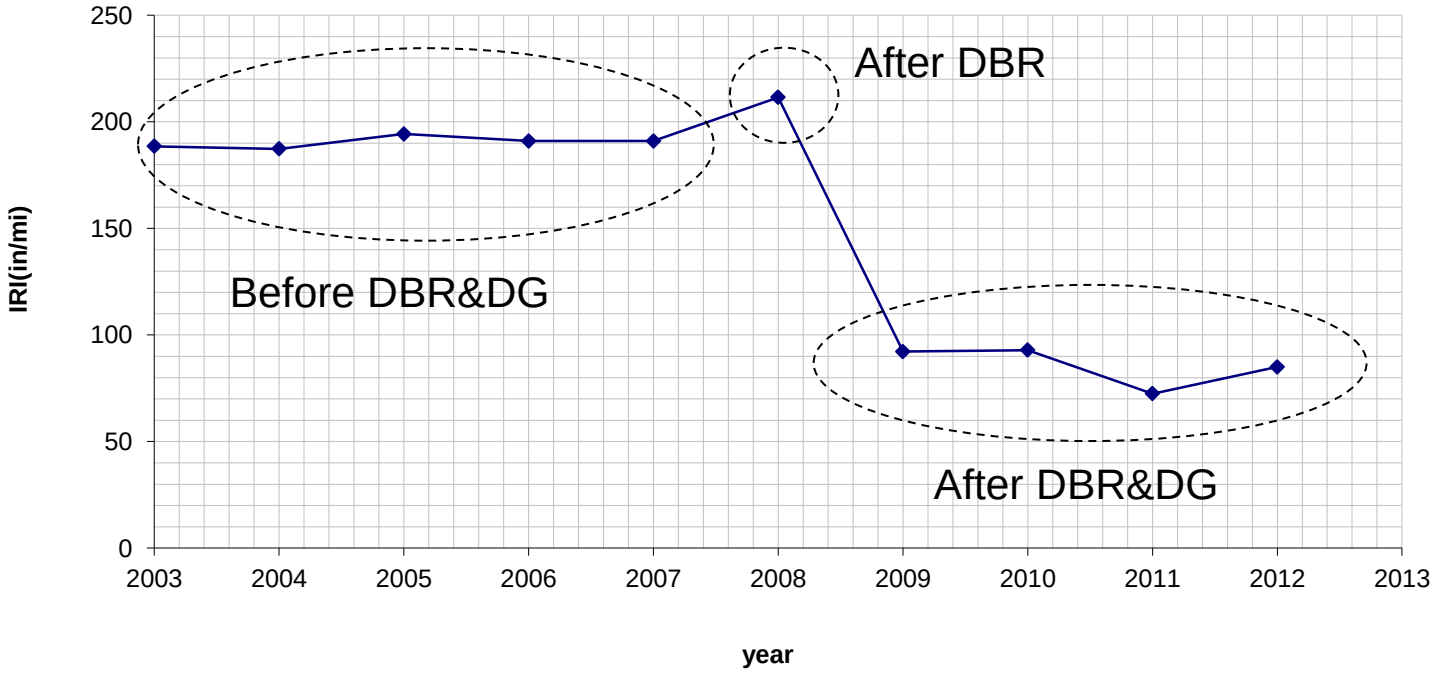
Case Study 2 @ US287: Results



Case Study 3 @ US69

- Location
  - Beaumont district, US69
- Pavement type
  - JCP (12” JCP on 6” stablized base)
- Treatment
  - DG & Dowel Bar Retrofit (DBR) in 2001
  - Purpose: fix faulting at joint
- Performance index
  - Ride quality (source: PMIS)

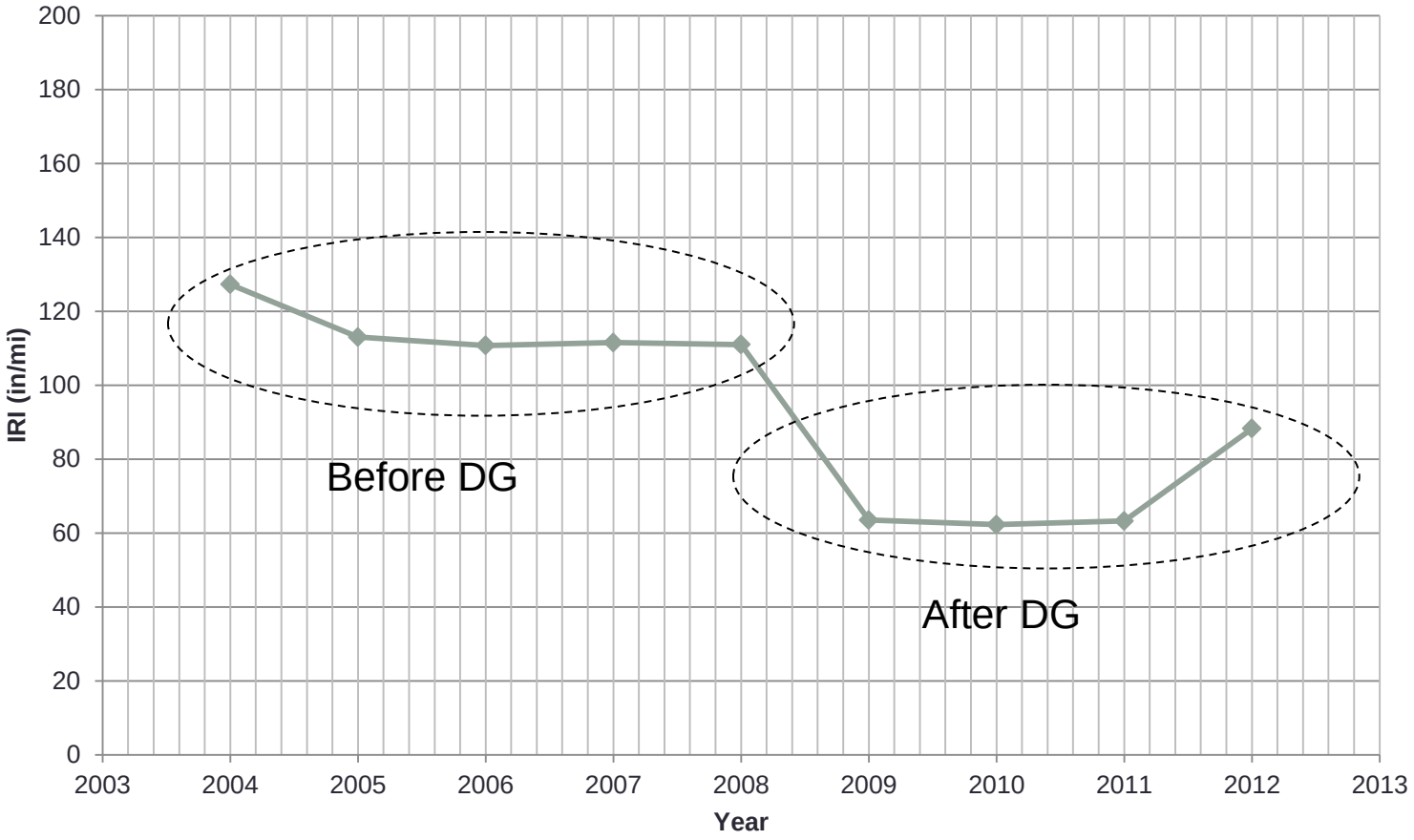
Case Study 3 @ US69: Results



Case Study 4 @ US96

- Location
  - Beaumont district, US96
- Pavement type
  - JCP (11” JCP on 1” AC bond breaker on 6” cement-treated base)
- Treatment
  - DG in 2008
  - Purpose: improve ride
- Performance index
  - Ride quality (source: PMIS)

Case Study 4 @ US96: Results



Performance Trend Analysis: Data Summary

			Traffic			Year DG	Change in IRI (in./mi.)[1]	Change in Skid
#	Highway	DBR	MESAL	ADT	Truck%			
1	US69L	Yes	14.47	22,000	13.7	2008	-62.9	0.8
2	US69R	Yes	14.47	22,000	13.7	2008	-122.8	1.8
3	US287	Yes	24.40	14,000	26.8	2004	-72.4	2
4	US59	Yes	24.69	17,000	23.1	2005	-43.7	0.5
5	US96L	No	15.61	25,000	13	2008	-72.3	-
6	US96R	No	15.61	25,000	13	2008	-47.5	-
7	US82EB	Yes	20.70	24,000	18.6	2010	-52.0	-
8	US82WB	Yes	20.70	24,000	18.6	2010	-55.4	-
9	US90	No	10.49	22,000	9.9	2008	-79.4	18.1
10	IH35 R	No	150.21	115,000	22.6	2009	-25.3	7.6
11	IH35 L	No	150.21	115,000	22.6	2009	-19.6	8.5
						Average	-59.4	5.6

1. 1 in./mi. = 1/63 m/km

Ride Analysis: Statistical Model

$$IRI = a_0 + a_1 Age + a_2 BeforeIRI + a_3 DBR + a_4 ADT + a_5 Site1 + a_6 Site2 + a_7 Site3 + \varepsilon$$

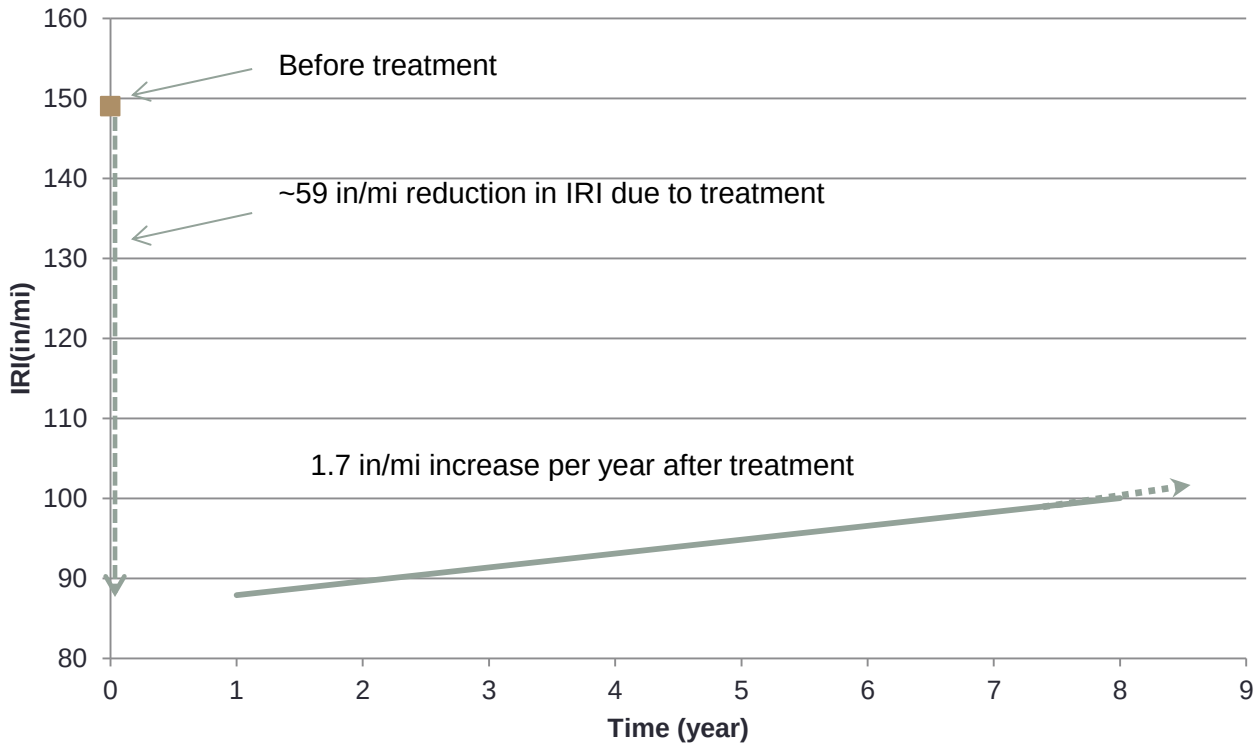
Where:

IRI : The ride quality after DG, in./mi.;
Age : Time after DG, years;
BeforeIRI : The ride quality before DG, in./mi.;
DBR : Dowel bar retrofit, dummy variable;
ADT : Average daily traffic, in 1,000 vehicles;
*Site*1 : Site specific factor representing site 1;
*Site*2 : Site specific factor representing site 2;
Site3 : Site specific factor representing site 3;
a_0, a_1 ,…: Parameters to be estimated; and
ε : Error term.

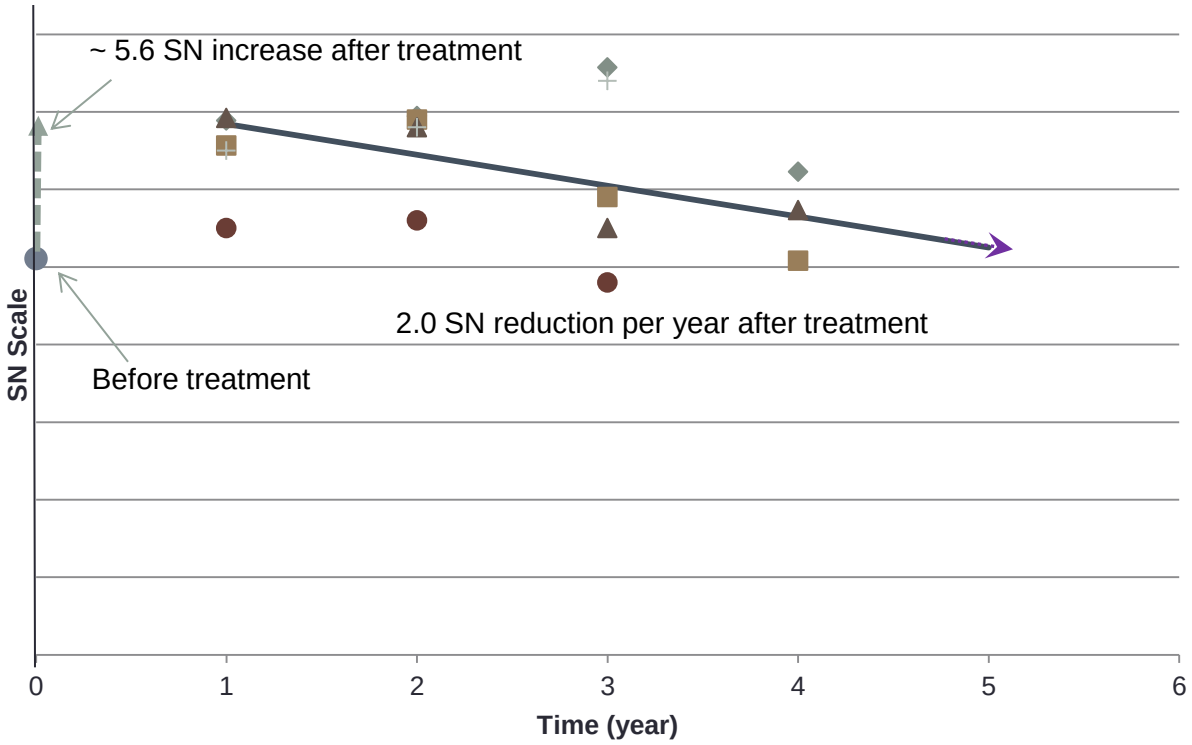
Ride Analysis: Model Estimation Results

Variable	Parameter	Mean	t-stat
Intercept	a_0	52.0	**5.7**
Age	a_1	1.7	**3.0**
Before IRI	a_2	0.1	**2.6**
DBR	a_3	4.7	1.1
ADT	a_7	1.7	**4.3**
Site1	a_4	2.1	0.5
Site2	a_5	42.1	**12.7**
Site3	a_6	-4.7	-1.2
R^2	0.92		

Ride Analysis: Change and Trend



Skid Analysis: Trend



Summary

- Based on field studies of a sample of concrete pavements across Texas, it is suggested that DG could be an effective measure to:
  - Improve ride quality
  - Improve skid resistance
  - Reduce noise

Acknowledge

- Dar Hao Chen, Magdy Mikhail, Juan Gonzalez, David Wagner, Hua Chen, John Wirth, Wade Blackmon, and Peter Jungen of the Texas Department of Transportation

Thank you
&
Be safe

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