



**TIMBY: THE TUNNELLING INNOVATION.
TO CROSS RIVERS AND STRAITS.**

timby



FOUR WAYS TO CROSS A RIVER. WHICH IS THE BEST?

Mobility has priority. Rivers and straits are a considerable obstacle to the mobility of people and goods – especially in large cities and conurbations. As well as mobility, a region's growth and development can also be impeded.

Any solution has advantages and disadvantages. The classic infrastructure solution is a bridge – an architecturally complex construction.

In recent decades, tunnel constructions have become increasingly common as solutions for road and rail traffic. When tunnelling beneath water, we distinguish between two procedures: mechanical tunnelling technology and the immersed tunnel procedure.

All three methods have advantages and disadvantages. The immersed tunnel procedure makes large demands on space and requires complex work to install temporary construction site facilities, which are often out of the question in inner city areas. In addition, the time spent transporting the tunnel elements with tugboats and sinking them extends the construction period.





TIMBY.
For the strait
and narrow.

Both bridge construction and tunnel sinking can lead to interruptions in shipping traffic – an effect which is to be avoided when mobility is the aim.

The ingenious alternative is TIMBY. The TIMBY tunnelling technique (patented by Bouygues Travaux Publics) is based on a tunnel boring machine developed by Herrenknecht, which relies on tried-and-tested technologies. TIMBY (Tunnel **IM**mersed **BY** BTP) has significant advantages over the conventional immersed tunnel procedure. TIMBY is extremely space-saving, cost-effective, ecological and in the main causes no interruptions to shipping traffic. While the tunnels are under constant construction at the riverbed, shipping continues to flow uninterrupted above.

TIMBY means maximum efficiency:

- space-saving
- little interruption of traffic
- short construction times
- minimum environmental impact
- comparatively low costs





① Place-saving launch construction for TIMBY.



② TIMBY sets off towards the opposite bank or shore.



③ Two cutting mill arms cut the lower tunnel contour into the riverbed.



④ The prefabricated concrete elements are transported to the tunnel boring machine through the backup system ...

TIMBY COMBINES THE ADVANTAGES OF TUNNEL BORING TECHNOLOGY AND THE IMMERSSED TUNNEL PROCEDURE. AND THIS IS HOW IT WORKS:

Innovation with a good name. Taking tried-and-tested Herrenknecht technology for shield tunnelling in soft and water-bearing ground as a basis, a specialized, innovative procedure was developed for the production of tunnels under water, which also makes most additional work and construction site installations unnecessary.

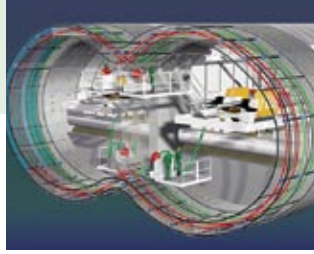
Getting a head start. A cofferdam – a dry area directly on the river bank drained using sheet pile walls – functions as the launch construction for the TIMBY machine ①. This is flooded after the system has been assembled, and tunnelling can begin ②.

Two milling cutters cut the lower tunnel contour into the riverbed, the excavated material is removed hydraulically. This procedure for material excavation allows a significant reduction in preparatory measures to level the construction bed, compared to the immersed tunnel procedure ③.

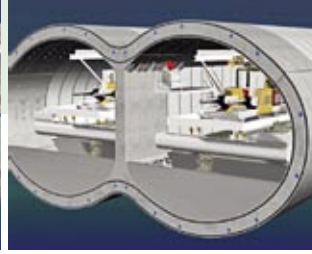




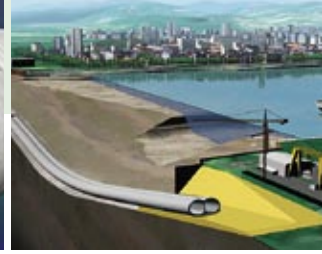
5 ...and are connected to form the next ring.



6 Steel anchors connect the lining segments lengthways. Steel cables secure the rings around their circumference.



7 The lower section is filled with sand; the tunnel can no longer float to the surface.



8 TIMBY enters the target shaft at the water's edge.

Reaching new shores, segment by segment. The machine proceeds lining segment by lining segment. Each time tunnelling has proceeded by the width of one lining segment, the prefabricated concrete elements are transported to the tunnelling machine via the backup pipe 4, where they are assembled. First an open ring for the right-hand tube, then one for the left-hand tube, and finally a dividing wall in the middle completes the double ring 5. The lining segments are connected lengthways with steel anchors 6. Sealing frames installed between the individual concrete elements reliably seal the joints against even high water pressures.

Securing ring by ring. Each finished tunnel ring is secured around its circumference with steel cables. This reliable technology has been used successfully for decades in bridge building. Several stressing tendons are stretched through each lining segments from the upper Y-element to the lower one and are tightened as open rings 6.

To prevent the constructed tunnel and the machine from floating to the surface like a re-emerging submarine, the lower part of the last three finished rings is immediately filled with a sand and cement mixture 7. New tracks are laid on top and the backup system can be advanced by the size of three rings. The machine is also given extra protection against floating using a ballast sled. On the opposite bank or shore TIMBY enters the prepared target shaft built without the need for complex constructions at the water's edge 8.

And finally the tunnel "disappears". When the tunnel tube has been completed under water it is buried to prevent damaging effects from outside. This, too, takes place without major disturbances to shipping traffic. In the end, the TIMBY tunnel tube is embedded in a similar way to an immersed tunnel.

THE MACHINE IN FIGURES

INSTALLED POWER	DIMENSIONS	WEIGHT
1,500kW	height: 12m width: 25m	700t

These figures are given as examples.

2x2 lanes



1x3 lanes



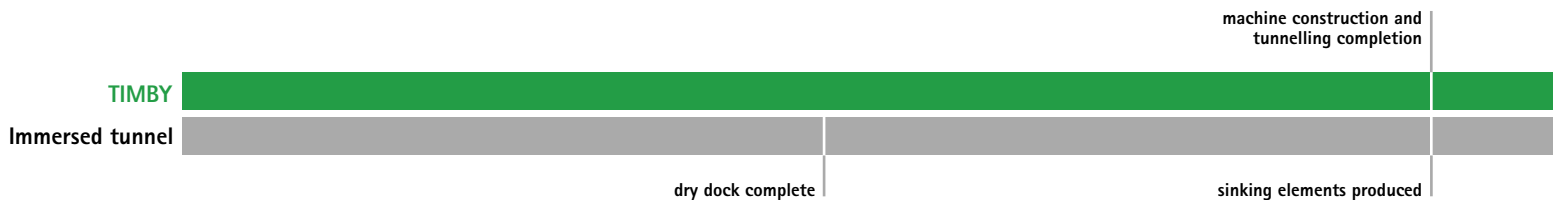
1x2 lanes



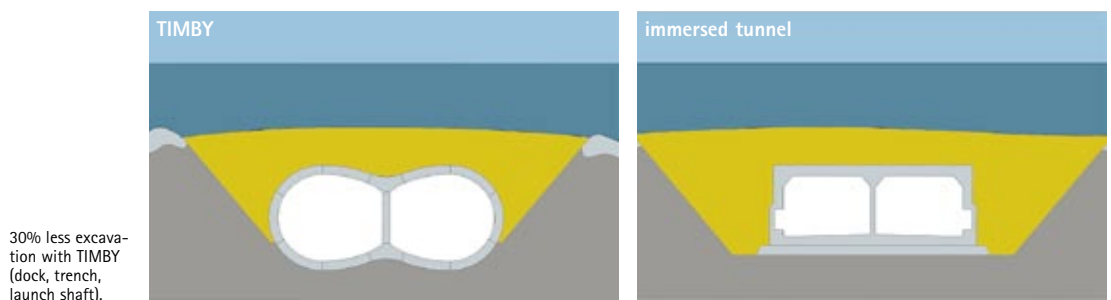
TIMBY can also be realized with other dimensions and cross sections.

COMPARATIVELY UNIQUE: THE FIRST AMPHIBIAN IN TUNNELLING CONSTRUCTION.

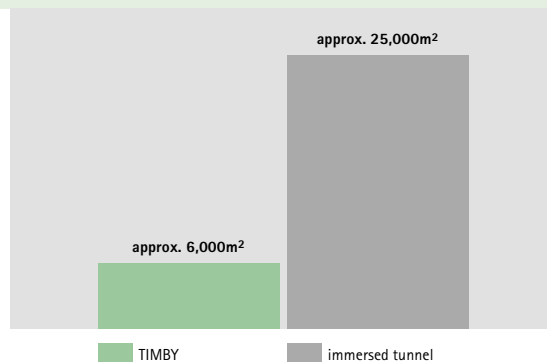
COMPARISON OF TIME REQUIREMENTS.



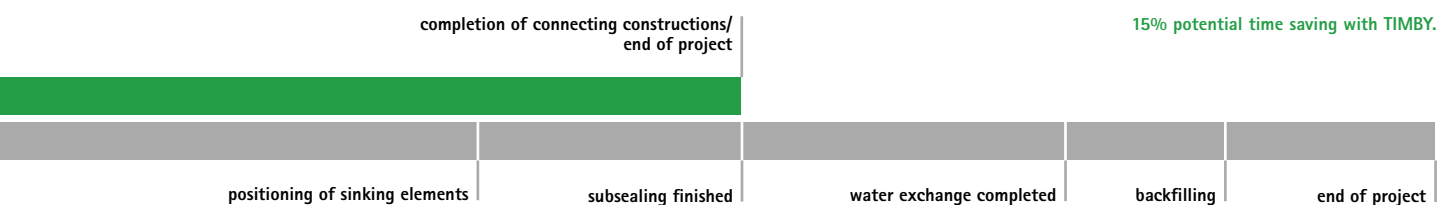
TIMBY requires less space and creates flexibility. Unlike the immersed tunnel procedure, it requires no complex launch and target shaft installations, as TIMBY starts directly at ground level. Cost, labor and space requirements are reduced to a minimum. Also, no extra areas are required at the water's edge: temporary installations – such as the dry dock required in the immersed tunnel procedure to construct the 120 meter long caissons – are not needed. In addition, the connecting constructions do not necessarily need to be built right at the water's edge; this flexibility is a particular advantage in highly built-up locations.



TIMBY is efficient. The machine's contour, a figure 8 lying on its side, and the double back up system mean both tunnel tubes are produced simultaneously. Cross cuts for rescue and service access from tunnel tube to tunnel tube can be realized easily. No other connecting tunnels are necessary. Two separate, unconnected tunnel tubes can also be built, with circular or elliptical cross sections, if needed, by adapting the machine.

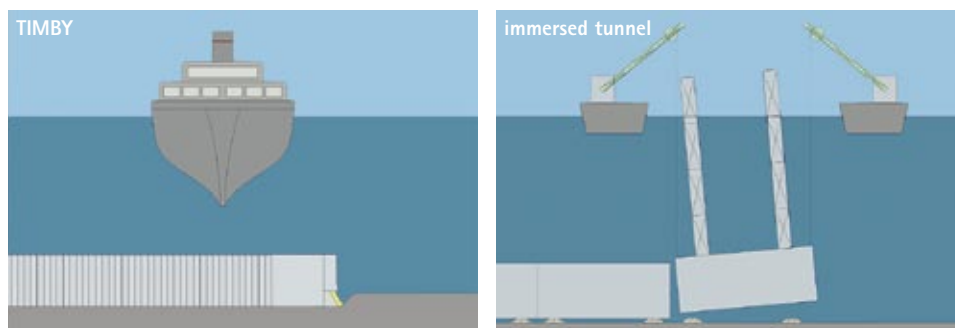


Comparison of space requirements construction site/dry dock.



TIMBY saves time and money. Since no supplementary installations are needed, their dismantling is also not necessary. Therefore, the considerable costs for this, which occur in the immersed tunnel procedure, are cut. In addition, this puts an end to the extensive tunnelling interruptions which necessarily occur as the caissons are constructed successively. TIMBY builds continuously, segment by segment, which means it reaches its target up to 15% faster (see timeline above). Yet another advantage: the machine is reusable.

Captains will love TIMBY. Unlike bridge building or the immersed tunnel procedure, TIMBY does not impact shipping traffic. No restrictions, no delays, no loss.



TIMBY is kind to the landscape and the environment. As well as its clear economic advantages, TIMBY is also ecological. The much-reduced space requirements, the avoidance of extra construction sites and its route flexibility mean it has little impact on the landscape, the environment or inner city structures.



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Herrenknecht AG is a technology and market leader in mechanized tunnelling. As the only provider of a full range of services worldwide, Herrenknecht delivers high-tech tunnel boring machines for all ground conditions and with all diameters – ranging from 0.10 to more than 16.0 meters.

Herrenknecht's tailor-made machines create pipeline systems for water and sewage, for gas and oil (Utility Tunnelling) as well as tunnelling systems for car, metro and railway traffic (Traffic Tunnelling) around the world. Our tunnel boring machines are forging ahead with the world's longest railway tunnel and the largest metro lines. They help to cross under water with supreme accuracy and to lay pipelines throughout continents.

Herrenknecht sees itself as a partner in team-work tunnelling throughout the entire project. Comprehensive services for all aspects of tunnel boring activities complement our range.

The Herrenknecht Group employs more than 1,800 people and has more than 30 subsidiaries and associated companies working in related fields, e.g. in logistic solutions or deep drilling systems.

Herrenknecht AG
D-77963 Schwanau
Phone + 49 7824 302-0
Fax + 49 7824 302-364
timby@herrenknecht.com

