Tamar Crossings Newsletter

No. 6 April 2021

Tamar Crossings

Welcome to the latest edition of Tamar Crossings



As we move into the next phase of the Government's Covid recovery roadmap we are looking forward to re-opening our Bridging the Tamar Visitor and Learning Centre to the public on 17 May. While we have delivered a range of online workshops and courses for schools and community groups during the lockdowns, we have missed meeting people face to face. You can read more about activities at the centre, including our plans to celebrate the bridge's 60th birthday in October, in this edition of the newsletter.

The planned resurfacing of the Tamar Bridge is now due to begin in June. This is a complex project which involves resurfacing the three traffic lanes on the main deck and both the north and south cantilevers, while keeping three traffic lanes available for use. This will inevitably cause some traffic disruption particularly at peak times but we are doing our best to keep this to a minimum. We have set up a separate section on our website to provide information about this project and will be providing regular updates about what is happening.

We regularly receive questions about how the Torpoint ferries work and the programme for maintaining them. You can find out the answers to these and other questions about the ferries in the newsletter.

Thank you for your support and stay safe

David List, General Manager

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Managing the impact of the Covid-19 pandemic

For many individuals, businesses and organisations the impact of COVID -19 on their lives during the past 12 months has been something they would prefer to forget. For Tamar Crossings this has meant developing different ways of working to keep staff and the public safe whilst continuing to operate both crossings.

Led by Davood Kalantar, Tamar Crossings' Health, Safety and Environmental Manager, managers at both crossings reviewed the scientific and medical guidance issued by the Government and NHS England to introduce a wide range of new safety measures across all areas of the organisation. These included specific actions to support social distancing, use of PPE as well as increased cleaning and hand hygiene practices.

New guidance was issued for staff working in the bridge and ferry operations teams, as well as for contractors working on both routine maintenance and major projects, such as the kerb replacement works on the bridge and the refit of the LYNHER. Changes were made in key areas such as tolling to ensure the safety of both staff and the public.

Contactless card payment was introduced at the Tamar Bridge, with people encouraged to use this method wherever possible. Those paying by cash were asked to ensure they had the correct money, with specific social distancing tools, including 'fast cash' slots initially added to the booths. Tolling at the ferry was moved shoreside for several months during the first lockdown period, while robust procedures were put in place to enable it to be carried out safely on board.

The offices at both the Bridge and Torpoint were closed to the public during the lockdown periods, with customer service staff continuing to provide support via email, the Tamar Crossings website or by phone. Drop boxes were made available at both crossings for people needing to return tags. The Bridging the Tamar Learning Centre was also closed to the public during the lockdowns, with staff and volunteers working from home to develop new online resources.

The arrangements put in place to ensure that Tamar Crossings was COVID secure were checked by representatives from the Health and Safety Executive in October. They were very happy with the measures which had been put in place at both crossings.

Everyone at Tamar Crossings has worked incredibly hard to respond to the challenges of the pandemic. The organisation will continue to follow the latest Government guidance and is supporting the vaccination programme and workplace testing.

Resurfacing works

Work on resurfacing the Tamar Bridge is beginning in June

Originally scheduled to begin in April, the later start date was requested by the contractor VolkerLaser to ensure that all its specialist equipment and workforce are in place before work begins on resurfacing the deck, and traffic restrictions are introduced.

This is a very complex project which involves resurfacing the three lanes on the main deck and both the north and south cantilevers. At the same time we are taking the opportunity to resurface the toll plaza area and the bridge approaches, and replacing all six of the bridge expansion/movement joints.

Constructed between 1959 and 1961, the bridge was last fully resurfaced at the time of the strengthening and widening project in 1999-2001. As part of that project the original concrete deck was replaced by a much lighter orthotropic steel deck – this uses steel plate with stiffening ribs underneath.

The bridge deck surfacing provides a safe durable running surface for vehicles and protects the orthotropic steel deck from wear due to corrosion and fatigue. Just like standard road construction, bridge deck surfacing has a limited lifespan as the millions of loading cycles from traffic eventually cause deterioration. The deck of the Tamar Bridge needs to be resurfaced every 20 to 25 years to prevent damage occurring to the steel deck. In the last 20 years the Bridge has carried around 300 million vehicles.

Routine inspections of the bridge surfacing are carried out every four months. During the last two years these inspections have revealed that the existing surface is nearing the end of its serviceable life and requires replacement.

The project has been in the planning stage since 2015 and was originally due to be carried out during 2020. Unfortunately it had to be postponed until this year because of the coronavirus pandemic and the need to complete the kerb replacement works before resurfacing. The resurfacing works are currently due to be finished by the end of September, when all the lanes will re-open to traffic.

It was not possible to carry out the resurfacing works at the same time as the kerb works - these needed to be completed first so that the new surfacing material can be laid right up to the kerbs with minimal construction joints in the new surfacing material. It also means we can create a good seal between the kerb and new surfacing as well as providing the best waterproof protection to the deck. Additionally, the contracts require very different expertise, plant, equipment and materials and trying to integrate both contracts together would have been complex, inefficient and more expensive as a result. This is a major scheme which is essential for the safety of bridge users and the ongoing life of the structure. Delaying the project again could result in further damage to the surfacing material, leading to cracks which then enables water to penetrate onto the steel plates underneath with the potential for corrosion to occur. Despite the slow release from lockdown, traffic levels are still well below our normal levels for this time of year and we have worked hard with our contractor to develop a scheme that will complete the work as efficiently as possible.

The £6m cost is being met by Tamar Crossings funded from toll income. That project cost also covers replacement of the illuminated lane studs and includes the costs of design and supervision.

How is the scheme being carried out?

Three traffic lanes will be kept open throughout the works to help minimise disruption to bridge users, with the south cantilever used as an additional traffic lane when necessary. This means that the south cantilever will be closed to pedestrians, cyclists and mobility scooter users for the duration of the works. As with the kerb replacement project, a free bus service will be provided to enable these groups to cross the bridge.

A specialist, thin asphalt material will be used to resurface the bridge deck. At just 45mm thick, this material is much thinner and lighter than the materials used in standard road construction.

The scheme is being carried out by VolkerLaser, a specialist civil engineering contractor with extensive experience of working on bridges. It will be overseen by our Engineering Manager Richard Cole.



Resurfacing the steel bridge deck involves a series of sequential activities, the majority of which need to be carried out in dry and mild weather conditions. These are:

- removing the majority of the existing surfacing material using a road planer – a thin layer is left bonded to the steel deck so that the steel deck is not damaged by the aggressive teeth on the road planer
- removing the remaining thin layer either by hand using mechanical hand tools or using a large flat blade on a suitable digger/dozer machine
- blasting the steel deck with grit/shot using an enclosed mobile blasting machine - this process removes any stubborn remains of existing surfacing and deck waterproofing material, and provides a clean deck, enabling engineers to thoroughly inspect the steel deck and welds for cracks or damage
- carrying out repairs to any identified damage on the deck as required
- applying paint 'primer' to the bare steel deck to protect the steel from corrosion
- applying a two-layer waterproofing system on to the primer this provides vital corrosion protection to the steel deck
- applying a 'tack-coat' on to the waterproofing the 'tackcoat' helps the surfacing material bond to the waterproofing material creating a composite surfacing system
- laying the surfacing material in two thin layers using a special surfacing machine that runs on rails - the rails are set up to ensure that the contractor achieves the correct material thickness while also providing a smooth running surface
- applying road markings and installing a replacement illuminated road stud system.



The following FAQs have been designed to cover what we believe will be the majority of questions on the project:

Why do the works have to be carried out during the summer?

The timing of the project means that the resurfacing will be carried over the summer period. The work must be carried out when there is the highest chance of prolonged dry or fine weather and the period from April to September provides this opportunity. Many of the processes outlined above require dry and mild weather conditions. These conditions will give the contractor the best opportunity to achieve the highest quality of workmanship, which in turn will provide the longest service life for the bridge deck surfacing.

Why can't the works be carried out at night?

There are a number of reasons why we cannot undertake the works solely at night. The various sequential processes involved mean that between processes the deck surface will either not be safe for vehicles or needs to be left for materials to cure properly, or both. It is also not practicable to undertake the work in small sections as most of the plant and equipment is optimised for larger areas. Once work starts on an area of the bridge deck or cantilever, that area cannot be used by traffic until the resurfacing operation is complete.

In addition there are many residential properties near the bridge and some of the resurfacing processes are noisy. This would cause unacceptable noise for our neighbours and the noise generated by the work could also breach environmental legislation and noise limits designed to protect the public in such circumstances.

Additionally, undertaking construction work at night in generally less efficient and does not generally achieve the same quality end product, while also introducing additional hazards and greater risks for the workforce. Temperature and humidity at night would also be more likely to be outside the acceptable ranges for some of the more sensitive materials.

Why can't you just patch the areas which are worn?

Reliable waterproof patching repairs are difficult to achieve on steel bridge decks and would not be as durable as full resurfacing. Adopting this approach would also require more frequent repairs to be carried out, leading to closures of lanes over a longer period, and increasing the potential disruption to bridge users.

Will the crossing remain open?

While the crossing will remain open throughout the works, the traffic management arrangements and lane restrictions mean that drivers of 'abnormal loads' may be restricted during certain phases of the project. Full details of abnormal load restrictions will be shared with hauliers via ESDAL2 and our website which will also include a suggested diversion route for wide vehicles. Advanced warning signs will be placed at key locations on the A38 and the local traffic network, as well as on the main motorway junctions.

How will you keep people informed about what is happening?

Regular updates on the project will be posted on the Tamar Crossings website and social media channels, and provided to motoring organisations and the local media. This will include details of any traffic congestion or delays which will also be displayed on electronic messaging signs along the A38 at Manadon Junction and Trerulefoot Roundabout.

What about COVID?

All the works will be carried out in a Covid-secure manner, with contractors required to adhere to Government guidance. Tamar Crossings will also ensure that the latest Construction Leadership Council Site Operating Procedures are rigorously enforced.

Bridging the Tamar



In the last edition of the newsletter we brought you the 'fake news' image of the Shackleton. Since then there has been heated debate about whether this was in fact a real image!

As previous readers will know this was not a real photo the image of the aircraft had been superimposed onto a contemporary image of the Tamar Bridge. The aircraft in question - XF701 - did not arrive at RAF St. Mawgan, where the aircraft in the flypast were based, until August 1962, some months after the flypast. Further discussions with the Shackleton Society also revealed that the image was a fake!

During the latest lockdowns our volunteers have been busy researching more of the fascinating stories relating to both bridges. We've continued to hold regular Zoom video calls to update and check in with our volunteers and are looking forward to seeing them in person when it's safe to do so.

The Visitor and Learning Centre continues to be an important element of the Tamar Crossings, educating young people about bridges and enthusing locals and visitors alike about the iconic bridges. To this end we were very fortunate to recruit a full time Heritage Officer to support the team in delivering the educational programme alongside the Visitor Experience Manager.





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Spotlight on Mark Tebbs

From an apprenticeship in mechanical engineering to a history degree and teaching qualification followed by 10 years as an electrician on the Torpoint Ferry: Mark Tebbs' journey to a role at the Bridging the Tamar Visitor and Learning Centre surely makes him the perfect person for the job.

Appointed as a full time Heritage Officer earlier this year, Mark's role includes developing resources for the centre, creating and leading workshops and tours for schools and community groups and overseeing the team of volunteers who support the centre.

"As the centre has been closed during the Covid lockdowns this has meant focusing on developing online resources rather than face to face activities" explained Mark. "We have thousands of images related to the history and heritage of both the Tamar Bridge and the Royal Albert Bridge in our archives and the closure of the centre to the public has provided an opportunity to review these for future use."

Mark joined Tamar Crossings in 2005 after an interesting few years pursuing other career options. After completing an apprenticeship in mechanical engineering, he joined the Royal Navy's Fleet Air Arm where he did weapons and electrical engineering before joining British Rail as a locomotive engineer (involving both mechanical and electrical engineering). After deciding on a complete career change Mark successfully studied for a degree in history followed by a post graduate teaching qualification at Plymouth's Marjon University.

After working as a supply teacher for a number of months while trying to find a full time primary teacher role, with his savings running out he applied for a job as a relief cleaner on the Torpoint Ferry. While he did not get that job, he received a phone call from the ferry manager a few days later offering him a temporary position as a labourer while details of a job as an electrician on the ferries were finalised.

"They were waiting for the arrival of the third new ferry and so were planning to recruit another electrician" said Mark. "I was lucky to have been in the right place at the right time and was later offered the job. I then worked as part of the ferry maintenance team for the next 10 years."

In 2015, experiencing problems with his knees, Mark experienced another piece of luck when a member of the office staff at the Torpoint ferry office left just as he was unable to continue in his electrician role. After working in the office for the next three years in 2018 he was seconded to the Tamar Bridge as a project assistant.

It is fair to say that Mark loves his job, which enables him to combine his passions for history and engineering with using his teaching skills. His favourite moments come from researching the amazing range of images in the archives to find new stories to share with the people visiting the centre, and helping the groups of school children to find out about the history of the incredible bridges crossing the Tamar. He also enjoys working with the range of volunteers who support the centre.

He also represents Bridging the Tamar on the Brunel network, run by the Brunel Institute based at the SS Great Britain in Bristol, to encourage representatives of Brunel sites around the country to get together. A self-confessed admirer of the engineering behind the Royal Albert rail bridge, Mark is researching the work of William Glennie who used a small caisson to investigate the river bed to find the ideal location for the central pier of the Royal Albert Bridge.

"The construction of the rail bridge meant that people could travel from Cornwall to London in nine hours rather than the nine days it had previously taken" said Mark. "Building a bridge across the river without any of the equipment and technology we take for granted today was an incredible achievement."

"The great thing about my job is being able to share information about the history and importance of both bridges today with people visiting the centre, as well as helping the next generation to understand and be inspired by the amazing feat of engineering carried out by the people who designed and built them."





Working through the pandemic

Despite the challenges of the pandemic we have delivered an educational outreach workshop to a local Primary School utilising our new outreach bridge model. This required extensive risk assessments and covid-secure ways of working. Feedback from the teacher indicated that children had a better understanding of the engineering significance of the bridges, were more inspired by engineering and design than before their visit, and had increased confidence in STEM (science, technology, engineering and mathematics) subjects, which is why these workshops are so important.

We also delivered our first joint schools workshop with our project partner The Box in between lockdowns. The 'Bridges, Lighthouses and Breakwater' workshop is part of an all-day workshop schools can book in partnership with the new Museum in Plymouth.

We started a new digital series of courses called 'Tamar Bridge Live' in partnership with the Workers' Educational Association (WEA), our adult education partner, who have been championing virtual learning throughout the pandemic. The people who logged in for the initial courses were from all over the country as far afield as Manchester and Blackpool! We are also partnering with our fellow Brunel bridge, Clifton Suspension Bridge, to deliver talks.

Date for the diary!

With the vaccination programme going well our thoughts are turning to the future. Did you know the Tamar Bridge will celebrate its 60th birthday on 24th October this year?

We're planning a series of celebrations including an Anniversary Arts Project with local young people, balloted tower top tours, and a new under-bridge and anchorage tour!

Finally, did you spot the animation of the bridges on social media? This was made by local families last Half Term and we think it's great. It's right here on our homepage https://www.bridgingthetamar.org.uk/

Maintaining the Torpoint Ferries

The Torpoint Ferry is the world's biggest and busiest estuarial vehicular crossing chain ferry service. It is the UK's busiest inland waterway ferry crossing – providing crossings for two and a half million vehicles and approximately 750,000 foot passengers and cyclists each year.

The three chain ferries are operated under Maritime and Coastguard Agency regulations and are maintained 'in class' with Lloyd's. They are unique vessels offering a wide range of both engineering and operational challenges.

The ferries operate 24 hours a day, 365 days a year, and provide an essential transport link for the people living in Plymouth and South East Cornwall. Achieving this requires a significant planned maintenance programme. While some maintenance activities must be carried out during refits in dry dock conditions, most of the maintenance takes place while the vessels are afloat or during off peak periods while an individual vessel is not on scheduled service.





How do the ferries work?

Each ferry propels itself across the river by pulling on two steel chains. Each individual chain is over 650 metres long and weighs 23 tonnes. The total length and weight of chains in the river is around 4 kilometres (approximately 2.4 miles) weighing some 140 tonnes.

The ends of each chain are connected to swivels and steel cables under the road joining to two large weights and pulleys housed in gantries on each side of the river. The weights are buckets made of steel, containing cast steel and concrete. Each bucket weighs approximately 12 tonnes, helping to keep the chain tensioned and the ferry on track in all weathers. Without this tension the chain could go slack in some situations and this would compromise the chain drive and directional control.

Each ferry is powered by three powerful Volvo Penta 12 litre diesel engines coupled to generators, with a drive motor turning each of the two chainwheels.

Moving a 1,000 tonne fully loaded ferry requires a lot of power and torque – each of the generators can each produce around 350kw and these power the 250kw electric motors that turn each chainwheel. One generator usually produces enough power for all normal operations, with a second being used to provide extra power in bad weather or for fast emergency crossings. The third generator is a duty spare to allow for planned maintenance and to enable the service to continue to run safely should one of the other generators suffer a defect that puts it out of action. The three generators are rotated in sequence so that they run equal hours for maintenance - 1-2-3, 2-3-1, 3-1-2.

The chain wheels are nearly two metres in diameter, with seven segments on their outer circumference which locate and grip the chain links. This is the equivalent of a sprocket on the rear wheel of a bicycle, but instead of the chain engaging on a sprocket with teeth, it engages in the pockets on the segments. The chains run through chutes within each side of the hull on the ferry.

Where the chains enter the chutes on the ferry, special 'sacrificial' wear plates are fitted to reduce wear and tear and keep noise to a minimum. Each chainwheel drive has a hydraulic disc brake to hold the ferry when not moving.





How are the ferries maintained?

Technical Manager Lee Hunt is responsible for overseeing the complex maintenance programme, supported by an onsite team of 12, including mechanics, electricians, fabricators and welders, and stores staff.

"Everyone in the organisation has a key part to play in the planned maintenance programme" said Lee.

"From the ferry controller and the deck crews, to the mechanics, plant operators, electricians and the health and safety team, everyone is a part of a jigsaw, working together as a team to ensure that we provide a safe and efficient crossing of the river for passengers."

There are a large number of sensors on each ferry. These cover all areas of the vessel from individual pieces of machinery in the engine room and the control cabin, to the lighting on the deck and passenger areas, and the chain propulsion system.

All of the sensors are linked to a series of control junction boxes which then feed into the main VTAS (Vosper Thornycroft Automation System) computer system. This system is installed and maintained by Rolls Royce, and is the heart of each Torpoint Ferry. It provides real time monitoring of every key element of machinery and electronics on the ferries, giving an immediate alert in the event of a defect.

Rolls Royce carry out annual health checks on the system, with additional checks made when the vessel goes into dry dock for refit. Routine work includes carrying out program upgrades, replacing hard drives when needed and debugging.

Regular checks are also carried out on all key elements of the ferry, and these are digitally listed using a marine planned maintenance system. These checks take place daily, weekly, monthly, bimonthly, quarterly, 6 monthly and annually, depending on the specific piece of equipment and in line with manufacturers' data and specifications, based on life expectancy and durability in the marine environment.



Some checks are as simple as cleaning filters on the saltwater cooling system, with more complex ones involving monitoring cooling temperatures within the motor drive system. One safety critical check focuses on the 'black out' recovery system – these are carried out weekly by one of the team's electricians, and checks that the standby generators will start and come online in the event of failure of the in-service generator.



Deck safety checks include the evacuation door mechanisms, public address system, emergency lighting, firefighting equipment and life rafts which are all checked monthly. There are also checks carried out on the upper deck life buoys outside the Controller's cabin and upper traffic deck which include a bright strobe light and red smoke device to help alert emergency services if necessary in the event of an incident. Regular checks are also made on the defibrillators and first aid kits carnied on the ferries.

Staff on board the ferries also carry out visual checks to ensure that any problem is flagged as early as possible. The planned maintenance system uses a 'traffic light' marker to keep track of routine maintenance tasks. Maintenance staff arriving at the start of their shifts log onto the programme which identifies any overdue or urgent maintenance tasks (coloured red), pending tasks (amber) and completed tasks (green).

The VTAS system uses alarms or sirens to alert staff in case of an emergency or fault within the operating system such as an engine failure, overheating plant shutting down or a fire on board the vessel. There are also visual indicators in the engine room which alert staff in case of an emergency.



What can go wrong?

"The extensive programme of checks carried out by staff, and the ongoing monitoring provided by the computer system means that routine maintenance is always kept up to date" explained Lee.

"However, as with any other kind of transport, including a family car, regular servicing and maintenance does not always prevent faults from occurring especially under heavy usage. When these faults do happen, we work very hard to ensure that they are resolved as quickly as possible so we can get the ferry back into service, and take appropriate action to prevent it from occurring again."

One of the most common problems that occur on the ferries is damage to the chain pulleys (sheaves) which carry the chains through the ferry to the main drive wheels. Although bearings in the sheaves are regularly greased and are sealed to provide protection against the harsh environment they operate in, they regularly get covered in salt water, seaweed and silt when the ferries are working.

The sheaves also suffer more when the ferries are battered by strong winds and heavy seas during poor weather, being subject to the immense pressure and repetitive impact from the moving chain links. As a result the sheaves need to be changed at various intervals during the winter months. This involves using heavy lifting equipment to move the chain off the sheaves to enable them to be lifted out and replaced.

Other vulnerable areas include the cast rubbing plates at the entrance to the chain chutes. These can become loose as a result of the friction and repetitive impact caused by the constant rubbing of the chain in heavy tidal and wind conditions.



What about spare parts?

The ferry workshop store holds an extensive stock of parts. This enables routine repairs and regular maintenance to be carried out in a timely manner as well as supporting emergency repairs. In cases where a part is not already in stock, the team will first try and source it from local suppliers.

"We cannot keep every single part on the shelf as this would not be cost effective" said Lee. "We rely on regular maintenance and monitoring of the machinery to predict failure or replacement. Also some parts will have a set shelf life, so we will buy these in prior to carrying out the work."

Any parts used in the vessel's 'safety critical' machinery must be obtained direct from the companies which originally designed or built them to meet the requirements of Lloyd's Register and the Maritime and Coastguard Agency. This includes bearings, seals and specialist parts for machinery and the engines, as well as specialist electronic equipment used in the computer system.

"We have to provide detailed records of all the parts used on the ferries for our Lloyd's inspections" said Lee. "This includes the serial numbers of the parts which have been used, as well as a photographic record of every stage of the process. Inspectors can also make spot checks if there has been a

particular problem with a ferry to make sure that the work has been carried out correctly."

Other replacement parts, such as the chains, have to be specially made. The interaction between the chains and the chain wheel, combined with the abrasion caused by the slipways and the gantry weights, means the chains are normally replaced once every three years.

A main chain change is a major, and lengthy, job that cannot be done with the ferry in service and can only be completed when the wind and tides are within set limits. While chains have been sourced from within the UK in the past, there are no longer any manufacturers in this country who produce the size and quality of chain required. As a result, replacement chains are now imported from a specialist manufacturer in China.



Why do ferries need to go away for a refit?

Some maintenance activities, inspections and surveys cannot be done while the ferry is afloat and have to be carried out in dry dock conditions. These include replacing obsolete equipment and installing new power management and IT systems. Other work carried out during a refit includes removing the prows to completely overhaul them, repairing the steel structure and working on the hydraulic prow systems, cleaning the hull and repainting the vessels, both above and below the waterline.

LYNHER II, PLYM II and TAMAR II currently have a refit once every five years. The size of the ferries (and their width in particular) and the specialist nature of the work means that very few facilities in the UK have the dry dock facilities needed to carry out this work. Recent refits have all been undertaken at A&P Falmouth.

These refits also give Lloyds Register and the Maritime and Coastguard Agency (MCA) the opportunity to carry out their five yearly dry docked inspections which are aimed at ensuring that the ferries are in a good condition, and that they meet all requirements that make them safe to operate.







