

Increased Pavement Performance and Customer Satisfaction Using Diamond Grinding



THE ULTIMATE QUESTION!

- *How do I make limited budget dollars stretch and provide a highway system that offers a high level of service?*



1986-93 Rigid Pavement Design Equation

Change in Serviceability

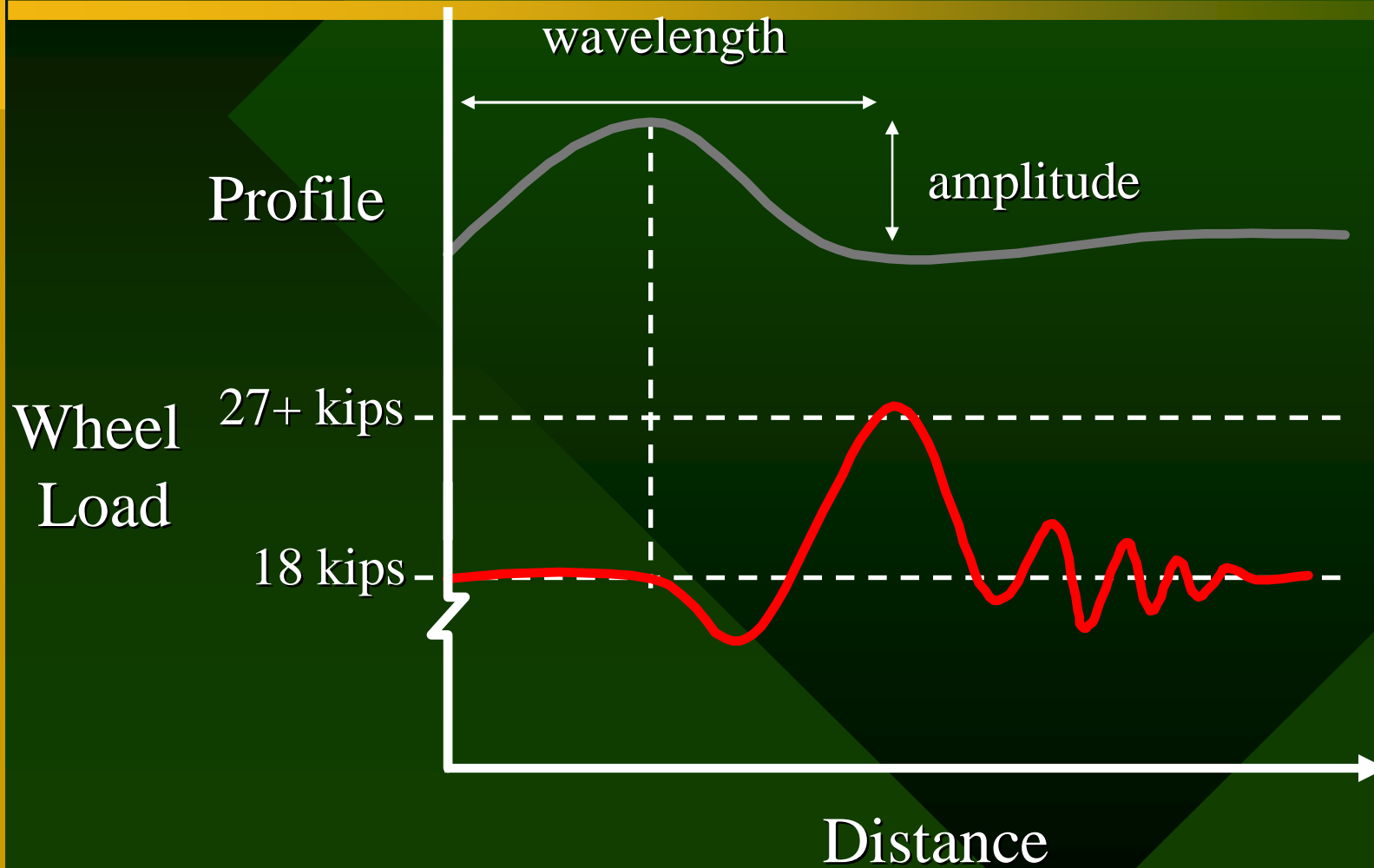
$$\begin{aligned}
 & \text{Standard Normal Deviate} \rightarrow Z_R * s_o + 7.35 * \text{Depth} \rightarrow \text{Log}(D+1) - 0.06 + \left[\frac{\text{Log} \left[\frac{\Delta \text{PSI}}{4.5 - 1.5} \right]}{1 + \frac{1.624 * 10^7}{(D+1)^{8.46}}} \right] \\
 & + (4.22 - 0.32p) * \text{Terminal Serviceability} \rightarrow \text{Log} \left[\frac{S'_c * C_d * [D^{0.75} - 1.132]}{215.63 * J * \left[D^{0.75} - \frac{18.42}{(E_c / k)^{0.25}} \right]} \right] \\
 & \quad \text{Modulus of Rupture} \rightarrow S'_c \quad \text{Drainage Coefficient} \rightarrow C_d \\
 & \quad \text{Load Transfer} \rightarrow J \quad \text{Modulus of Elasticity} \rightarrow E_c \quad \text{Modulus of Subgrade Reaction} \rightarrow k
 \end{aligned}$$



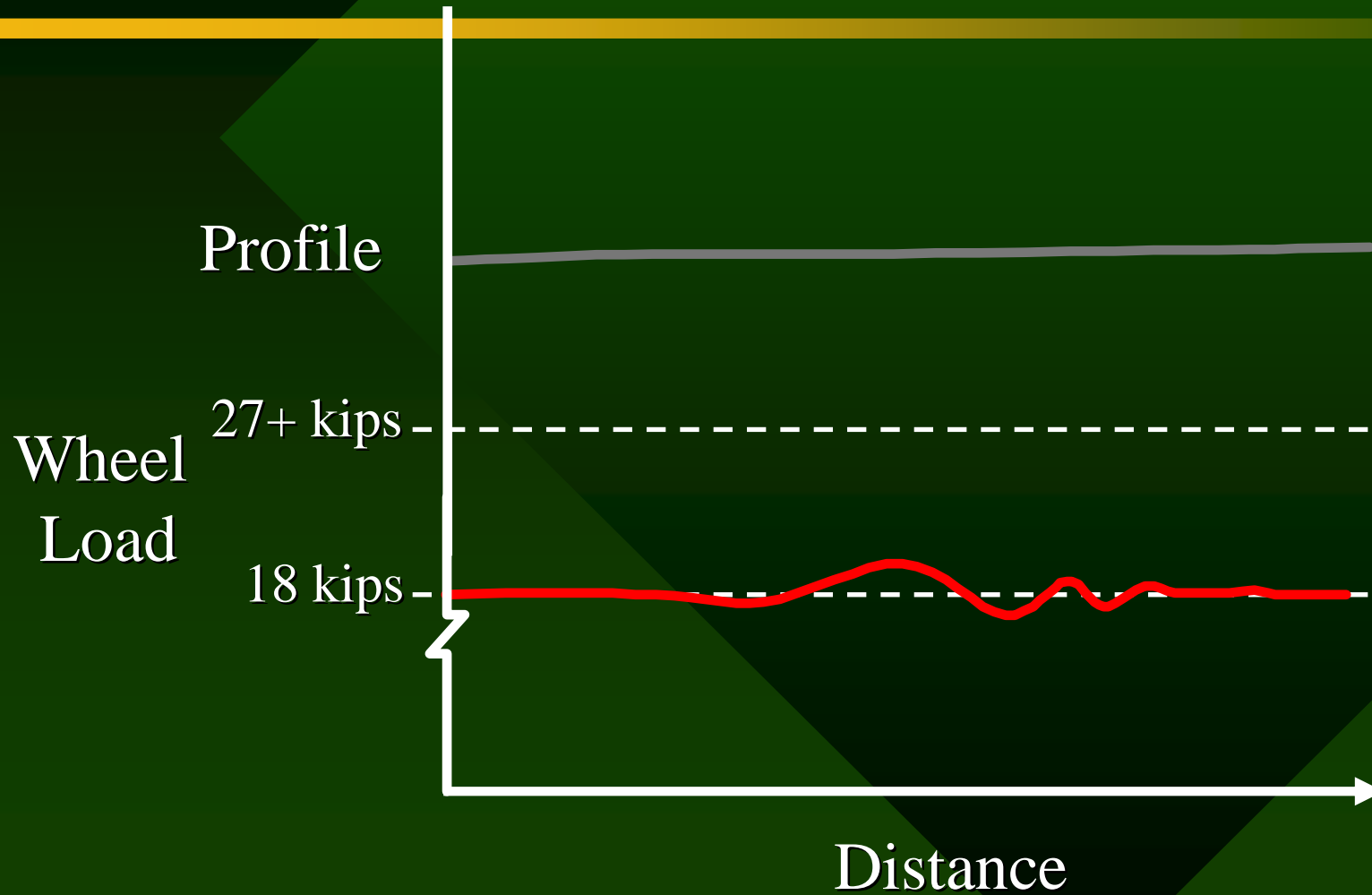
***SMOOTH PAVEMENTS
LAST LONGER!***

10/3/2006

Rough Pavement



Smooth Profile



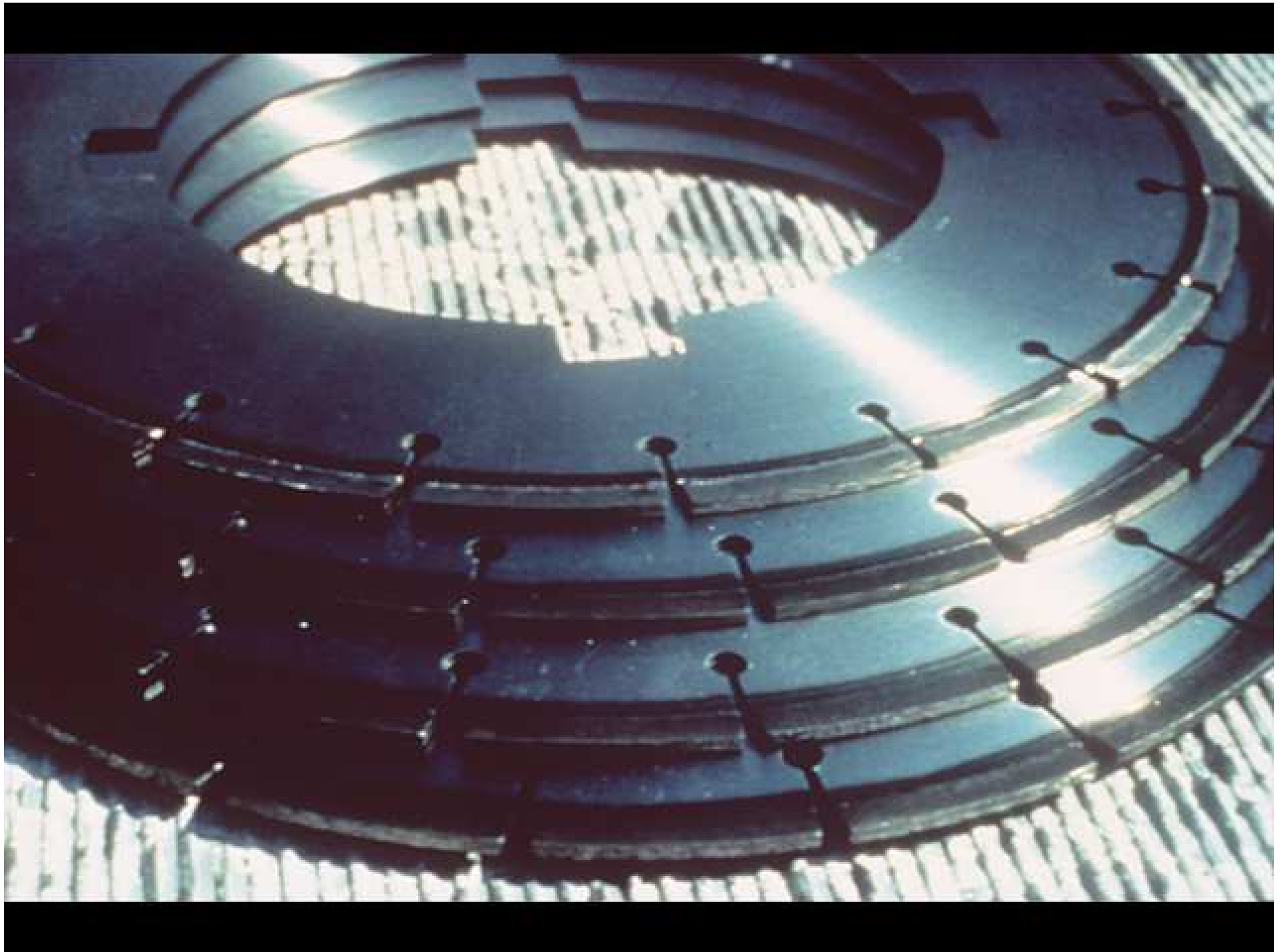
Diamond Grinding



Grinding

What is Diamond Grinding?

- Removal of thin surface layer of pavement using closely spaced diamond saw blades
- Results in smooth, level pavement surface
- Longitudinal texture with desirable friction and low noise characteristics
- **Comprehensive part of any Pavement Preservation program**



Diamond Grinding

Cutting Head



Grinding

Diamond Grinding Grinding Machine



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Diamond Grinding

Grinding Process



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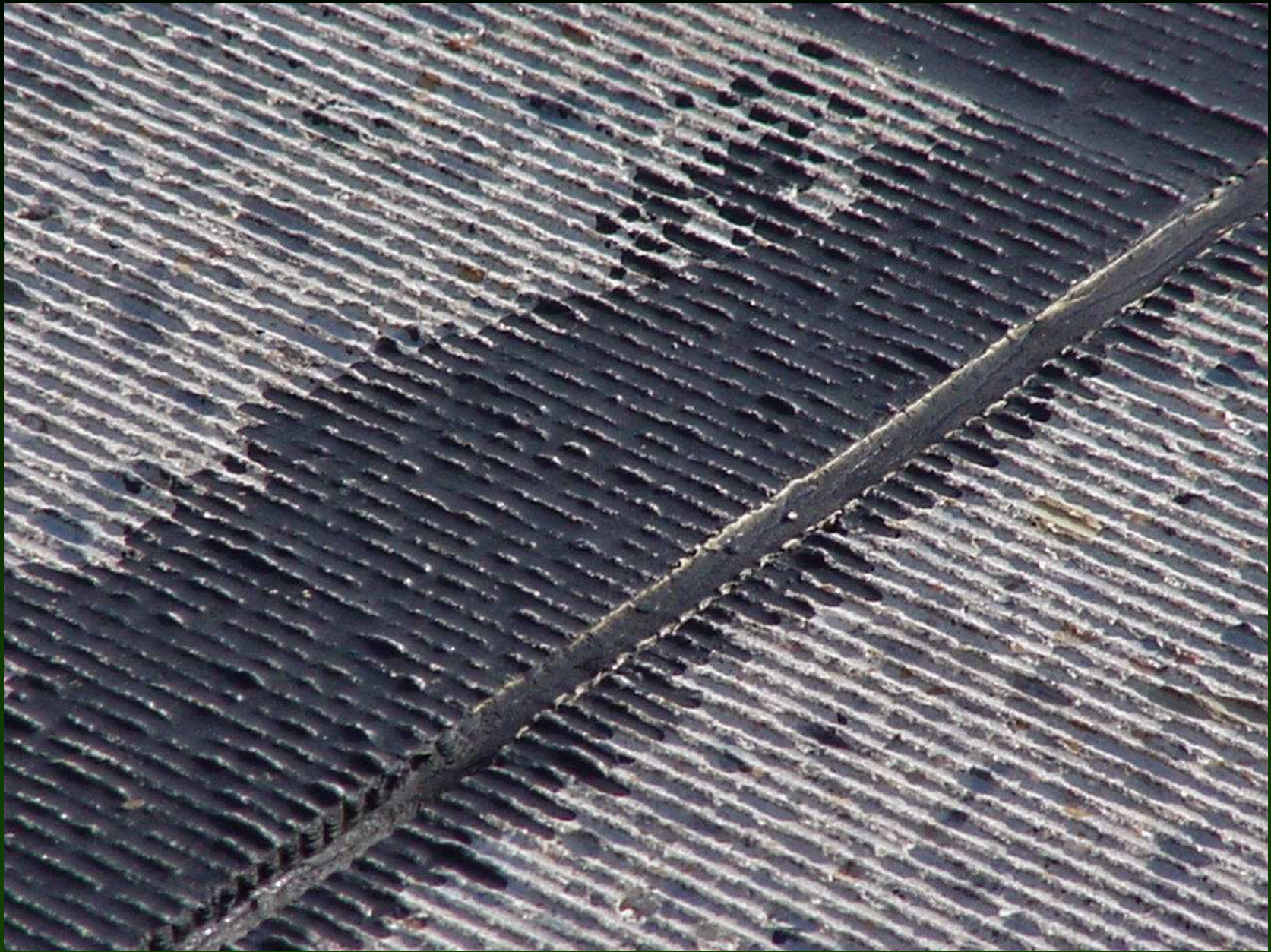
Diamond Grinding



Grinding

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Diamond Grinding Was Invented in California

- Diamond grinding was first used in California in 1965 on a 19-year old section of I-10 to eliminate significant faulting (Neal and Woodstrom 1976)
- In 1983, CPR was conducted on this same pavement section, including the use of additional grinding to restore the rideability and skid resistance of the surface. In 1997, the process was repeated and the pavement is still carrying over 225,000 vpd.
- Since its first use in 1965, CALTRANS has determined that the average life of a diamond ground pavement surface is 17 years and that a pavement can be ground at least three times without affecting pavement structurally. See IGGA.net for full report

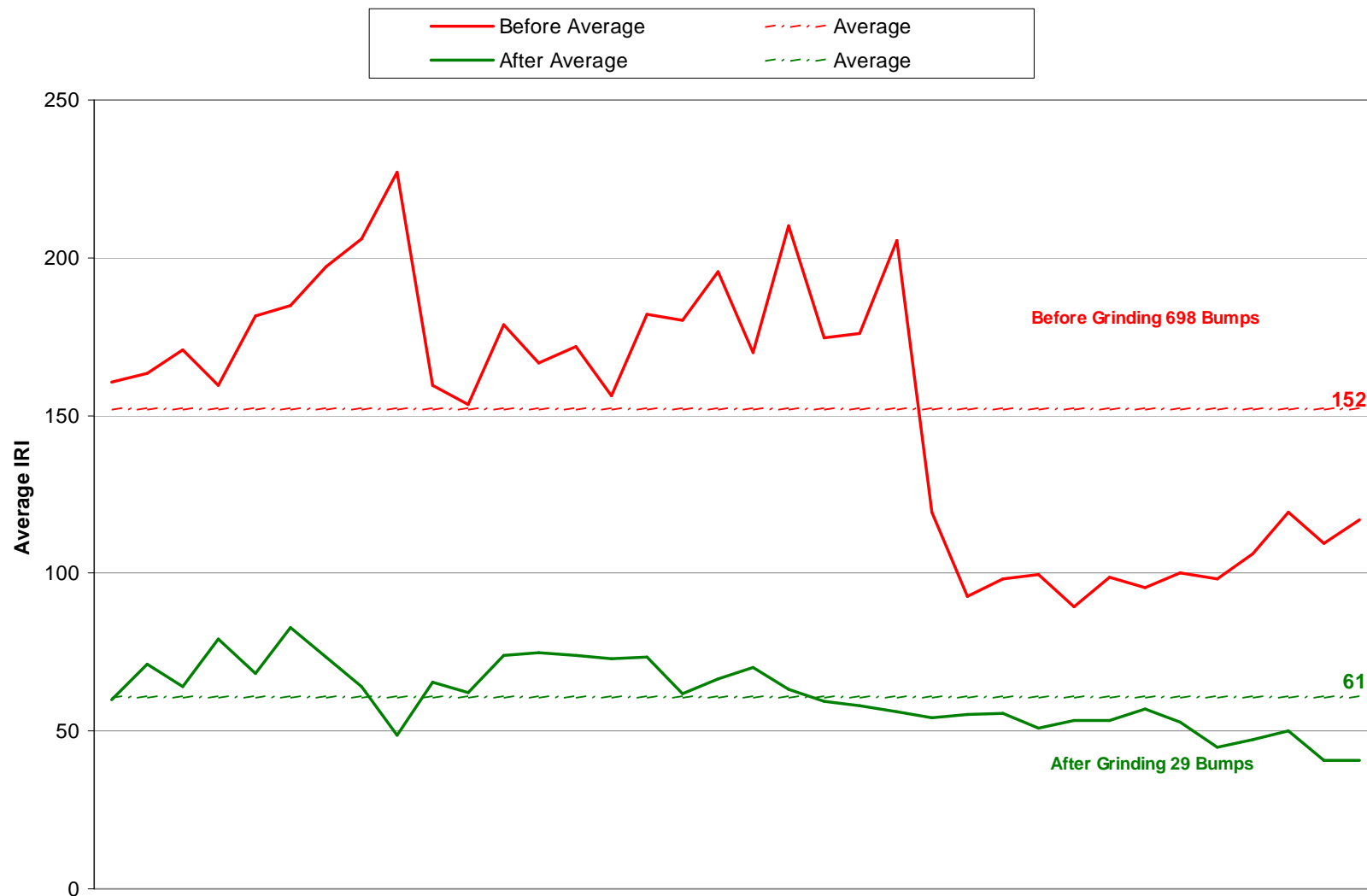
Advantages of Diamond Grinding

- Can be used on bridge decks, PCC and AC pavement
- Costs substantially less than AC overlays
- Enhances surface friction and safety
- Can be accomplished during off-peak hours with short lane closures and without encroaching into adjacent lanes
- Grinding of one lane does not require grinding of the adjacent lane
- Does not affect overhead clearances underneath bridges
- Blends patching and other surface irregularities into a consistent, identical surface
- **Provides a low noise pavement surface**

I-635 Dallas County Texas - 2004

- TXDOT Project Number C 2374-1-145
- Area Engineer - Pete Garza, P.E.
- Contract Amount - \$4,199,820
- Project length – 12 centerline miles
- Diamond Grinding – 492,968 sq yards
- Surface Texturing – 579,484 sq yards

I - 635 WB Lanes K1, K2 K3 & K4



I-635 Dallas County Texas - 2004

Summary

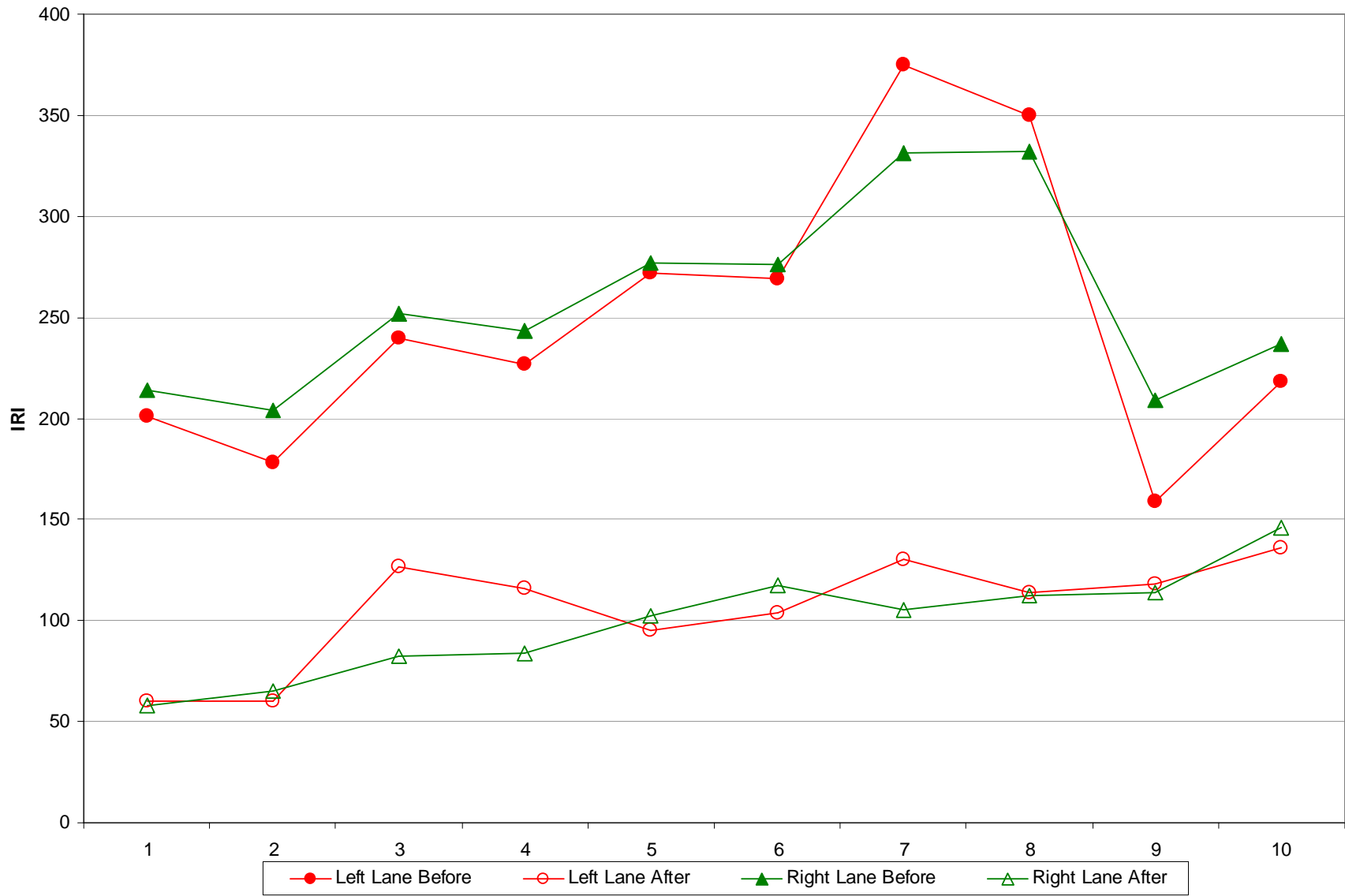
- Project DID NOT include ANY pavement patching
- Smoothness increased by 60% on average*
- Diamond grinding cost less than shot blasting
- Shot blasting may increase friction but does not improve smoothness and may increase noise

*Based on 3.54 miles of IRI data averaged for WB lanes

US 287 Childress County, TX

- TXDOT Project Number - C 43-1-68
- Contract Amount - \$814,036
- Original Project Required Micro milling – 6,000 sq yards
- Diamond Grinding - 70,905 sq yards
- Dowel Bar Retrofit - 5,915 bars

TEXDOT C43-1-68
US 287 - Quanah, TX

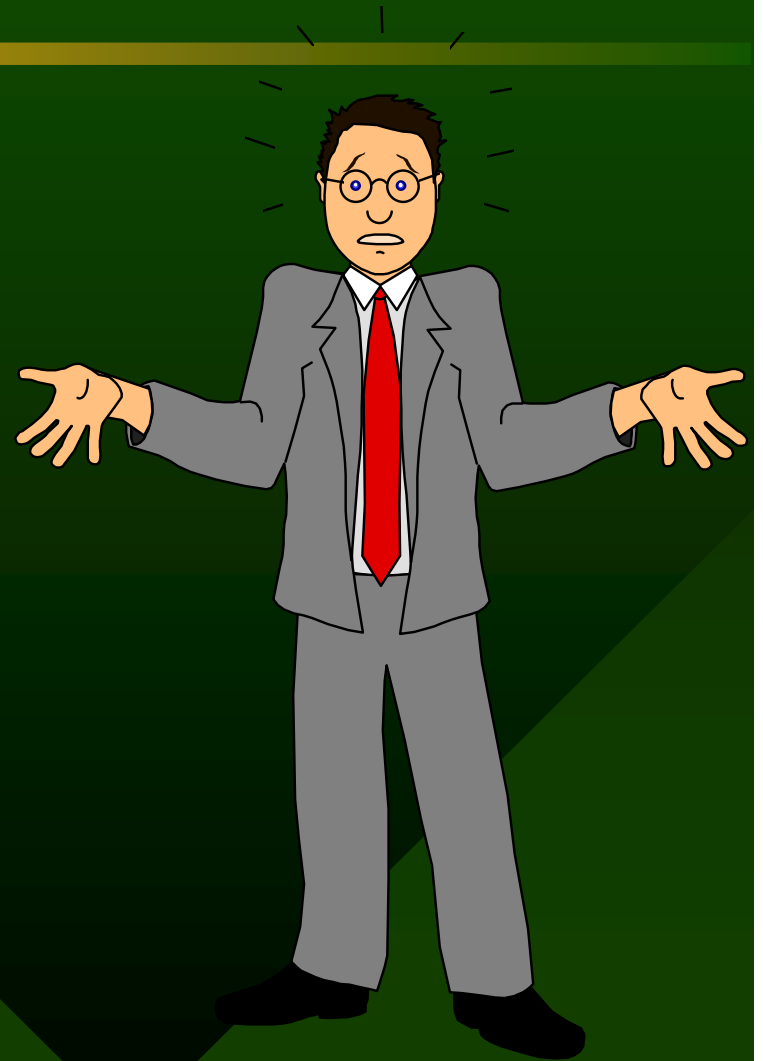


US 287 Childress County, TX

Summary

- Smoothness increased by 67% on average
- Friction?
- Noise?

So what is all
this noise
about diamond
grinding in
Arizona?!?



Want to learn more about noise?

- Visit IGGA.Net for more information in “whisper grinding”

SR 202 56st WB PCCP Grinding

Prepared by Larry Scofield
Preliminary Draft 6/6/03



Safety, Surface Texture and Friction

- Improvement in friction number and skid resistance due to increase in pavement macrotexture
- Longitudinal texture provides directional stability and reduces hydroplaning (side-force friction)
- In Wisconsin, overall accident rates for ground surfaces were 40% less than for un-ground surfaces over a 6-year period, 57% in wet weather conditions (Drakopoulos et al. 1998)

Eliminates Polished Surfaces



MODOT- Safer, Smoother, Sooner

- MODOT initiates Safer, Smoother, Sooner program in 2005 – To be completed December 2007
- The initiative invests \$400 million on 2,200 miles
- Improve customer satisfaction through
 - Safer pavements
 - Smoother ride quality
 - Quiet ride quality
- Approx 8,000,000 sq yds let in 1st Qtr 2005 alone
- See IGGA.Net for MoDOT's BMP on diamond grinding new PCCP

It's a Fact!

- **Diamond grinding can provide the safest, smoothest, most quiet PCC pavement texture available when properly designed and constructed with durable aggregates!**

FHWA Technical Advisory

- TA 5040.36 Surface Texture For Asphalt And Concrete Pavements
 - State Of Practice Surface Texture includes diamond ground surfaces for new pavements
 - Technique Recommended Application
 - Factors For Selecting Texture Techniques
- See [IGGA.Net](#) for a copy of TA 5040.36

Summary

- **Diamond grinding** can extend pavement life significantly at a competitive cost.
- Diamond grinding is a key **Preventive Maintenance** tool.
- Diamond grinding will increase customer satisfaction, increase friction, reduce noise and reduce life cycle costs.
- Performance and cost vary with given conditions.
- Timing is everything.
- **ACPA and IGGA are ready to assist!**

Visit Us on the Web

International Grooving and Grinding Association

- igga.net

American Concrete Pavement Association

- pavement.com

