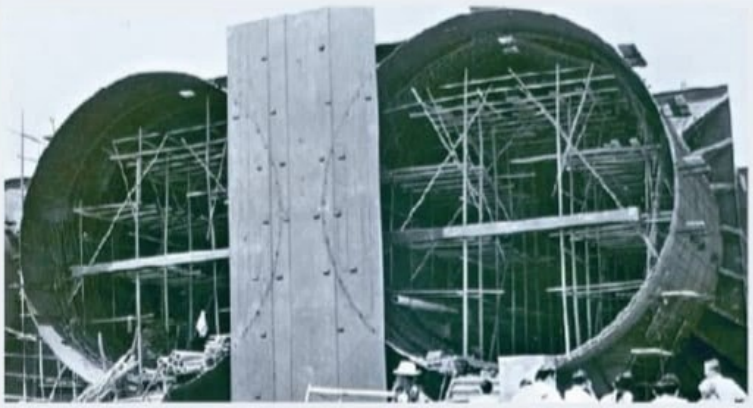

The Cross-Harbour Tunnel, opened in 1972, was designed in round steel sections. SING TAO

TUNNEL VISION THAT GOT US PLACES WITH HARBOR

In a previous article, I described how tunnels are built underground. Let me explain how tunnels are built across harbors.

Simply put, giant sections made of concrete or steel are sunk to the seabed and joined together to form a continuous tube that vehicles can pass through.

However, like all engineering solutions, the theory is simple but its execution is an accumulation of technology and years of experience.

Such concrete sections are normally pre-cast in a dry dock near the harbor so that when ready, they can be dragged into the sea for easy transport. For easy manufacture and transit, they are normally about 100 meters in length and in rectangular sections.

The weight of the concrete is designed so that these sections can float in the harbor when the ends are sealed, to facilitate easy towing to the final site. An opening in the sealing plate then lets water fill the hollow space in the section so that the total weight causes the piece to sink to the seabed.

Meanwhile, along the alignment of the tube tunnel, a trench is formed and supported by gravel to receive the tunnel sections so that they stay put in the final location and do not get disturbed by tides or other forces.

To further secure them, another layer of rock armor is placed atop the sections for long-term protection.

As adjacent sections are placed in the final location, they are joined up to form a continuous tube. The sealing plates at the ends of each section are then removed and water pumped out.

The joints between sections are synthetic rubber seals called "omega seals" because the tunnel's cross-section resembles the Greek symbol. These seals prevent seawater from entering the tunnel but allow certain flexibility for thermal expansion and other minor movements.

Such construction methods were pioneered in Europe and the United States in the late 1960s, when we planned the first immersed tube tunnel from Causeway Bay to Hung Hom.

At the time, we had a construction doldrum, so steel prices were low and welders freely available. Thus the contractor changed the design from rectangular concrete sections to round steel sections and saved a lot of time and costs.

The latter is, in theory, less efficient, but for a two-lane tunnel, by placing two tubes next to each other in binocular formation, the layout was made fairly efficient.

The inferior corrosion properties of steel were augmented by lining the steel tube with concrete, as in any case, the additional weight would be desirable for easier sinking of the tunnel sections during construction. This tunnel has reliably served us for some 50 years.

Other cross-harbor tunnels built subsequently, including the Eastern and Western crossings, are of the rectangular concrete type, especially as concrete prices are much more stable than steel and more adaptable for Hong Kong due to the abundance of concrete workers in the construction industry.

The increasing trend for three-lane tunnels today also points to the advantage of a rectangular section.

As we enjoy the convenience of cross-harbor tunnels as better alternatives to ferries, we cannot stop admiring the engineering ingenuity of our construction professionals.

We no longer feel restricted to one side of our harbor and Hong Kong Island is now fully integrated with the Kowloon peninsula and the New Territories.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over Hong Kong's iconic infrastructure