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## *Winfield Tainter Gate Cylinder Rod Corrosion*

LRD Annual Maintenance Conference  
Feb 11<sup>th</sup> 2010  
St. Louis, MO

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## *Winfield Locks & Dam Red House, West Virginia*



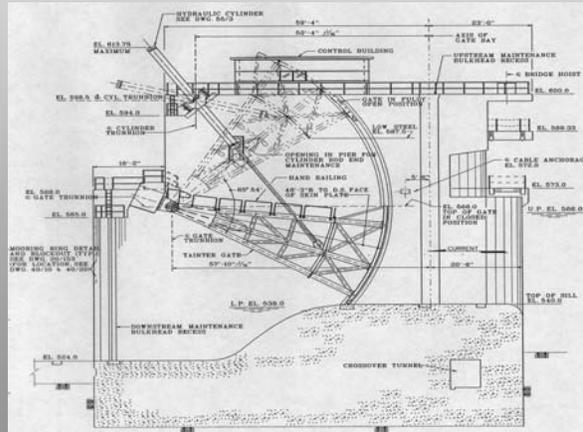
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## Tainter Gate Arrangement



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## Installation



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## *Original Design Considerations*



- Ceramic coating allowed use of an integral position sensing system
- Inexpensive
- Promoted as superior to other rod coatings, backed by testing



## *Cylinder Characteristics*

- 9.54 Meter Stroke
- 520 mm Bore
- 220 mm Rod
- Ceramax 1.0
- Cylinders Delivered in December 1995
- Commissioned in July 1997
- CIMS Position Sensing



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## *Installation*



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## *Installation*



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*Newly Commissioned, 1997*



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*Rod in May 2005*



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## *Typical Gate Operation*

- Small gate operations (1'-2') during flood season every year
- Never Fully Retracted Since 1997

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## *Maximum Opening of Gate in 2003*



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*Rod in May 2005*



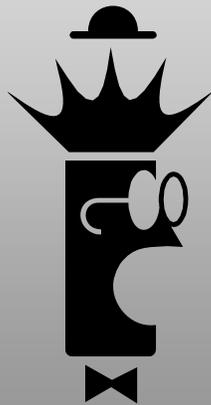
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*Only Three Years Later*



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*Rod Condition in April 2008*



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*Rod Condition in April 2008*



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## *Abrupt Transition to Failed Coating*



## *Observations*

- Flaking of Ceramax and Corrosion mostly on top half of the rod
- Begins at just above the end of the rod and extends to about halfway up the rod
- The rod exposed to more sunlight had more severe and extensive corrosion





## *Conclusions*



- Corrosion was caused by water penetration through the porous ceramic coating
- Water penetration occurred after the rod lost its coating of hydraulic oil due to never being retracted
- Contributing factors were sunlight and maybe natural bending of the rod
- The rods are not salvagable



## *ECB No. 2009-3*

- Recommends that “ceramic coated piston rods no longer be used at locks and dams for either new construction, or repair or rehabilitation projects” because of coating failures at Winfield and other projects
- Corps guidance and criteria will be revised to remove the option of ceramic coated rods
- All new and repair projects should specify chrome plated stainless steel or nickel and chrome plated carbon steel piston rods



## *Way Forward*



- Periodically coat ceramic coated rods, that are not regularly retracted, with a silicon oil
- Use chrome plated stainless steel or nickel and chrome plated carbon steel rods when possible
- An alternative rod coating for new and existing installations is needed if position sensing is required



## *Questions?*



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## *Contact*

Brenden McKinley  
Chief, Electrical/Mechanical Section  
Huntington District  
U.S. Army Corps of Engineers  
502 8th Street  
Huntington, WV 25701

(304)399-5593  
[Brenden.F.McKinley@usace.army.mil](mailto:Brenden.F.McKinley@usace.army.mil)

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