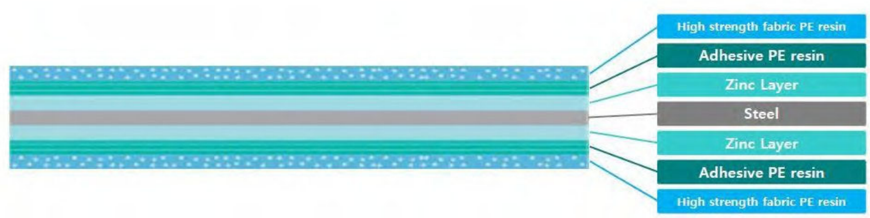
HPL PE-Coated Steel Culverts - overview.

HPL is a polyethylene-coated galvanized steel with the same steel strength and galvanizing weight (G250, Z600) as used in the manufacture of our standard culverts. The reinforced PE layer provides considerable additional protection to the underlying Z600 galvanizing resulting in substantially increased lifespan of the culverts even in the most aggressive conditions.

Unlike other PE-coated steels, HPL has a reinforcement layer within the polymer that provides very high resistance to abrasion, harsh environmental conditions and localized surface damage. The coating is applied on both the internal and external surfaces of the culverts, as shown below:



The HPL materials are available in wall thicknesses of 1.6mm to 3.0mm in the 68 x 13mm and 125 x 25mm corrugation profiles specified in AS/NZS 2041.4. The culvert diameter range will remain the same – 300mm to 3,650mm on our standard mills, with the potential for >4,000mm on our mobile mills.

The Australian Standard for helically-formed corrugated steel culverts, AS/NZS 2041.4:2010, allows for the use of the polymer coated steel materials, as detailed in Section 2.2, and reproduced below.

2.2 MATERIALS

2.2.1 Base material

The base material consisting of the base metal and a protective coating shall be—

(a) galvanized steel strip complying with the requirements of AS 1397 for steel base grade G250 and galvanized to Z600;

(b) aluminium cladding aluminium substrate strip classification Alclad 3004-H34 (7072 cladding and 3004 core) in accordance with AS/NZS 1734 and ASTM B744;

(c) steel strip of grade G230 minimum with an aluminized (Type II) coating in accordance with ASTM A929; or

(d) galvanized steel strip of grade G230 minimum and galvanized to Z600 with a polymer coating in accordance with ASTM A742.

Ref. AS/NZS2041.4

HPL has been tested independently to ASTM A742 and meets the requirements 2.2.1 (d) above in full. The tests include the following:

- Adhesion
- Impact
- Thickness
- Holidays
- Abrasion Resistance
- Imperviousness
- Freeze-Thaw Resistance
- Weatherability
- Resistance to Microbial Attack

In reviewing the ASTM A742 standard, it is important to note the PE coating thickness specified in ASTM A 742 is 250 microns per side. This is due to the standard being based on the original Trenchcoat materials produced by Dow Chemicals, the only product available at the time. HPL materials are a minimum of 550 microns per side, including the reinforcement layer, which significantly increases its abrasion resistance and overall durability performance.

Product Specifications & Features:

- PE coating thickness: 550 microns (double the ASTM A742 standard).
- Corrosion and abrasion resistance levels.
- Service life expectancy (100 years in normal conditions).
- Available corrugation profiles: 68x13mm and 125x25mm.
- Available wall thicknesses: 2.0mm to 3.0mm.

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In addition to testing to the above ASTM standard, we have carried out extensive Taber abrasions tests comparing HPL materials to both standard Z600 galvanized steel and Trenchcoat PE-coated steel. By conducting directly comparable tests for the three materials, we were able to assess the benefits of against the known performance of Z600, together with comparisons to the Trenchcoat PE. The testing was carried out as follows:

Abrasion test overview:

- The Taber abrasion tests have been carried out in accordance with ASTM D4060 – 14.
- CS-17 abrading wheels have been used, as per the above standard.
- The abrading wheels are resurfaced every 500 cycles, as per the above standard.
- The abrading wheels are loaded with a 1,000-gram load.
- Three sample materials have been tested:
  - G250 Z600 galvanized steel.
  - Trenchcoat PE-coated steel; and,
  - HPL – PE-coated steel.
- In the case of the Z600 galvanized steel, testing continued until bare metal was reached.
- In the case of the Trenchcoat PE-coated steel, the testing continued until the galvanized steel surface was reached. This was also originally the intention for the HPL, but testing was halted at 80,000 cycles without the galvanized substrate being reached. Given that both the Trenchcoat and the HPL coated materials are galvanized to Z600 prior to the application of the PE coating, we can assume the lifespan of the underlying zinc coating will be the same across all samples.

The Z600 galvanized coating was removed after 8,000 cycles. The Trenchcoat PE-coated steel failed at 40,000 cycles. Testing on the HPL materials was stopped at 80,000 cycles without reaching the galvanized substrate. The samples were then water-cut and micro-measured to assess the degree of material loss, as detailed below:

Material	Original coating thickness - µm	Average coating thickness - µm	Total Cycles applied
HPL PE-coated Z600 steel	600, 630, 550, 610, 570	592	80,000
Z600 galvanized steel	30, 40, 30, 30, 30	32	8,000
Trenchcoat PE-coated Z600 steel	330, 350, 330, 340, 330	336	40,000

Material	Wear scar - µm	Average - µm
HPL PE-coated Z600 steel	300, 280, 280, 320, 300	296
Z600 galvanized steel	10, 0, 0, 10, 0	4
Trenchcoat PE-coated Z600 steel	30, 20, 30, 20, 20	24

We can see from the above results, the HPL materials wear at a rate approximately half that of the Trenchcoat materials. Given that the HPL coating thickness is also double that of Trenchcoat, the overall performance of HPL has the potential to be eight times superior.

Approvals and Certifications:

Our HPL culverts have been approved by the following organizations:

- **MRWA** - Main Roads Western Australia (including Panel Contract No. 0054/24).
- **TMR** – Transport and Main Roads, Queensland (various projects).
- **ARTC** – Australian Rail Track Authority (Type Approval ref. NESA-T157).

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Culvert lifespan:

In terms of the expected lifespan of PE-coated steels, Section 3 of AS2041.1 details the estimated service life for PE-coated steel, against a range of pH and Resistivity values as shown in Table 3.7.2(E), copied below.

TABLE 3.7.2(E)

ESTIMATED MATERIAL SERVICE LIFE FOR POLYMER PRECOATED GALVANIZED STEEL

Estimated service life	Site environmental conditions	Maximum FHWA ID-85-15 (see Note 1) abrasion level
Minimum 100 y	$5.0 \le pH \le 9.0$ $r > 1500$ ohm-cm	Moderate (see Notes 1 and 2 of Table 3.4)
Minimum 75 y	$4.0 \le pH \le 9.0$ $r \ge 750$ ohm-cm	
Minimum 50 y	$3.0 \le pH \le 12.0$ $r \ge 250$ ohm-cm	

NOTES:

1 See Bibliography.

2 Polymer precoated material in accordance with ASTM A742.

As noted above, the estimated service life detailed in the above table assumes the thickness of the coating to be a minimum of 250 µm as per ASTM A 742. Given the additional thickness of the HPL coating, together with the significant results of abrasion tests, it is reasonable to expect the HPL materials to last well in excess of the service life estimates detailed in Table 3.7.2 (E).

In conclusion, the HPL PE-coated steel materials represent a significant move forward in the production of helically-formed steel culverts, offering end-users and specifiers a significant choice where durability remains a concern.
The material will provide substantial durability performance in aggressive environments and in areas where high abrasion rates are a concern, whilst offering the same cost- effective benefits of traditional steel culverts.

HPL PE-coated steel - close up

Designed for durability and engineered for all conditions, **HPL PE-Coated Steel Culverts** represent the next generation of high-performance drainage solutions. With industry-leading abrasion resistance and a 100-year service life, HPL sets a new standard in sustainability and strength—ensuring long-term reliability across the harshest environments.

Key Applications:

- Mining projects (Rio Tinto, South32).
- Large-span drainage culverts and tunnels.
- Heavy-load underpasses and stockpile tunnels.

On-Site Support Services:

- Installation guidance and QA support.
- Inspection and maintenance programs.

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