J10889/06 Bramble Bush Bay – Public Toll Inquiry

Supplementary Statement to 'Planned Maintenance & Costing Report Rev 0'

Introduction

My name is Tim Hope and I am a Principal Consultant Naval Architect at Burness Corlett Three Quays in Southampton.

I joined my company in 1998 and professionally have over 25 years' experience in the design, build and operation for a range of vessel types and sizes.

Our company provides technical consultancy to passenger and commercial vessels and other specialist vessels, including chain ferries in the UK.

Maintenance History

The 74 metre Bramble Bush Bay chain ferry has been well maintained since entering service in 1994 and has undergone routine planned maintenance throughout its lifetime.

This includes annual 'in service' refits with a dry-docking every 4 years.

Like other well maintained ferries a refit specification is prepared to ensure all routine maintenance is covered.

The Operator has a Planned Maintenance System to help manage the frequency of the maintenance based on:

Calendar – maintenance based on a given date/time interval, for example, hourly routines on general equipment

Utilisation – maintenance undertaken when a given number of running hours are completed, for example, engines or the hydraulic system.

Condition – maintenance completed when a condition parameter is reached, for example, wear & tear on prows or renewing protective inner & outer hull coatings.

In fact, this is just the same as a car that when it requires new tyres, an oil change or more complicated serving such as changing a cam belt.

Furthermore the ferry is kept 'in Class' with Lloyd's Register and is also annually inspected by the Maritime & Coastguard Agency.

It should be noted that there is no statutory requirement to keep the ferry in Class but it is the Operator's decision to do so and this helps maintain the vessel to the high standard of modern ships.

The advantage of keeping the ferry in Class is it provides a third party assessment that helps ensure the ferry is kept in a sound condition and is being operated safely.

For example, as a minimum a Lloyd's Surveyor will conduct the following inspections:

Full Survey

Mid-Term – conduct internal inspection afloat

Dry-Dock – special survey completed in conjunction with an out of water hull bottom survey every 4 years. More recently the ferry has been towed and dry-docked at the nearest available facility at A&P in Falmouth.

Note Lloyd's require this type of inspection at year 5 but the Operator requests the hull survey at year 4 which goes beyond the requirements.

Machinery Inspection

Continuous inspection - through the periodic planned visits by a Lloyd's Surveyor.

Annual surveys completed by MCA to enable issue of Chain Ferry Certificate includes inspection and demonstration of:

- Fire-fighting equipment
- Lifesaving appliances
- Safe operation of equipment
- Safety management system – such as procedures

2019 Breakdown History

On the 12th July 2019 it was reported that the In-Harbour drive shaft had failed.

It was found the shaft had sheared between the inner bearing and the drive wheel.

Within a couple of days the ferry had been towed to Hythe Shipyard near Southampton to undergo immediate repairs.

A new shaft was ordered which allowing for ordering of materials and machining would take a couple of weeks.

However when the Contractor set about removing the drive wheel from broken drive shaft it was found impossible to remove the Hyloc Voith tapered coupling that is used without damaging the chain drive wheel.

Therefore the decision was taken to also order both a new coupling and new drive wheel assembly.

The new drive wheel could be fabricated fairly quickly but unfortunately the new coupling (noting that is standard ship building practice for coupling components onto shafts) had to be specially made had a 10 week lead time that caused a considerable delay.

To make the best use of the ferry's extended outage it was decided to also replace the Outer – Harbour drive wheel and shaft assembly to mitigate the risk of a similar failure happening again. Again this was going considerably beyond what was required, but was implemented to future-proof the ferry.

Following Lloyd's approval the ferry returned to service on the 31st October.

Drive Shaft Life & Design History

The original drive shafts would have been designed to last 25 to 30 years.

However in 2002 the original drive shafts were replaced with a new design for the purpose of accommodating a modified bearing and hydraulic motor arrangement.

This would mean that at the time of failure in 2019 the vessel was fitted with drive shafts that were only 17 years old and therefore would potentially out last the life of the vessel.

It should also be noted that all work relating to major hull and machinery items from the time of build to present has been undertaken, scrutinized and approved by Lloyd's Register which would mean the drive shafts were fit for their intended purpose.

Both the old and new shafts were designed and manufactured with a safety factor of 5 which exceeds Lloyd's Register Class requirements and therefore deemed fit for purpose.

In conclusion this failure is considered a rare occurrence and just bad luck, however the Operator has now implemented a new regime for the regular inspection of the shafts.

The knowledge of this failure has been shared with other chain ferry operators who will be undertaking similar measures to inspect their shafts and couplings.

Non-Destructive Testing (NDT)

Learning from the 2019 breakdown the Operator has implemented a new regime for inspecting both shafts which will now undergo a quarterly NDT inspection.

Put simply this is a bit like taking an X-Ray and the last inspection took place on 2nd November this year without any issues reported.

Also the ferry now has two Voith couplings on the shelf and the plan will be to change the couplings at every major refit, i.e. every four years and to get them serviced.

Future Environmental Considerations

<u>Note on Chain Ferry Concept</u>

Compared to a faster free running vessel, a slower moving chain ferry will generally require about a quarter of the power to travel from A to B. This lower power requirement also follows from the fact that the ferry is permanently anchored to the chains, meaning it encounters less maneuvering issues especially when negotiating a strong flowing cross tide.

In addition, there is a double effect resulting from the drive wheel as it lifts up the chain catenary the weight of the falling chain by the stern helps propel the vessel forward. Provided the chain is properly tensioned then this will keep the vessel on track which further reduces the power requirement and time to dock, compared to a free running vessel that would need a lot of reserve power to both arrive and keep position on a slipway with 6 knots of tide running.

As such the concept of a chain ferry is an efficient method of transport and ahead of its time in terms of needing relatively low power requirements, meaning that it is already considerably greener option compared to a more conventional type of ferry.

Diesel Hydraulic v Diesel Electric

The ferry current configuration consists of a Diesel Hydraulic (DH) system which has similar emission characteristic to a Diesel Electric (DE) system that has been previously considered.

This current system operates using just one of three gensets that drives a hydraulic pump which in turn drives two hydraulic motors, one on each chain wheel.

Both DH & DE systems provide good pulling power at low RPM.

Diesel Hydraulic was chosen at build to save installation costs and for general simplicity.

Diesel Electric is a more expensive option to install but does offer more flexibility,

including:

- Quick & clean to switch between engines compared to existing hydraulic manifold or pipe
- More robust if using modern brushless motors
- Less and cleaner maintenance
- Future proofing for fully electric low emission options i.e. use of battery technology

New Technology & Future-Proofing

As we know the World is currently going through a big transition in trying to achieve emission free energy solutions to meet the respective national and international environmental targets.

The marine industry is working hard on various hybrid or single energy solutions, such as bio-fuel, hydrogen, fuel cells, battery power etc.

However at the moment it is not possible to be precise on the design and cost of powering a new ferry with any new technology until nearer the time.

For example, there are electric hybrid and full electric ferries now being launched and there is potential to utilise this power source for this short ferry route. That said, at present this technology is relatively unproven, and there are only a few innovative examples in service that are considered very much the pioneers at this time.

Full electrification may be the answer but first I would strongly advise observing and gaining knowledge from other projects rather than jumping in at the deep end with an unproven technology.

Like with all new technologies that we are still learning about this can also introduce new challenges and it remains to be seen what will be the most practical and reliable solution.

Sometimes it pays to let others go first, and to learn from their experiences. However, insofar as costing is concerned, as can be expected innovative technologies are expensive when they first emerge.

Notwithstanding this I would expect the costs to come down somewhat from their current high levels over time with developments in the new technology. As such my view is that adopting the cost of current diesel hydraulic option as a useful reference point given this cost shows us what the market will pay at present for a new diesel powered ferry.

I would expect market value of any electric ferries (should they prove viable in the long term) to at least move closer to that value similar to what we see is happening to an extent within the automotive industry and which no doubt will continue over next decade.

Vessel Capacity & Future Demands

The size of the existing ferry remains the largest platform in terms of length and breadth that can be accommodated on the service.

The size of the ferry is both limited by the Harbour Master's restriction on maximum length at 75m and the breadth which is restricted by the current slipways and infrastructure arrangements.