



Comparison of Aluminium and Steel Wall Culverts

CSP Pacific offer corrugated metal culverts made of aluminium or steel. This document explains the main differences between these two materials to help the Specifiers assess which product best suits their requirements.

Steel Multiplate culverts feature hot dip galvanised mild steel plate walls. The layer of zinc deposited by the galvanising process offers cathodic (sacrificial) protection to steel. Once the zinc has been expended, which in normal environmental conditions in New Zealand can take 10-20 years, corrosion accelerates as it starts to attack steel. This leads to a rusty appearance, loss of the wall thickness and, eventually, perforation. Galvanised steel culverts in New Zealand are designed using the “sacrificial wall thickness” method meaning that some loss of wall thickness is acceptable without compromising the structural integrity of the structure.

Steel culverts have the following advantages compared to the aluminium wall product:

- Mild steel, with a yield stress of 250MPa, is up to 40% stronger than an aluminium plate of the same thickness. Since the residual steel wall thickness decreases as a result of corrosion this advantage diminishes for culverts designed for service life longer than 25 years

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- Bolted connections in steel plates have higher capacity than aluminium so, for larger spans, less bolts will be required
- Mild steel, with the Young modulus of 205GPa, is three times stiffer than aluminium. The additional stiffness reduces culvert deformation during backfilling and in service
- Better availability of steel plate means that the lead times will normally be shorter than for aluminium
- Up to 5-10% cheaper than equivalent strength aluminium culverts designed for 25 - 50 years service life.

Aluminium Multiplate and **Multiplate 100+** culverts are made of marine grade 5052-H34 aluminium alloy. In contact with aggressive environment aluminium forms a protective layer of oxides which gives it corrosion resistance superior to steel. Unlike galvanised steel which corrodes faster once the zinc has been expended, the rate of corrosion in aluminium does not increase over time. While aluminium culverts are also designed using the “sacrificial wall thickness” method the rates of wall thickness loss are much lower than for steel (in low corrosion environments there is no loss of thickness at all).

The advantages of the aluminium culverts over galvanised steel are as follows:

- Superior durability which negates the price premium over galvanised steel for longer design lives
- Aluminium is three times lighter than steel which leads to substantial savings in freight, handling and installation
- Aluminium oxides are dull grey in colour so no “rusty” appearance in service
- Cheaper than equivalent strength galvanised steel culverts designed for 50+ years service life.

Based on the above comparison aluminium generally outperforms galvanised steel for little or no price penalty in culverts with design life longer than 25 years. The table below summarises the CSP Pacific recommendations for the culvert material, based on the required service life and environmental conditions:

Design life	Low corrosion conditions (including dry culverts /underpasses)	Mild corrosion conditions	Corrosive conditions
25 years	Steel Multiplate	Steel Multiplate	Specific Design – contact CSP Pacific
50 years	Steel Multiplate	Aluminium Multiplate	
75 years	Aluminium Multiplate	Aluminium Multiplate	
100 years	Multiplate 100+	Multiplate 100+	