

[Questions and Answers](#) [1]

The following questions and answers come from the *Memorial Park* [Ask-an-Expert](#) [2] web board. This web board closed one month after the fourth and final field trip and a selection of posts were then moved to this page.

When you drive through the tunnel, do you drive the length or the width of the Park?

Hi Levi, you drive the length of the park as the trench is 300 metres long. Take a look at the [background pages](#) [3] to see the design drawings for the park to give you an idea.

Shelley - LEARNZ Field Trip Teacher

Why do you need 800 millimetre thick concrete and steel walls?

Hi Logan, ever had thin toast that ends up falling apart? Well it's a similar theory for the concrete. 400 millimetres is too thin and simply not strong enough to withstand the pressure from an earthquake. 800mm is a good thickness to hold up under that pressure.

Andrew - LEARNZ Field Trip Teacher

Why does putting the tunnel deeper make it earthquake proof?

Hi Paris, do you mean the piles? The piles have to be put in deep enough to go through the softer soil before reaching the bedrock. Once they are anchored in the bedrock it will stop the tunnel "floating" up with any liquefaction that may occur around the tunnel in the event of an earthquake.

Andrew - LEARNZ Field Trip Teacher

How much weight can the tunnel hold above it?

Hi there, the tunnel is built to hold quite a lot of weight. On each ten metre section of the roof, apart from the two metres of soil that is going to be placed on top, you could safely put three of the largest cranes on top and it would still be strong enough.

Andrew - LEARNZ Field Trip Teacher

Why is concrete the best material to use for the tunnel?

Hi Katrina, concrete is great because it can be moulded to the shapes the engineers want. It can be made to blend into the environment or stand out. It can also hold up under heavy compression (pushing force) in an earthquake. The steel that is put in the concrete can handle tension (pulling force) in an earthquake.

Andrew - LEARNZ Field Trip Teacher

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Because some of the retaining wall is made of timber, won't it rot?

Hi Morgan, the timber retaining walls were put there when the trench was being dug out. These were supposed to be removed later but it was found to be too costly to remove them so they are now staying. They have no major effect on the underpass. The timber is also treated to prevent rot from setting in.

Andrew - LEARNZ Field Trip Teacher

Who had the idea of for the construction and who got to choose the design?

Hi Kim, this decision was not the job of only one person. The design was done by a team and much discussion was had about the final design. There was a competition that designers could enter and the winning design became the design for Memorial Park. It took over five years to confirm design details and planning for the park.

Andrew - LEARNZ Field Trip Teacher

Why spend so much money on an underground road and how much will it cost all up?

Hi Andre, the project is costing 120 million dollars. When you see the amount of people, time and materials that are used for the construction of the park and underpass, it is pretty easy to see where all the money goes. This is more than just a roading project though Andre. This is the construction of a park for all New Zealanders and a place to remember all those who have served our country at war.

Andrew - LEARNZ Field Trip Teacher

What will happen if the project isn't finished on time?

Hi Sophie, nothing will happen as such. It would just mean that it will be unfinished when the 2015 ANZAC Day commemorations take place. But the project is on schedule and it would take a major incident to stop the team completing it on time.

Andrew - LEARNZ Field Trip Teacher

After a class discussion; Hamish would like to know why the roof doesn't fall down when the micro-cracks form?

Hi Hamish, the term micro-cracking refers to very small cracks that form in concrete but cannot be seen with the naked eye. Some micro-cracking occurs as a natural part of the concrete drying process, but it also occurs as pushing forces are applied. Basically, the roof doesn't fall down because of the amount of steel reinforcement in the concrete, as well as certain fibres that are mixed into the concrete (helping to stop microcracking).

Andrew - LEARNZ Field Trip Teacher

I would like to know how you test whether things will be strong enough? How do you simulate an earthquake? If you make a scale model how do you know how strong to make the earthquake? Do you build models or is it all done on computers?

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Hi David, here is the answer from Peter Lipscombe from the Memorial Park Alliance:

The question comes in four parts I'll tackle each separately.

I would like to know how you test whether things will be strong enough?

The size of the underpass is too large to test the whole structure so we need to test individual parts to ensure they will be strong enough. The underpass is made from reinforced concrete. To ensure this has the correct strength we test both the concrete and reinforcing bars. For testing the concrete we regularly take test samples of the concrete delivered to site. We let the concrete harden for 28 days and then crush the sample to measure its strength. To date we have crushed about 500 test samples. For testing the reinforcing bars, a short length of bar is taken from each batch of steel from the steel mill. The bar is stretched in tension until it breaks. The load and the amount of stretch are measured and recorded, these are both important to the design.

How do you simulate an earthquake?

Small scale models are tested in University Laboratories. We have not undertaken any specific testing for this project, instead we have relied on past testing. From the results of these experiments we can predict how the whole structure will behave.

If you make a scale model how do you know how strong to make the earthquake?

We predict earthquake forces by studying how much the ground is expected to move and how fast it moves based on measurements from past earthquakes. This varies depending on our location in the country. Wellington has some of the most severe shaking in the country and the Underpass has been designed to resist these forces. The models made in the Lab will be made to a scale, this may be 10 times smaller than the real structure. The earthquake forces and movements applied to the model will be scaled down by the same factor.

Do you build models or is it all done on computers?

Almost all of our design work is done on computers. We are able to build a model of the underpass on our computer and see how it will look when it is completed and how it will deform under different patterns of load.

Peter Lipscombe - Memorial Park Alliance

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Links

[1] <http://www.learnz.org.nz/memorialpark/questions-answers>

[2] <http://askanexpert.learnz.org.nz/>

[3] <http://www.learnz.org.nz/memorialpark134/bg-standard>