

# THE RIO ABAJO FOOTBRIDGE




**Kiewit**

**COWI**

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A low-angle, silhouette photograph of two men standing on a suspension bridge. The bridge's steel truss structure and numerous suspension cables are visible against a bright, hazy sky at sunset or sunrise. The sun is a glowing orb on the horizon, creating a strong backlight effect. The man on the left wears a wide-brimmed hat, and the man on the right is in a light-colored shirt. A wooden ladder-like structure is attached to the bridge's tower on the right. The overall mood is contemplative and industrial.

“When constructed, Rio Abajo was Bridges to Prosperity’s second longest suspension bridge worldwide, and the longest suspension bridge in which the superstructure was completed on an accelerated construction schedule of 8 days. The joint COWI and Kiewit team were given limited resources in a rural environment to complete the project. They had to overcome challenges including not having electricity on site, a language barrier between the team and the local community work force and the blistering heat of tropical weather in the dry season.”

Brandon Johnson – Bridges to Prosperity Director of Programs

# PROJECT INFORMATION

## PROJECT NAME

The Rio Abajo Footbridge

## LOCATION

N13 22.300' W86 27.544' Rio Abajo, Esteli, Nicaragua

## YEAR COMPLETED

2015

## CATEGORY

I. Community Outreach and In-House Initiatives

## ENTERING FIRMS

COWI North America Ltd. (formerly Buckland & Taylor)

Kiewit Bridge & Marine

## ROLE OF ENTERING FIRMS

COWI North America Ltd - Corporate Partner responsible for sponsorship, design review and construction

Kiewit Bridge & Marine - Corporate Partner, responsible for sponsorship and construction.

## CONTACT NAMES

Hendrik Westerink, P.Eng. - Project Engineer (Engineering inquiries)

Hannah Price - Marketing Administration (Gala inquiries)



"I've worked on many larger bridges around the world, but none have provided the sense of joy and satisfaction that the Rio Abajo bridge has."

Don Bergman -  
COWI Senior Vice President and  
Project Director





## PROJECT HIGHLIGHTS

### NATURE OF THE PROJECT

Bridges to Prosperity (B2P) is a non-profit organization that works with bridge designers and constructors, local governments and student groups to build essential footbridges with rural communities in underdeveloped parts of the world. B2P has completed more than 200 footbridges around the world since its inception in 2001. In 2015, COWI Bridge and Kiewit Bridge & Marine volunteered with B2P to construct the Rio Abajo Footbridge in Nicaragua – a vital crossing over the dangerous Pueblo Nuevo River that divides the isolated community of Rio Abajo and the larger town of Pueblo Nuevo.

Rio Abajo is a 3,000-person community with little more than a primary school and corner store. Many of the Rio Abajo residents work in agriculture, producing tobacco, grains and vegetables to sell at local markets. The town is a 30-minute walk from Pueblo Nuevo, a larger town that offers essential facilities such as a health clinic, secondary school, stores and markets. However, without a bridge to cross the river that separates the towns, during rainy season, the Rio Abajo residents must walk two hours in the opposite direction to another major town or swim across the fast-flowing river to Pueblo Nuevo. The flooded river prevents children from attending school year-round, inhibits the ability of farmers to deliver their goods to market, and creates a barrier to accessing healthcare services.



The goal of the project was to create a year-round link between these communities by building a footbridge with members of the Rio Abajo community and training them in the upkeep of the bridge. The wide river crossing required an 81-metre long bridge, which is B2P's second largest suspension bridge worldwide. COWI Bridge and Kiewit each donated \$25,000 to cover the cost of the project and sent a combined crew of 12 volunteers to construct the bridge with the local residents. The team constructed the bridge during the region's dry season when the river levels were quite low, enabling construction access across the river. COWI Bridge also completed an extensive design review of the footbridge design by B2P. The footbridge design review and construction was a formidable task that completely relied upon the volunteers being willing and keen to take on a project that decreases poverty and effects positive change in a community.

The project was a great success, with the superstructure completed on an impressive accelerated bridge schedule of just eight days. Key to this achievement was the strong teaming effort: COWI Bridge's design review complemented Kiewit's construction expertise and the team worked well with the local volunteers to keep the project moving forward, despite the language barrier and logistical challenges that come with construction in a rural, underdeveloped country.







## EFFORT AND COMPLEXITY

### COMPLEXITY AND CHALLENGES

When constructed, the Rio Abajo Footbridge was Bridges to Prosperity's second longest suspension bridge worldwide, and the longest suspension bridge in which the superstructure was completed on an accelerated construction schedule. Scaling up the size of the bridge also meant scaling up the complex project challenges the team had to overcome, which included constructing with a lack of resources in an underdeveloped rural environment. For example, when erecting the large steel pipe towers required for a bridge of this scale, the team planned to use a cable winch attached to the back of a truck located in the dry portion of riverbed. However, the weight of the towers overcame the truck's resistance and the vehicle began to slip forwards. With limited options available, the team loaded the truck with extra weight to increase the dead load. This on-site improvisation is just one example of the resourcefulness that was required to successfully complete the project in such a short time frame.

Other challenges that the engineers had to overcome were working with a language barrier and teaching an inexperienced work force about bridge construction and jobsite safety. Local volunteers donned personal protective equipment, many for the first time in their lives, and communicated with the bridge professionals using hand gestures and rudimentary Spanish to complete the construction of this vital footbridge. In addition, a lack of availability of construction equipment meant that the volunteers had to lift many of the heavy bridge components into place using manual labour. For example, the 9-metre tall steel pipe towers, each weighing close to 700 pounds, had to be moved using more than 15 volunteers. Overcoming these challenges required resourcefulness and flexibility from the entire team.



### EFFORT AND COMMITMENT

In addition to travelling to Nicaragua to construct the bridge, COWI Bridge completed a design review of the B2P-designed footbridge. More than 20% of COWI Bridge's engineering staff voluntarily worked on this review. The design was divided into six packages, each of which was reviewed by a designated team. Several volunteers also modelled the footbridge in COWI's in-house structural analysis software to confirm assumptions that B2P had used in the design of the bridge. As well as reviewing the Rio Abajo design, COWI Bridge was able to provide recommendations for improvements of B2P's standard footbridge design, which B2P has now implemented into their design package. This exercise allowed COWI Bridge to utilize its significant experience in the design of cable-supported bridges for the betterment of future B2P projects. Furthermore, the four engineers who travelled to Nicaragua to complete the construction did so entirely using their own funds and vacation time. The hours to plan and complete the project- the flights, fundraising, transportation and accommodations – all came out of their own time and pocket.

From a financial standpoint, COWI Bridge split the cost required for the bridge materials with Kiewit, each donating \$25,000. This significant financial contribution from a small engineering firm amounts to more than \$150 per COWI Bridge employee. In addition to the capital cost of bridge construction, Kiewit and COWI Bridge employees internally fundraised more than \$2000 that was used to buy school supplies, sports equipment and fruit trees for the elementary school in Rio Abajo.





## SOCIAL, ECONOMIC AND OTHER BENEFITS

Nicaragua is the second poorest country in Latin America and poverty is most prevalent in rural areas. The World Bank estimates that just 655,000 of Nicaragua's 2.3 million rural residents live less than two kilometres from an all-weather road.<sup>1</sup> This means that when rivers swell during the rainy season, rural residents can either become completely cut off from essential services for several months every year, or face a life-threatening journey to access them. The provision of year-round river crossings noticeably increases economic development and improves children's literacy rates. One study in Andhra Pradesh, India that investigated three rural districts found that households with all-weather road access averaged more than double household income compared to those without access. Households with all-weather access also had, on average, a female literacy rate that was 60% higher than those without access.<sup>2</sup>

Before the Rio Abajo Footbridge was constructed, the 3,000 residents of Rio Abajo faced a two-hour walk to the second nearest town or risked crossing the dangerous river to get to school, work or the market in Pueblo Nuevo. Briselba Zavala Morales, a Rio Abajo elementary school teacher, told the B2P team of how she would swim across the river to work each day. During her pregnancy, she narrowly escaped when the flooded river caught her and dragged her downstream. She has heard of this happening to children, too.



With the new footbridge, Rio Abajo residents can now safely travel to work or the market. The bridge keeps schools open, providing opportunities to improve literacy rates and advance education. It creates a reliable route to markets for farmers selling their crops during the rainy season, a time of year when agricultural activity is at its highest, but the river levels are at their most dangerous. The bridge diminishes isolation. Life in Rio Abajo stabilizes, and the local economy can develop and move towards self-sufficiency.

Working on the Rio Abajo Footbridge also benefitted the local volunteers by providing them with practical skills that they can use to find fu

ture employment and repair the bridge when needed. The local involvement also generated a sense of ownership of the bridge. More than 150 families in the community donated labour or supplies to the bridge project. Fermin Garcia Espinoza, a Rio Abajo father of five, donated 30 days of his time towards the construction of the bridge and worked alongside the project team to construct the superstructure. The time and energy that the community invested in the bridge will ensure that the bridge will be repaired when needed so that it can provide access to opportunities for years to come.

This project demonstrates the importance of crucial infrastructure to everyday life around the world. It illustrates the importance of structural engineering; providing a bridge gives access to trade and essential services that towns do not have when isolated. Communities need year-round access to essential services to live in a state of stability and prosperity, and the provision of this access to the community of Rio Abajo is the greatest achievement of the Rio Abajo Footbridge.

<sup>1</sup> Roberts, P., KC, S. & Rastogi, C. 2006. Rural Access Index: A Key Development Indicator, World Bank Group, Washington, D.C., USA.

<sup>2</sup> Lebo J and Schelling D. 2001. Design and Appraisal of Rural Transport Infrastructure: Ensuring Basic Access for Rural Communities. The World Bank, Washington, DC, USA, World Bank Technical Paper No. 496.



“I am a teacher here in Rio Abajo. I know from experience what it was like to cross this river before there was a bridge. I used to cross the river almost every day from the neighboring town of Santa Teresa. We teachers used to have to cross the river no matter what to do our jobs. At one point, when I was pregnant with my second daughter, I was caught by the current and dragged downriver. This has happened to kids, too. Some kids who cannot access the bridge will still have problems crossing and will need an adult to help them cross. Thankfully for us in Rio Abajo, this bridge changes the story and I want to express my gratitude to the team that built the bridge for its excellent work. This project has been extremely valuable to this community.”

Briselba Zavala Morales – Rio Abajo Elementary School Teacher  
Brandon Johnson – Bridges to Prosperity Director of Programs

