TROPICAL SUSTAINABLE DESIGN CASE STUDIES

Skyrail

Project type: Commercial

Location: Caravonica to Kuranda, QLD, Australia
Year completed: 1995

- **One of Australia's most successful nature-based tourist attractions, and the world's most environmentally sensitive cableway project**
- **Extensive planning approvals, feasibility studies & world's best practise construction techniques in World Heritage rainforest**

OVERVIEW

The family owned Skyrail was conceived in 1987. It was proposed that a 7.5 km long cableway, the longest in the world at the time, be constructed in the rainforest from Caravonica to Kuranda. The developers were committed to delivering an environmentally sustainable tourist attraction that allows a unique interaction with the rainforest in an environmentally friendly way.

The process was arduous with seven years of extensive planning. Community responses to the construction of Skyrail through the Barron Gorge National Park and the newly listed Wet Tropics World Heritage Area quickly became polarised as being either for or against the project. The controversy and political attention was reported widely at the time.
After numerous studies and approval processes ensuring the rainforest habitat would not be threatened by the project, construction commenced in June 1994. The Skyrail project and construction required 'world first' construction techniques which have helped place it as the most environmentally sensitive cableway project in the world.

The cableway was originally installed with 47 gondolas, giving it a carrying capacity of 300 people per hour. A $2.5 million upgrade completed in May 1997 increased the total number of gondolas to 114 and increased the carrying capacity to 700 people per hour.

The successful application of sustainable practice in the planning, construction and ongoing operation of Skyrail has resulted in awards and recognition worldwide. It has been awarded some of the most internationally respected eco-tourism awards including the British Airways 'Tourism for Tomorrow' International Environment Award, and EIBTM European Greening of Business Tourism Award in the Category of 'Most Environmentally Conscious Visitor Attraction'.

In 2012 it became the first tourism attraction in the world to achieve the Platinum EarthCheck Accreditation placing it amongst the world's leading eco-friendly and environmentally sustainable businesses.

In Australia in 2008 and 2009 Skyrail received the Qantas Award for Excellence in Sustainable Tourism. In 2010 Skyrail was accepted into the Queensland Qantas Award for Excellence in Sustainable Tourism, Hall of Fame.

PLANNING AND MANAGEMENT

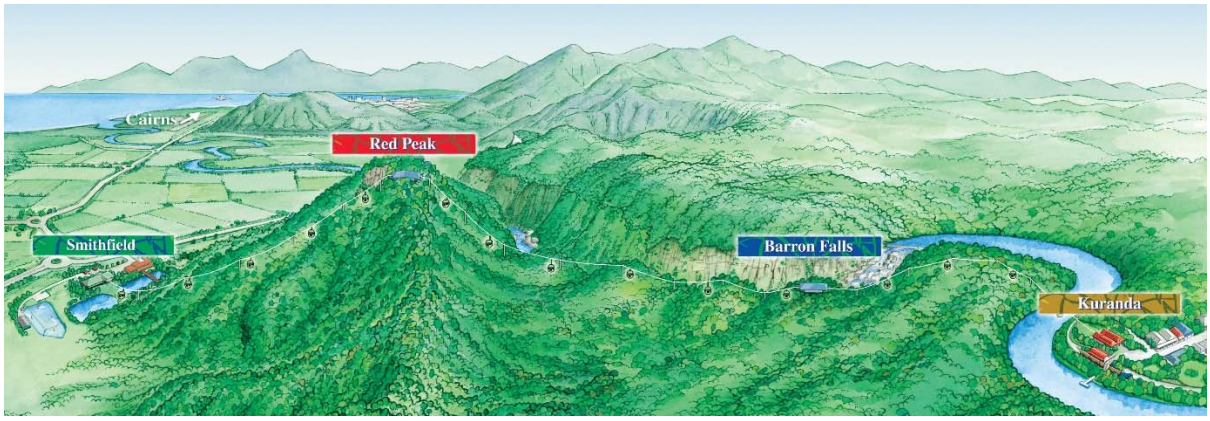
Seven years of pre-construction feasibility studies included an Environmental Impact Study and numerous other reports and assessments, and consultation and approval processes with 23 different local, state and federal government agencies. Despite environmental protest, approval was finally granted and construction began in 1994.

Skyrail's tower sites were selected to coincide with existing canopy gaps and clearings, and were surveyed to ensure no rare, threatened or endangered species would be affected by construction. Before construction commenced on the tower sites, the leaf litter and top soil was collected and stockpiled for reintroduction when construction was complete. Plant seedlings were catalogued at each site, then removed and propagated during construction, and re-planted in their original locations, with the saved top soil and leaf litter, when construction was complete. As a result, the environment was returned to its original state as much as possible.

Due to the size of the tower sites, they were difficult to locate from the air, and GPS satellite navigation and radio communication was used to enable the helicopter crews to pin point the ground crews and tower sites.

Specialist, heavy-lifting, Russian Kamov helicopters were used extensively to assist construction. The helicopters were used to carry equipment, materials and cement to tower sites and rainforest stations. To prevent wind turbulence from disturbing the delicate rainforest canopy, the loads were dangled from 100 metre long lines, so that the blades never came close to the trees. The towers themselves were flown-in in sections and assembled on site; some tower sections weighed up to five tonnes each. The cableway haul rope was then laid and tensioned across towers by the helicopters.

SITE



Skyrail passes through the Barron Gorge National Park and the Wet Tropics World Heritage Area, the latter being listed due to its outstanding universal/global value. The Wet Tropics World Heritage Area has worldwide recognition for its spectacular scenery, rugged topography with fast-flowing rivers etched with deep gorges and cascading waterfalls and panoramas of undisturbed rainforest as far as the eye can see. Stretching from Cooktown to Townsville in tropical north Queensland, this area is a living museum of ancient plant and animal species found nowhere else in the world. Wet Tropics World Heritage Area forests are home to many rare and endangered animal species, some that have changed very little since prehistoric times.

Red Peak is Skyrail's highest station at 545 metres above sea level (1,788 feet). The Kuranda Station sits at 336 metres (1,100 feet) and Smithfield Terminal is only 5 metres above sea level (16 feet).

Crews cleared an area no larger than 10 metres by 10 metres to build each cableway tower, and towers were placed as far apart as possible.

The tower footings were built largely by hand, up to five metres deep in some cases, using picks and shovels. There were no roads built during Skyrail's construction. Workers had to walk in to the remote tower sites each day, carrying their equipment, which took up to an hour each way. Contamination was rigorously managed with boot sterilisation occurring before going in and out of the rainforest.

In 1995, Skyrail introduced full time Rangers to conduct interpretive boardwalk tours at Red Peak Station and in 1996 the CSIRO released 'The Dynamic Rainforest' CD ROM. This product features rainforest information and facilities featured in the CSIRO Interpretation Centre at Skyrail's Barron Falls Station.

DESIGN

There are 32 towers in total. The highest tower is 40.5 metres (133 feet) high.

An interesting aspect of the design is the prefabricated roof steel space frames which were designed for 80m/s cyclonic wind loads, helicopter transportation and placement. Major considerations were weight and tolerances of specifically designed connections for placement by helicopter.

The engineering design pushed the limits of structural efficiency. This not only had a huge bearing on cost outcomes it also reduced the overall construction mass in this sensitive natural environment.

The Red Peak and Barron Falls Stations were designed to blend in with the rainforest surroundings and minimise environmental impact, and were built in pre-existing clearings. Red Peak Station is nestled amongst pristine rainforest with a 175 metre long boardwalk to explore the forest from ground level. The Station is surrounded by towering trees, lush palms, giant ferns and a diverse array of plants and wildlife.

The Barron Falls station is also home to the state-of-the-art Rainforest Interpretation Centre. The Centre, developed in conjunction with CSIRO, Australia's premier scientific research organisation, houses a visual and interactive presentation of the rainforest environment.

The Smithfield terminal is open plan and breezy, designed in a traditional Queenslander style of architecture with wide verandahs and open access areas, making it easy to access the Skyrail's ticketing and boarding pass collection point. The Kuranda terminal is designed to complement the heritage listed Kuranda Scenic Railway station buildings built in the early 1900's.

MATERIALS

The main structures are primarily built of steel, reinforced concrete and composite steel and concrete floors. Helicopters transported 900 tonnes of steel, cement and building materials into the Red Peak Station site alone.

The Red Peak station was originally to have separate foundations for the POMA cableway structures. The extent of the underground concrete footings proposed by POMA from the USA was reviewed by local engineers. Innovative engineering solutions reduced the size of the footings by incorporating the tail wheel tower footings with the building footings. 150 cubic metres of concrete was saved from having to be helicoptered in.

There is a multi-core communications cable which runs in the middle of the towers, between the two lines of haul rope. This carries all the voice and safety circuit communications.

Innovative design also minimised the lengths of steelwork for helicopter lifting and employed permanent steel formwork for concrete slabs to minimise standard scaffolding and formwork propping requirements in this sensitive environment.

Skyrail Rainforest Cableway also has 15 kilometres of 40.5mm galvanised steel rope weighing more than the equivalent of 100 sedan cars.

ENERGY

Over 90% of infrastructure lighting is fluorescent, rather than incandescent. Air conditioning is installed only in administration areas and areas housing sensitive electronic equipment. Maximum use of natural light is encouraged in buildings during daylight hours.

The need for air conditioning and lighting is minimised through the passive design of buildings. Automatic controls (e.g. timers, movement sensors) and a solar powered communication system service all cableway gondolas.

The cableway is driven by a 383kW (500hp) D.C Electric Motor located at each drive station, the Kuranda and Smithfield Stations. Each drive station has a back-up diesel motor and a further auxiliary Hydrostatic Drive.

WATER and WASTE

Skyrail is committed to using minimal water in its operation and to protecting the World Heritage values of the rainforest by eliminating the possibility of harmful liquid waste entering the rainforest. Initiatives to reduce freshwater use and wastewater generation include:

- Monitoring water quality from stormwater and testing for hydrocarbon and diesel as a part of this process
- Installing only cold water taps in toilet facilities at all stations using bore water for garden irrigation wherever possible
- Installing rainwater collection tanks where the rainwater undergoes ultra violet sterilisation for use at Skyrail's mid-stations
- Installing Clivus Multrum composting toilets and a set of detailed procedures are including in an Integrated Environmental Management System for testing and removing Liquid End Product (LEP)

OWNERS/USERS STATEMENT

I LOVE the Skyrail. ♥
The views over the whole area are amazing and also a great way to see the Rainforest.
It is a very unique experience. I would love to work there!
Facebook testimonial by Shelly Hahn, visitor

Comments from the Visitors Book at the CSIRO Rainforest Interpretation Centre at Barron Falls:

Victoria Corse from Boston USA: Remarkable preservation work, so extraordinarily beautiful.
Chris and Zita from New Zealand: Beautiful, amazing waterfall.
Rosanna and Nathan from Australia: Stunning views! Will have to come during full flood to see Barron Falls!
Odell family from Brisbane Australia: Very informative.
And G Flynn from Dublin Ireland: Out of this world experience!

PROJECT TEAM
Original project:
Architects of Smithfield, Red Peak, Barron Gorge, Kuranda Terminal buildings and Interpretive Centre: Clarke and Prince
Gondolas and associated technology: POMA USA
Structural Engineers: Colefax Clayton Smith (now Cardno of Cairns)

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