

# **A Crack is a Crack – Mn/DOT's Perspective on Cracking in Asphalt Pavements**

*Presented at the Pavement Performance  
Prediction Symposium 2007  
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# Typical Distresses in Minnesota



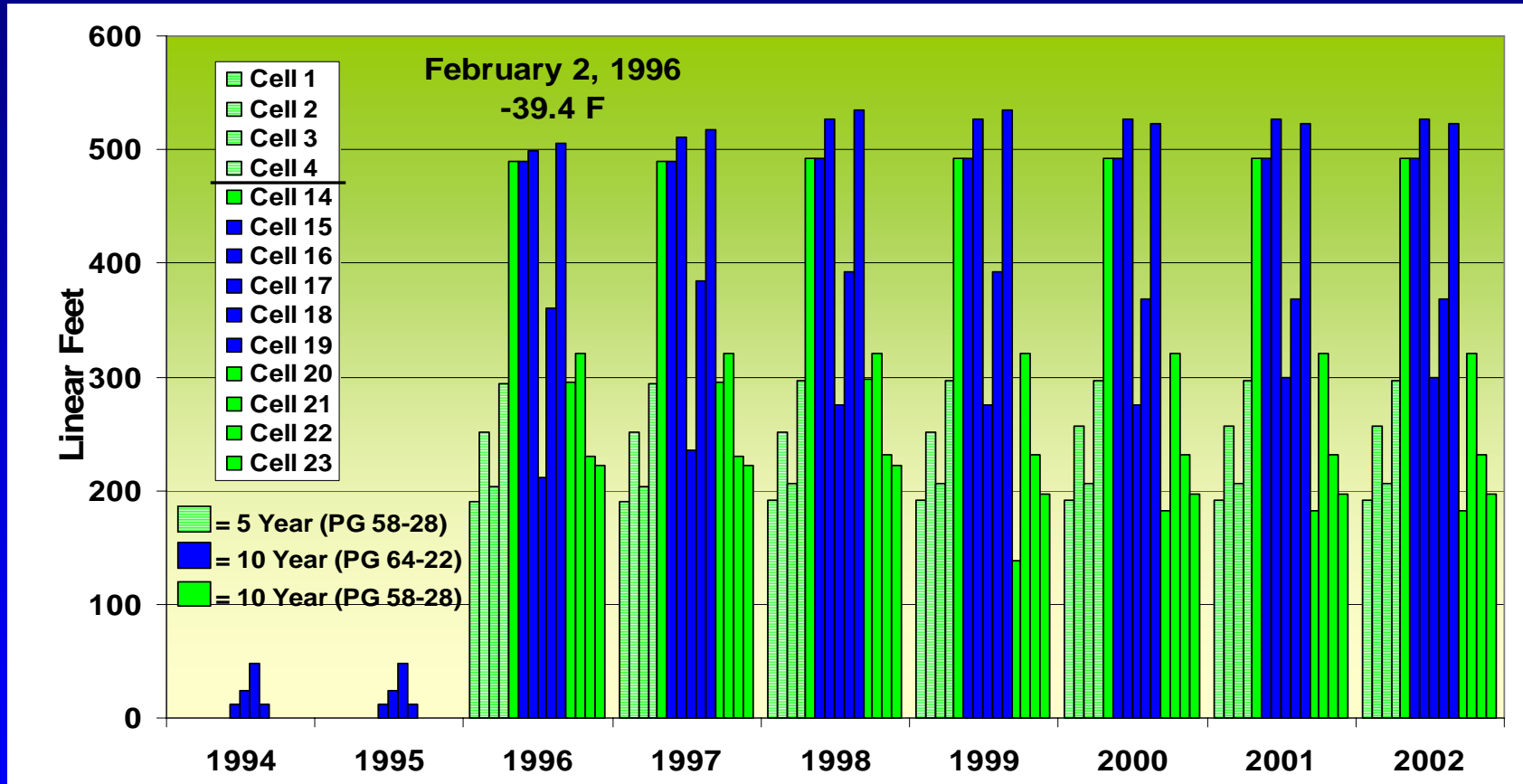
Transverse Cracking is Minnesota's #1 concern

# Low Temperature Cracking

- Single event
- Thermal fatigue
- Less severe event later in life (aging)

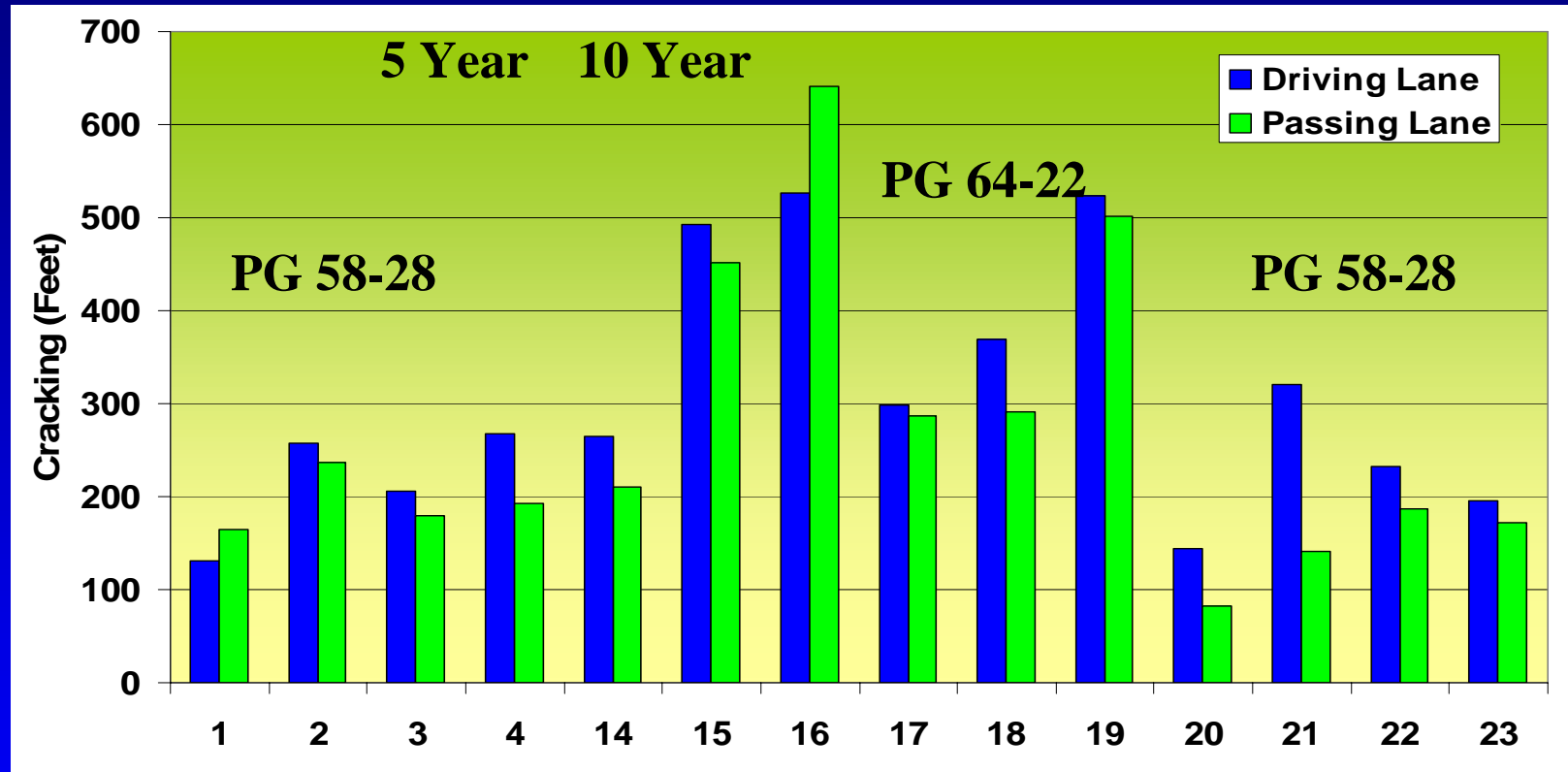


# MnROAD Mainline – When It Cracked



- Cracking occurred in a 4 month period after 2/2/1996
- Little increase since that time

# MnROAD Mainline – Where It Cracked

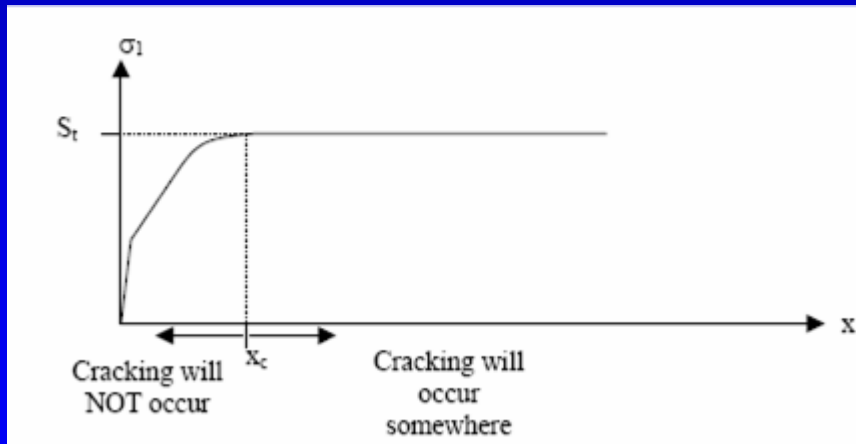


- Thickness had little effect on cracking
- Class 6 had more cracks than Class 3 base
- Driving lane had more thermal cracking than passing lane
  - Traffic effects

# Low Temperature Cracking 2-D Model

$$\sigma_x = \frac{aE(T_2 - T_1)}{2}$$

- Dave Timm et al, 2004
- Coefficient of thermal contraction, Stiffness, Temperature Gradient
- If Stress > Strength cracking will occur
- Advanced 3-D models in current pooled fund study



**PG 58-28**



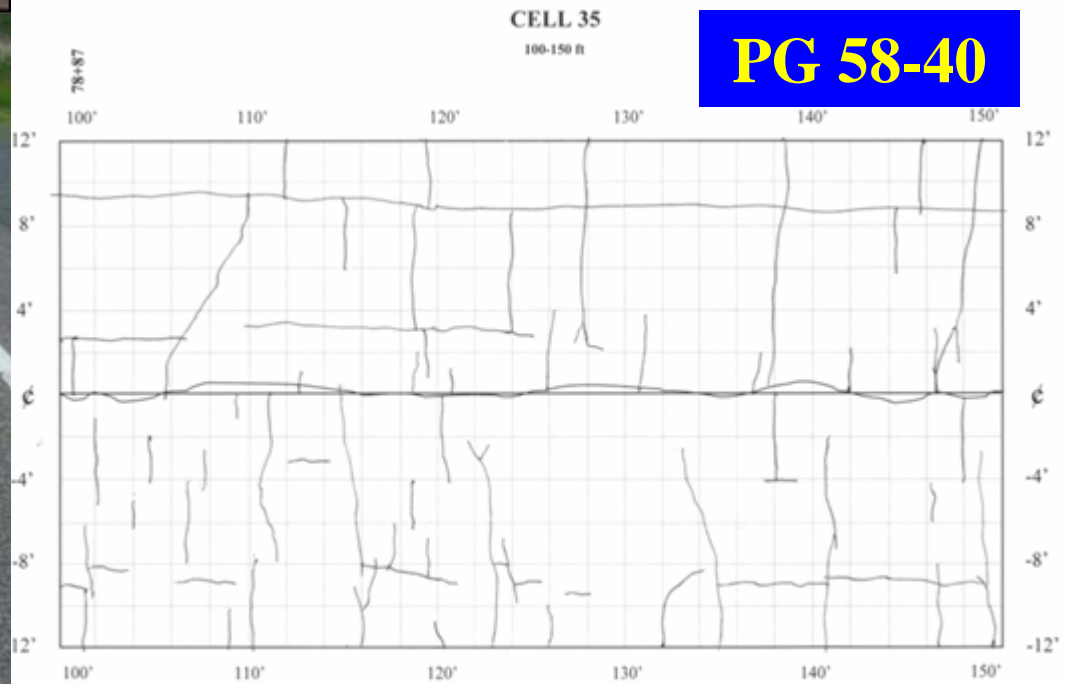
**PG 64-22**



**PG 58-34**



**PG 58-40**



# Shoulder Cracking

- Cell 31 – cracks from shoulders propagate through lanes
- PG 52-34 + RAP is common shoulder mix



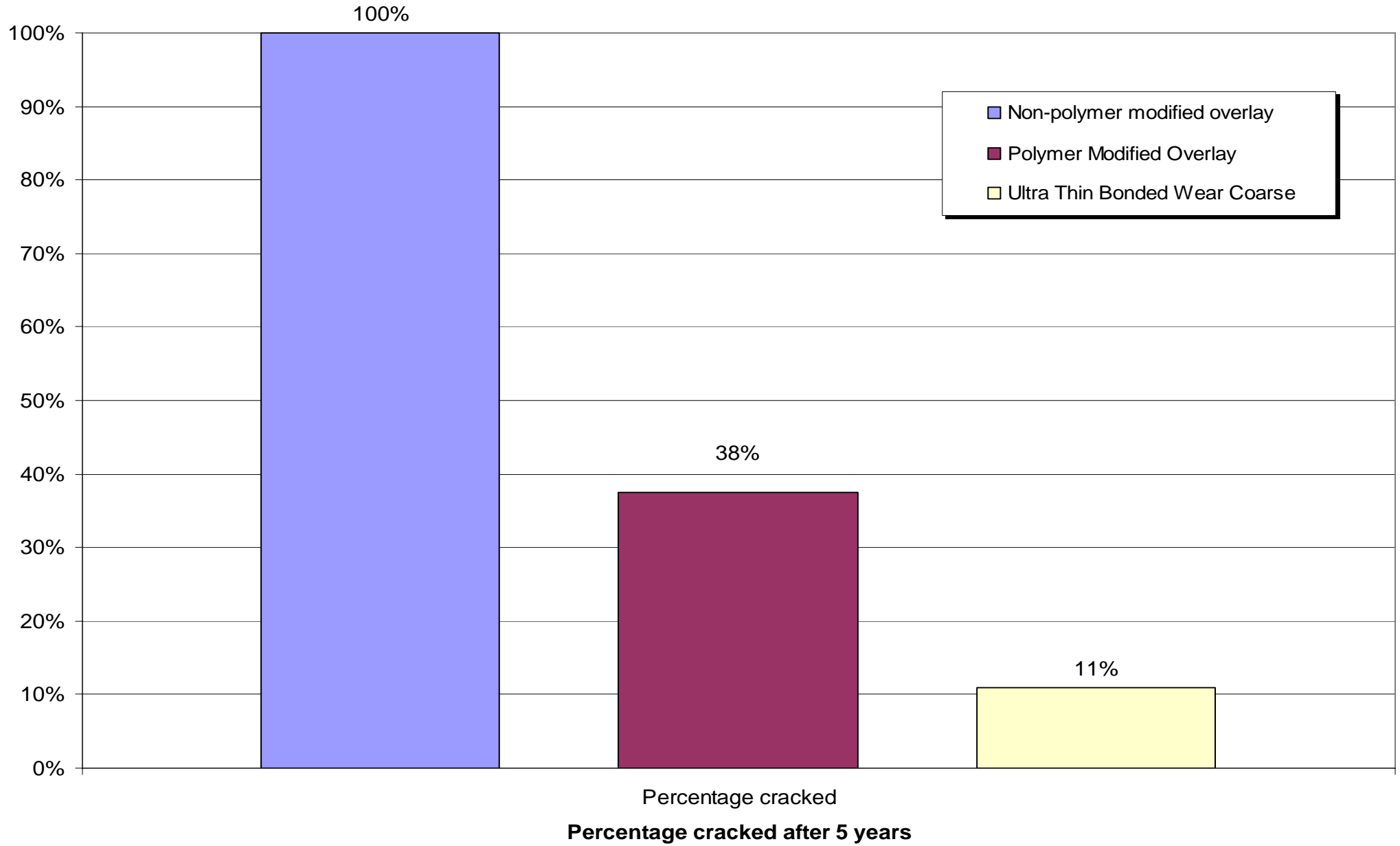
# Reflective Cracking

- Besides LTC, Minnesota's other main area of interest
- I-35 NB north of I-90
  - ★ Unbonded PCC overlay
  - ★ Shoulder mix PG 52-34 + RAP
  - ★ Not a single crack since 1998
- Several sealer/rejuvenator treatments

# Top-Down Cracking of BOC



### Transverse Cracking Percentage Comparision



# Rehab of Full-Depth HMA

- Clean & Go
- Route & Seal
- Mill & Overlay
  - ★ Milling depth
  - ★ Softer (PG -34) binder
  - ★ STRATA, fabrics, etc.
- CIR (a little bit)
- FDR (w/ & w/o stabilizer)
- Whitetopping (GASP!)



# Saw & Seal



- Mixed results over the years

- ★ Tried it, Mn/DOT doesn't do it anymore

- ★ Some Cities & Counties

- Cupping along every joint

- ★ Between joints OK

# St. Louis County Example - RAP



- PG 58-28, 30% RAP
  - ★ Cracked to pieces
- PG 58-34, 20% RAP
  - ★ No cracks

# Oil Gravel – “Poor Man’s Warm Asphalt”



- mid to late 1990s
- MnROAD Cells 26, 27, 28, 32, Jalger Ave.
- County Highways: Blue Earth, Stearns, St. Louis
- real WMA job paved 7/11/07 in Olmsted County

- ★ Oil Gravel requires solid base
- ★ No Transverse Cracking or Rutting
- ★ Some Fatigue and Rough Ride
- ★ Similar to current “WMA” development

# Shingle Research

- **Manufactured Waste**
  - ★ **TH 10 near Rice**
  - ★ **5% shingles, 25% RAP, 2.2% new PG 64-28 AC**
  - ★ **30% RAP, 64-28 control section much better**
- **Manufactured Waste vs. Tear-Off Shingles (5% vs. 10%)**
  - ★ **Hassan Township**
  - ★ **Better performance**



# Olmsted County Road 112

- WRI Binder Validation Study
  - ★ PG 58-28 Marathon
  - ★ PG 58-28 Citgo
  - ★ PG 58-28 Valero
  - ★ PG 58-34 MIF (RAP)
  - ★ PG 58-34 MIF (Virgin)
- Sealer/Binder study on SB lane



# Polyphosphoric Acid Study

- MnROAD Low Volume Road – 2007
- FHWA, Innophos, MTE Services
- Field validation of earlier lab work
  - ★ PPA + SBS
  - ★ PPA + Elvaloy
  - ★ PPA only
  - ★ SBS only



# Aging

- **Determination of Optimum Time for Application of Surface Treatments to Asphalt Concrete Pavements (University of Minnesota)**
  - ★ **Phase I – Literature Review**
  - ★ **Phase II – Lab & Field tests to predict aging**
- **Optimal Timing of Preventive Maintenance for Addressing Environmental Aging in HMA Pavements (new Pooled Fund project)**
  - ★ **Understand mechanisms that cause aging**
  - ★ **Apply right treatment at the right time**
- **Other ad hoc aging studies by Mn/DOT, U of M, Texas A&M, etc.**

# Other Mn/DOT Efforts

- **Asphalt Film Thickness**
  - ★ **Spec is in place and being used**
  - ★ **Do we get better performance than VMA spec?**
- **PG -28 vs. -34 study**
  - ★ **Do we get better performance with modified binder?**
  - ★ **Is it cost-effective?**
- **LTC & RAP studies, etc.**

Thank You!



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