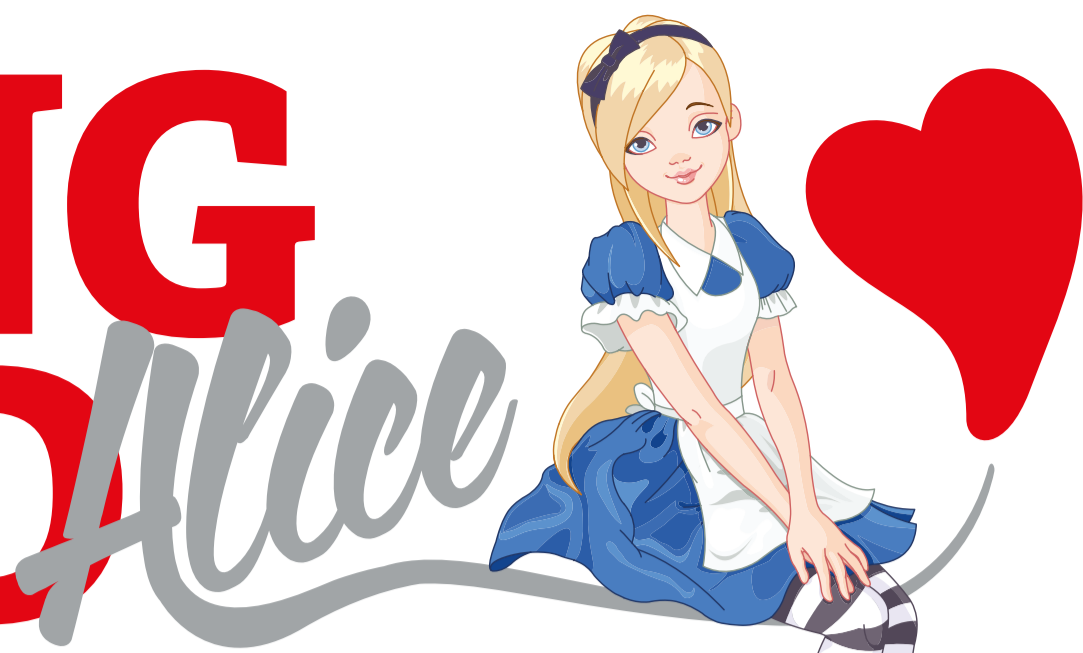


# TURNING AROUND



Alice's arrival at Waterview marks the completion of the first (the southbound) of the two Waterview tunnels. She is now halfway through her 4.8km underground journey between Owairaka and Waterview.

At Waterview she is being turned around, ready to bore southward in 2015 to build the northbound tunnel.

Turning Alice, the world's 10th largest-diameter tunnel boring machine, is a major undertaking. It's taking international engineering expertise and experience and a good measure of Kiwi ingenuity.

## What is the Waterview Connection Project?

The Waterview tunnels are being built as part of the NZ Transport Agency's Waterview Connection project. The project involves construction of five kilometres of six lane motorway between Owairaka and Waterview, connecting the Southwestern (State Highway 20) and Northwestern (State Highway 16) motorways, therefore completing Auckland's 47km Western Ring Route.

## Who is building it?

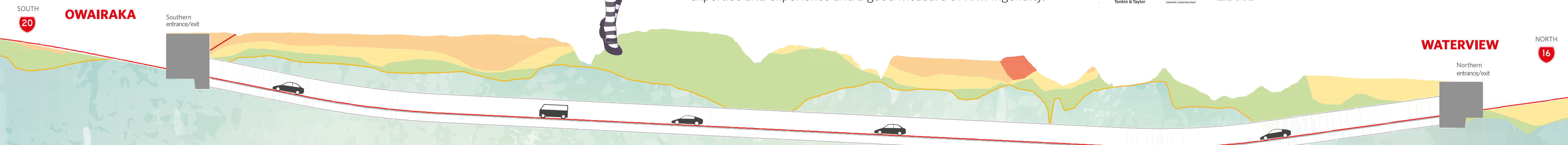
The Well-Connected Alliance comprising:



## WELL-CONNECTED ALLIANCE PROUDLY DELIVERING

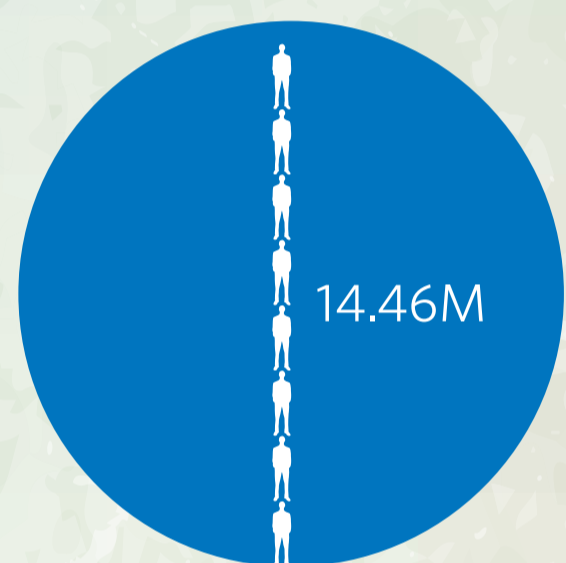


If you want to learn more about New Zealand's biggest infrastructure project to date, visit: [www.nzta.govt.nz/projects/waterviewconnection](http://www.nzta.govt.nz/projects/waterviewconnection) and visit our Facebook page to receive regular updates on Alice: [facebook.com/AliceTBM](https://www.facebook.com/AliceTBM)



## OUR BIGGEST CHALLENGE

Alice is a **HUGE** machine: The shield alone weighs **2400t**, has a diameter of **14.46m** and is **12.4m** long.



THAT'S THE SAME WEIGHT AS **1,600 HIPPOS** AND TALLER THAN **8 GROWN MEN!**

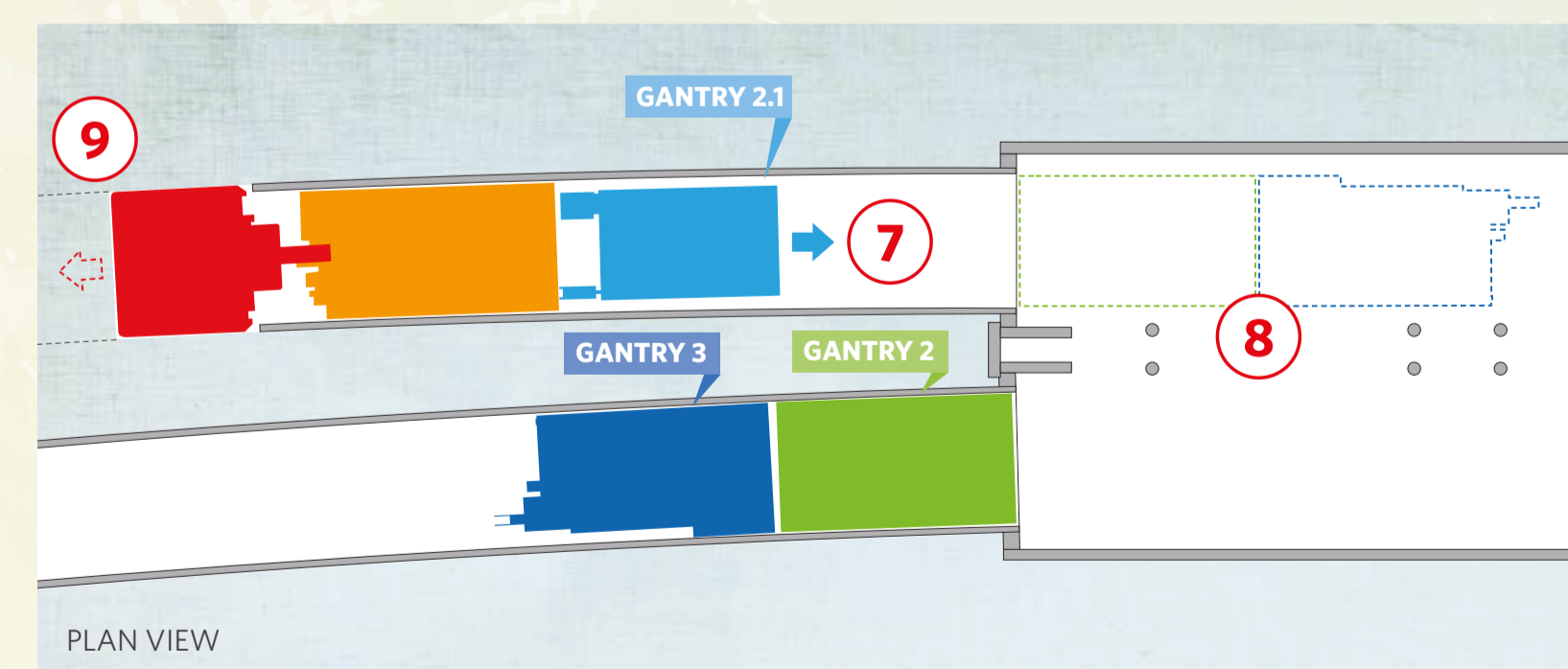
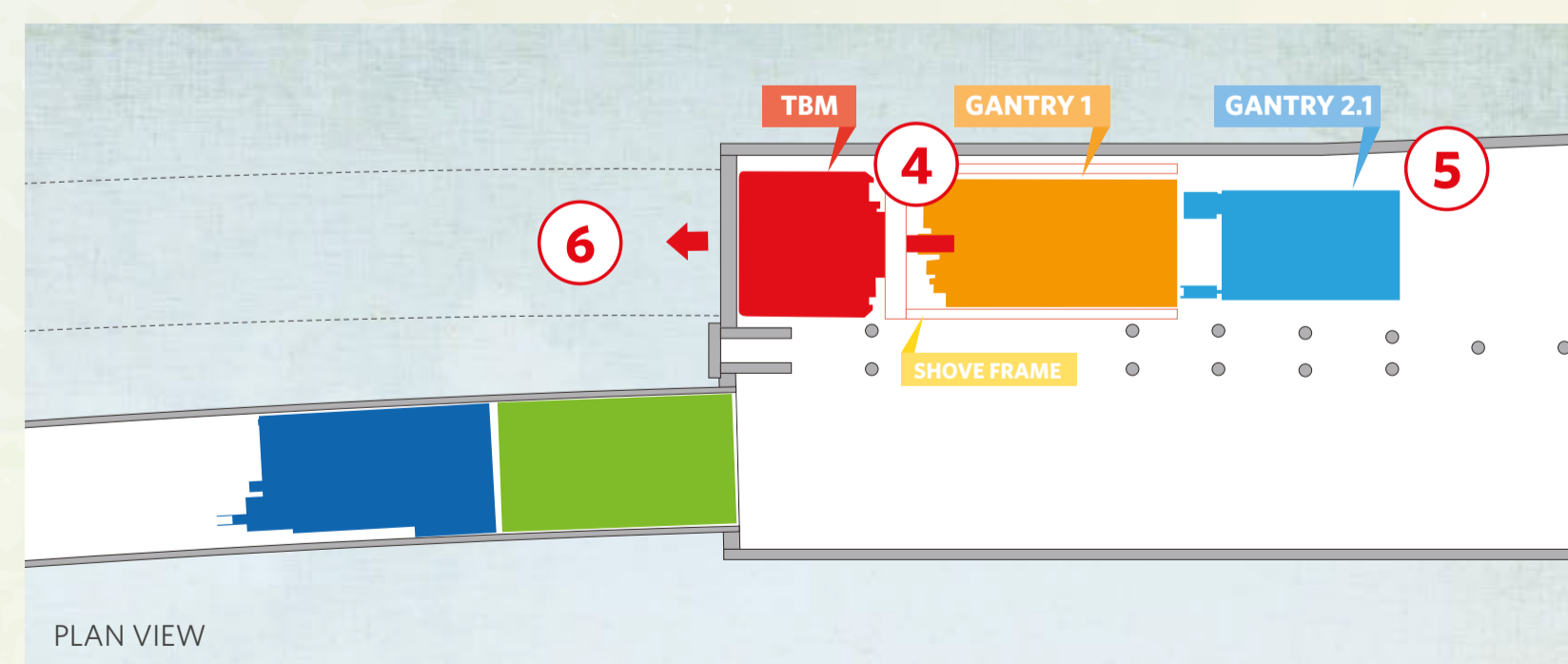
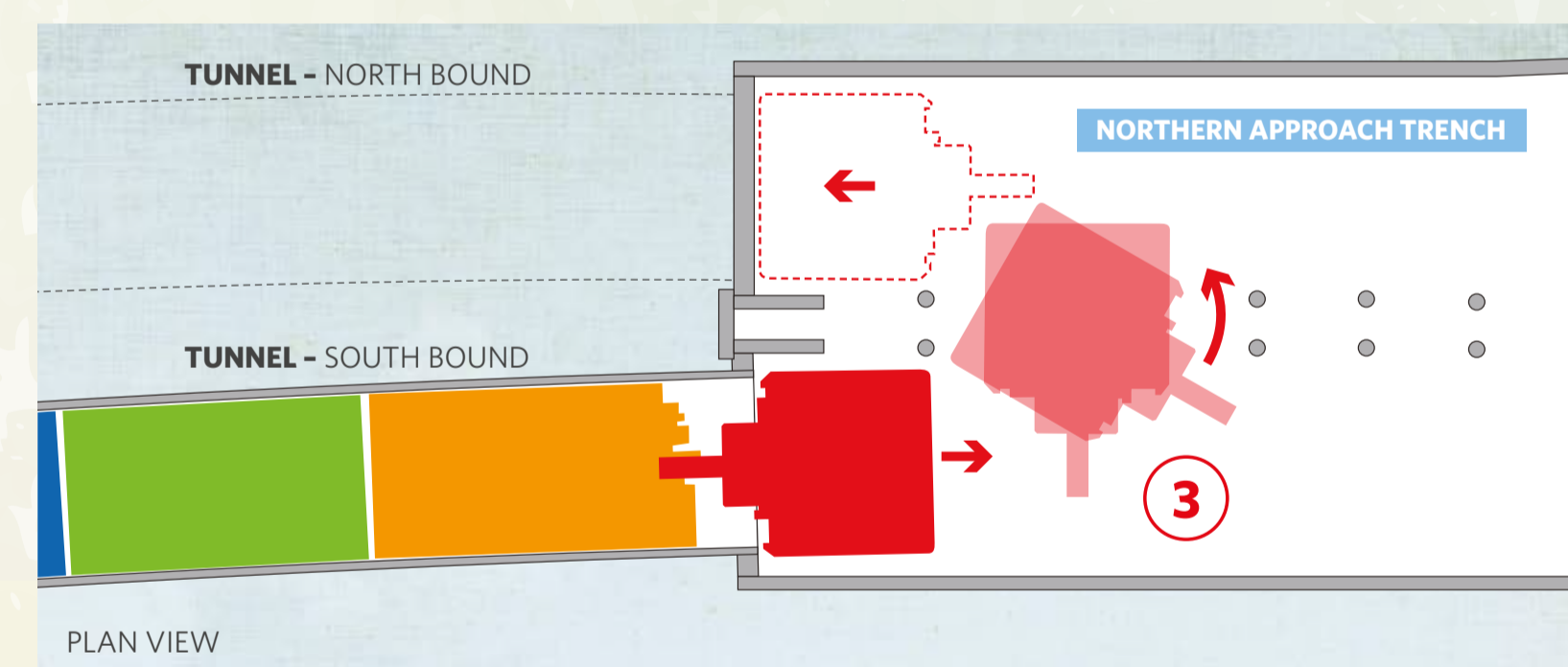
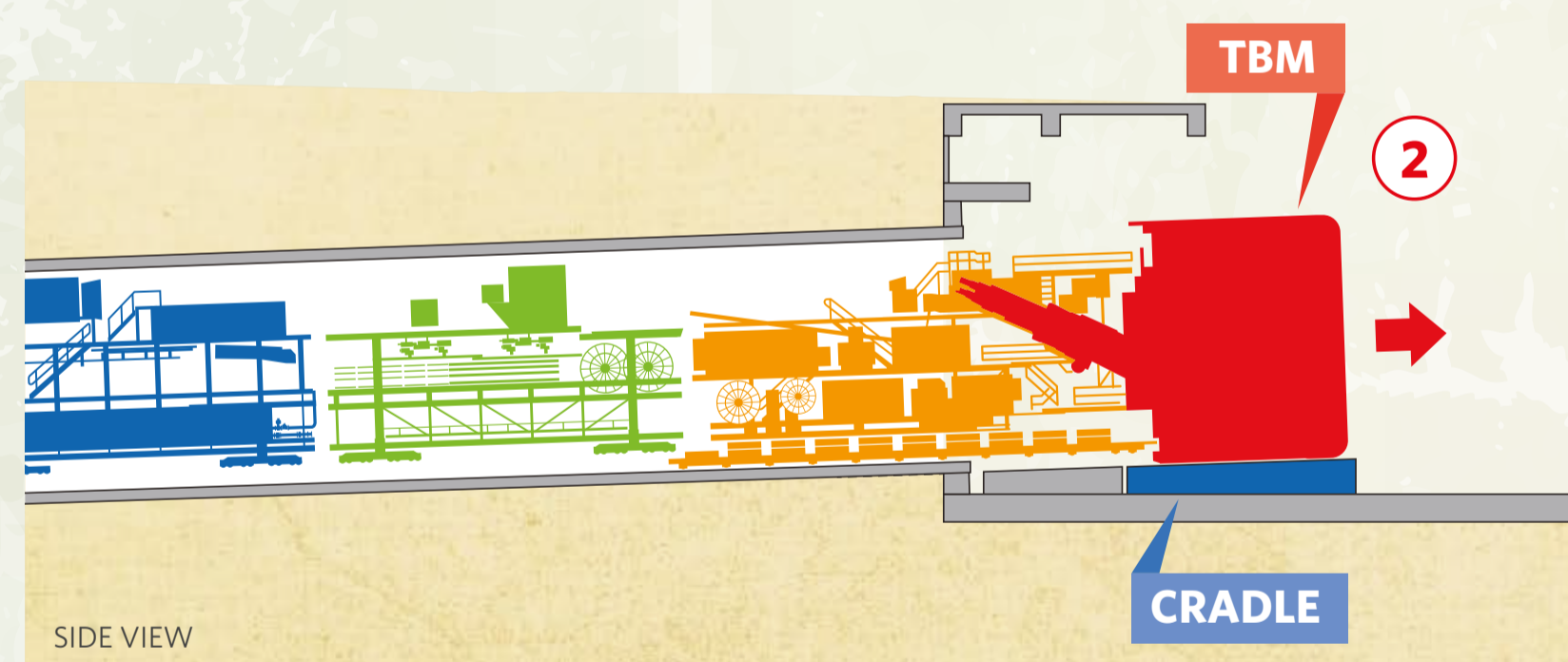
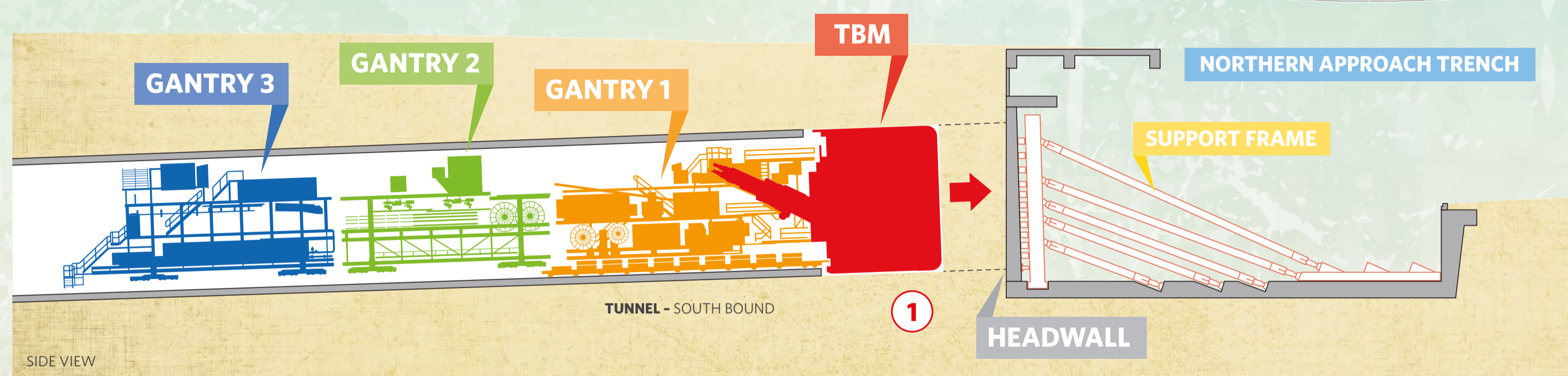
The weight increases to **3100t** and length to **87m** when the three gantries trailing Alice are included.



A short distance behind is a fourth gantry that works independently to install a culvert on the floor of the tunnel.

Services vital to the tunnelling operation also need to be turned. These include the conveyor system that removes excavated spoil and the cables that provide Alice and her crew with fresh air, power, water and communications.

Limited space is available to manoeuvre Alice and the supporting equipment into - in fact an area of only 42m by 42m with a pinch point between building columns of only 24m.



## HOW WILL IT BE DONE?

The shield and trailing gantries will be separated and taken one at a time, from the completed tunnel. They will each be moved sideways and turned 180° to face south - the direction they will travel underground.

Once the shield and first gantry are in place they will be launched to build the first 300m of tunnel. They will then stop so that the other gantries can be retrieved from the first tunnel, turned, and launched into position behind Alice.

The culvert gantry will be the last to be turned.

The entire operation will take approximately five months.

## THE TURN IN DETAIL

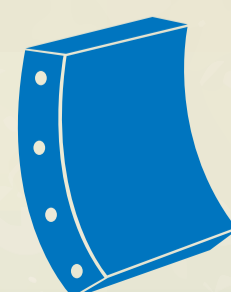
- As Alice approaches Waterview, a large steel frame is installed against the headwall of the Northern Approach Trench. The frame will support the wall as Alice breaks through.
- Alice breaks through the headwall. The headwall support frame is removed, and a large concrete receiving cradle is installed just under Alice. Alice moves out onto the concrete cradle, and then onto a second cradle, this one made of steel.
- Helped by hydraulic rams, the steel cradle is then slid across the cleaned and greased steel floor of the tunnel approach sump, turned and jacked up to her new start-up position.
- The process is repeated for Gantry 1, which is positioned behind the shield and reconnected.
- At this point, a smaller and lighter temporary gantry - called Gantry 2.1 - is introduced and positioned behind and connected to Gantry 1. (This gantry is needed because there's not enough space behind Alice for the full-sized Gantry 2.)
- Alice is re-launched using the same shove frame from her initial launch at Owairaka and builds the first 300m of the second tunnel.
- Gantry 2.1 is removed from the tunnel.
- Gantries 2 and 3 are removed from the first tunnel, turned, and installed in position behind Alice.
- Alice resumes tunnelling.
- The culvert gantry is turned to begin installing the services culvert in the second tunnel.

## IT'S A FACT!

**400,000m<sup>3</sup>** OF SPOIL has been excavated to build the first tunnel... That's enough to fill **160** OLYMPIC SIZE SWIMMING POOLS



**12,070** PRECAST CONCRETE RING SEGMENTS have been used to line the first tunnel



Environmentally friendly lanolin grease from NZ sheep's wool will be spread to help slide Alice across the floor of the tunnel trench to her new start-up position



The conveyor that removes excavated spoil from behind Alice will stretch for **5.5KM** from Owairaka to Waterview and back



Alice will be the largest tunnelling machine in the world turned around using this method.

IT COSTS **\$150,000** a day to operate Alice. That's the same as **50,000** BOTTLES OF FIZZY DRINK

