

TELSTRA INFRACO INTERCITY FIBRE NETWORK

Creating the network of the future
with sustainability in mind

With a huge explosion of data being used during the COVID-19 pandemic, and the rapid increase in digital bandwidth for day-to-day life and business, there has been increasing demand to upgrade the long-haul and access networks with high-capacity cable systems in Australia.

Telstra InfraCo has commenced a project to upgrade its Australian intercity long-haul transmission network. Telstra will boost its national fibre network, with new fibre paths being installed across the country. The network will provide high-speed connectivity transmission rates of up to 650Gbps – over six times the common rate of 100Gbps used today.

The intercity fibre network is unique because it uses dual-cable diverse architecture, which means two separate fibre networks (Express and Foundation) are being built simultaneously, connecting Australian capital cities with a minimum of two diverse paths between each city. This innovative architecture significantly increases network resiliency, enabling InfraCo to meet Australian demands for the next 25+ years.

In developing a new fibre cable for the network, Telstra InfraCo collaborated with Prysmian Group to develop a high-spec fibre optic cable with only 60% of the carbon footprint of its predecessor (see page 4 for more information). Combined with the benefits of local manufacturing and the deployment of a dual plough construction method, the project is forecast to deliver significant sustainability enhancements.

As a long-term strategic supplier, Prysmian has been selected to supply the fibre for the Foundation network as well as the cable for the Express network. Prysmian Australia is based locally in Sydney, enabling an efficient supply chain for a complex project and all the benefits of local manufacture.

Telstra InfraCo understood the importance of making the right technology choices from the start and minimising the build's carbon footprint – especially with a project of this scale. This is one of the social responsibilities of the business, which has been realised by working with Prysmian Australia on an advanced cable design.

This whitepaper showcases the new optical fibre cables in Telstra InfraCo's dual-cable diverse architecture, focusing on the advanced cable design and the sustainability benefits it delivers.

1. CABLE DESIGN INNOVATION

Several cable designs were considered for the new fibre types being selected for Telstra InfraCo's Express and Foundation fibre networks.

The most critical part of the network is in regional and remote areas that don't use ducts, as this is the majority of the new build footprint. Reactive soils are a particularity of the Australian terrain, so the chosen cable design must also be resilient enough for these conditions.

Prysmian's High Strength EXTR@CORE® (HSe) direct buried cables have been proven for many years to be suitable for use in Australia's tough climate.

The conventional 144f cable from the Telstra InfraCo catalogue was a 144f High Strength EXTR@CORE® cable that had a large diameter of 23mm.

The existing size and weight of the cable was not optimised for the dual plough network as it did not meet the budgetary, logistical, or sustainability goals set for the project. As such, reducing the size of the cable became the focus of its development.



Consideration was made into the bend insensitivity of the BendBright® A2 Low Loss fibre and it was believed that a 24f/tube design could behave the same way as a 12f/tube design. This had the potential to half the number of tubes and greatly reduce the overall size of the cable.

Significant research and development was undertaken by Prysmian to ensure cable performance and reliability. A large amount of fibre characterisation tests were conducted during the R&D phase, as well as production phases, to verify the cable attenuation. Special axial compression resistance (ACR) tests were performed to understand cable behaviour in the Australian reactive soil environment. Suitability in this environment was a requirement set by Telstra InfraCo.

After months of development, the new 24f/tube cable design was ready (see Table 1). The shrinking of cable size did not adversely affect the mechanical characteristics either, with the same figures being maintained.

Prysmian's High Strength EXTR@CORE® direct buried cables have been proven to withstand Australia's tough climate and reactive soils.

High Strength EXTR@CORE® with small form factor cable design

Characteristic	Previous design	New design	Reduction (Value, %)
			
Cable diameter (mm)	23.0	14.8	8.2, 36%
Cable cross-sectional area (mm ²)	415	172	243, 59%
Cable weight (kg/km)	394	180	214, 54%
Tensile strength (kN)	4	4	–
Crush (kN/100mm)	6	6	–
Impact (J)	20	20	–
Axial compression resistance test	Pass	Pass	--

Benefits of this size and weight reduction

- Reduces the cost of the cable directly by using fewer materials and less production time.
- Increases the available length on the drum from 5 km to 12 km, for the same size drum.
- Reduces the number of drums in the supply chain, greatly lowering logistics and storage costs.
- Longer drum lengths reduce the quantity of joints, greatly reducing civil and splicing installation costs.
- Longer available drum length provides planners with more flexibility when planning fibre path.
- Reduces quantity of joints, removing optical loss from the network.
- Significantly increases the quantity of cable that can be delivered on a truck, thus reducing fuel usage and costs.

After extensive investigation and analysis by Telstra InfraCo, the cable designs selected were Prysmian High Strength EXTR@CORE® direct buried cables, SM@RTCORE® loose tube and FlexTube® cables. Variants of these cables suitable for underwater and rat proof applications will also be used.

2. WITH SUSTAINABILITY IN MIND

Both Telstra InfraCo and Prysmian have committed to lower emissions. Since the project commenced, both parties have worked together towards the same goal of reducing its carbon footprint. Given the very high quantity of direct buried cable to be deployed, the new compact HSe cable design reduces the use of plastic which results in an estimated CO₂ reduction of 833 kg/km from the new cable.

Prysmian has developed proprietary system that estimates the carbon footprint of cables.

The system estimates the CO₂ emissions created from raw materials and from the cable production process. This information has been used by Europe's distribution system operators (DSOs) and transmission system operators (TSOs) to rate their suppliers from a sustainability point of view.

Using this software, the carbon footprints of the 12f/tube design and the new 24f/tube design High Strength EXTR@CORE® Cable have been estimated and compared, as shown below in Table 2.

Table 2

High Strength EXTR@CORE® CO₂ comparison between previous cable design and new design

Characteristic	Previous design	New design	Reduction (%)
CO ₂ from fibre in cable	100%	96%	4%
CO ₂ from plastic materials in cable	100%	45%	55%
CO ₂ from production processes	100%	64%	36%
Total CO ₂	100%	61%	39% (833kg/km)

In addition to the carbon emissions avoided from manufacturing, the CO₂ reductions from transportation are also significant, given the project will be rolled out across Australia.

On average, cable will be transported 2,000 km from factory to installation site. Based on this estimation, the CO₂ emissions from transportation will be reduced by 58%, or 46 kg per km of this cable. By adding the reduction of CO₂ from production and transport, the estimated reduction becomes 879 kg per km cable.

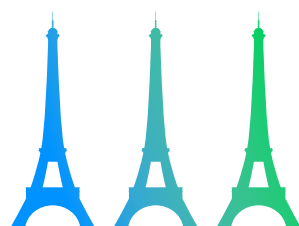
Considering 20,000 km route distance and dual cable diverse architecture, it is estimated that 35,176 tonnes of CO₂ emissions will be avoided at the end of the project, which is the equivalent weight of more than 3 Eiffel Towers, or the equivalent carbon produced from 4 million gallons of gasoline consumed, or carbon sequestered by 581 thousand tree seedlings grown for 10 years*.

Indirect effects such as reducing the number of splicing joints in the network which further reduce the material, civil work, transportation, and installation footprint are harder to quantify but will all contribute to the reduction of the carbon footprint.

By the end of this project, an estimated 35k tonnes of CO₂ emissions will have been reduced.



The equivalent weight of 3+ Eiffel Towers



*Carbon equivalents calculated using www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

CONCLUSION

Telstra InfraCo is building a world-leading fibre optic network with premium optical performance to offer their customers high bandwidth and performance.

Cable technology developments have significantly reduced the carbon emissions and the cost of the build without compromising their ability to survive the harsh Australian environment.

Coupled with Prysmian's fibre cable manufacturing capability, Telstra InfraCo has developed a full fibre optic network solution that will support current and future transmission requirements for years to come.

About Telstra InfraCo

As Telstra's specialist infrastructure business, Telstra InfraCo is committed to opening up newer and easier ways for customers to access Telstra's infrastructure portfolio. The business serves three customer segments, with more than 200 customers in total: Wholesale in Australia, NBN Co, and the broader Telstra organisation. InfraCo's asset boundaries include mobile towers, all fibre, and network supporting infrastructure, the Public Switched Telephone Network (PSTN), and legacy fixed and satellite infrastructure. Currently, Telstra InfraCo is accountable for 250,000 kilometres of fibre optic cable, 360,000 kilometres of ducts, 8,000 mobile towers, masts and poles, 5,000 exchanges, two data centres, and access to 400,000 kilometres of sub-sea cables.

About Prysmian

Prysmian Group offers the widest range of services and know-how in the business. Each year, the Group manufactures thousands of kilometres of underground and submarine cables and systems for power transmission and distribution, as well as medium and low voltage cables for the construction and infrastructure sectors. We also produce a comprehensive range of optical fibres, copper cables and connectivity systems for voice, video and data transmission for the telecommunications sector.

The Group builds on 150 years of experience, 30,000 employees and diversity in over 50 countries, to be the world leader in cables and systems.



www.prysmian.com

AUTHORS

Miled Abdulnour

Principal, Design Authority,
Telstra InfraCo

Terry Koerntjes

Network Senior Engineer,
Telstra InfraCo

Kent Huang

Technical Sales Support,
Prysmian

James Rando

Telecom Business Manager,
Prysmian

Richard Beattie

Telecom Commercial Director,
Prysmian

Follow us

