

Project title: Lifetime of fibre reinforced polymer (FRP) grease free bearings for lock gates

Project number: InfraQuest-2011-10

Start date: 15 September 2011 **End date:** 31 March 2012

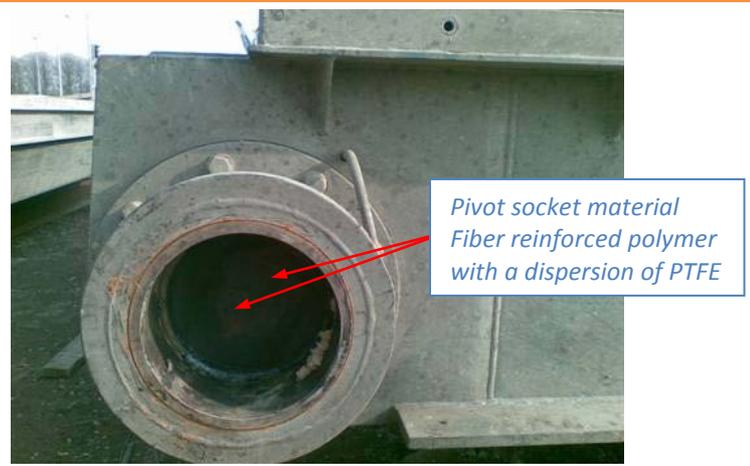
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Embedding in IQ-programme: The project relates to the InfraQuest Masterplan 'Materials'; it addresses the questions related to innovative materials and techniques for management and maintenance .
The project relates to the RWS project 'Full scale FRP pivot(axial & radial) bearing test for lock gates' and IQ-project 'UHMWPE disk for pivot bearing for lock gates' (IQ-2011-61).

Type of project: Fundamentalconcept Integration& development Validation of results Product-in-context / valorisation

Graphical abstract:

*Pivot socket (axial&radial) bearing of a lock gate in the Maas at Maasbracht (NL).
Used socket material: Fiber reinforced polymer with a dispersion of PTFE (solid lubricant).
This bearing with FRP has been in service for about 1 year.*



Research questions: The potential advantages of bearing systems with fibre reinforced polymers containing solid lubricants are:

- No need for lubricants as grease or oil for these bearings to properly function. This clearly means an **environmental** and a **maintenance advantage**.
- **Longer lifetimes** can be realized with FRP/metal than with metal/metal combinations.

The results of the performed inventory have been used to judge these potential advantages.

Conclusions: The inventory of available tribological test results with FRP/metal applications showed:

1. Most FRP materials outperform or equal grease lubricated bronze for wear rates.
2. Life expectancy of some tested FRP products could be at least 5 times longer than grease lubricated bronze in some bearing applications.
3. FRP self-lubricating bearings performance is more predictable than grease lubricated bronze since the latter is dependent on the consistency and effectiveness of the grease lubricant.
4. FRP bearing materials allow some accommodation of shaft misalignment by their ability to deflect much more under load than metals.
5. Cost of FRP self-lubricating bearings is generally less than bronze bearings.
6. Stopping the use of grease improves immediately the environment, eliminates risk of grease ingress into the water and saves on the cost of grease and grease dispensing equipment.

The results of the performed inventories show that the potential advantages of bearing systems with fibre reinforced polymers containing solid lubricants, in certain applications in lock gates, can be realized!

Applications of FRP self-lubricating bearing materials in hydropower stations, quote:
"In the long term, the **self-lubricating bearings** will provide First Hydro with **very substantial cost savings** owing to the **extended service life**, which is **at least three times that of the original grease-lubricated bearings**, thus extending the time between routine maintenance and reducing the annual expenditure on replacement bearings."

Other results: A lifetime-estimation for a FRP pivot (axial/radial) bearing, based on extrapolation of a full scale test at TNO, shows a lifetime of about 30 years. This is about twice the lifetime of a common pivot with a metal/metal combination.

Dissemination:

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