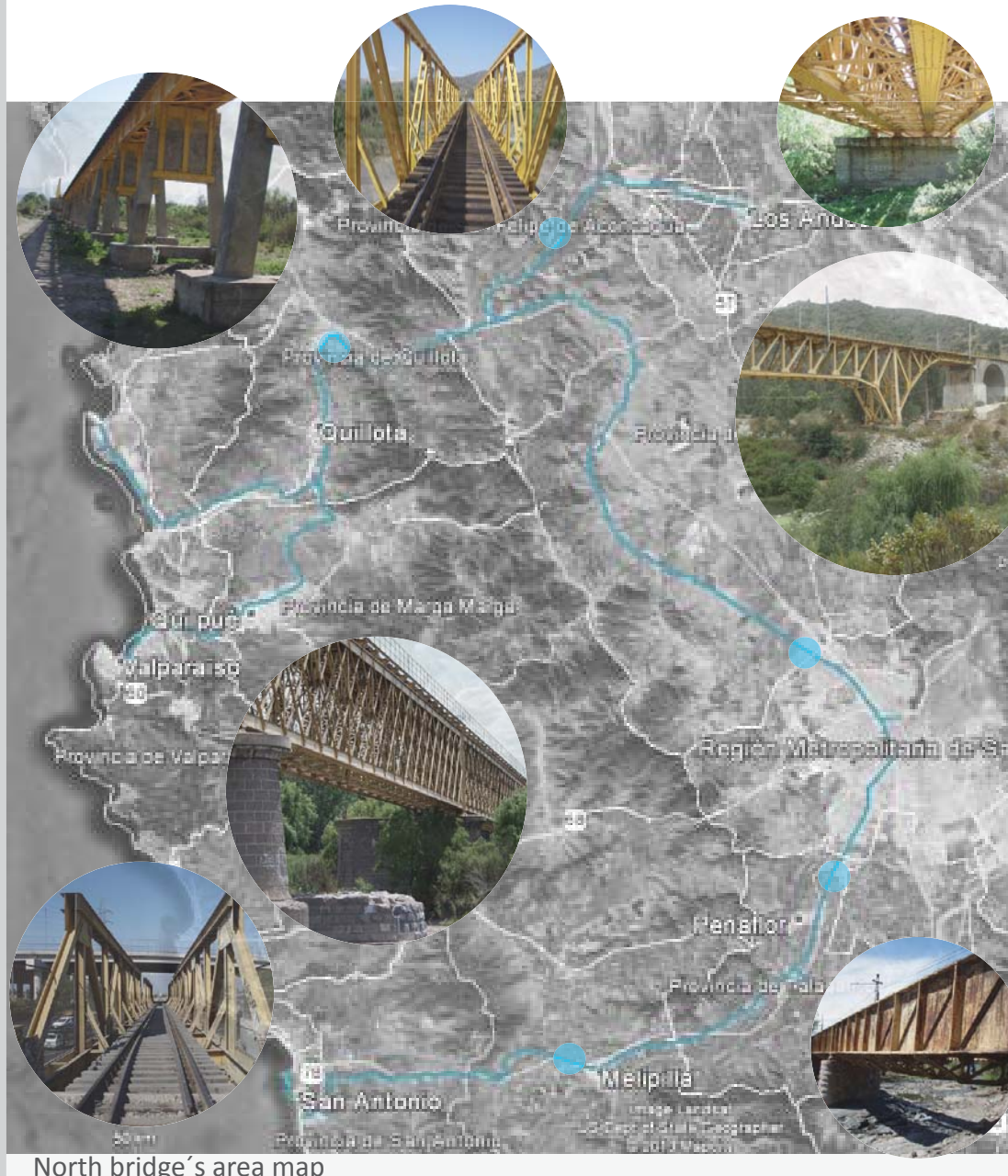


# Engineering Bridges Master Plan North Area Bridges Chile



North bridge's area map

CLIENT	EFE: Chile's National Administration
PROJECT DATE	2013-2014
LOCATION	Chile
FIELD OF ACTION	55 bridges reinforcement or replacement

Chile's National Railway Administration is conducting a Bridges Master Plan due to its intention of increasing the load carried by its freight trains, mainly oriented to transport the copper extracted from their mines.

For such purpose, the Administration has prepared 4 different lots based on the bridges location. The first of these lots corresponds to the North area, which was awarded to INES and KV joint venture team.

Such lot has got 55 bridges of which 70% were built at the end of the XIX century or at the beginning of the XX century. Within the 55 bridges, most of them are steel bridges, existing bridges with different typologies, spanning from 6m to 70 m. In the following list the most representative of the contract bridges are briefly introduced:



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3D, 28006 Madrid, Spain  
Tel.: +34 915237633

ines@inesingenieros.com  
[www.ines.es/en](http://www.ines.es/en)

## Engineering Bridges Master Plan North Area Bridges Chile



Talagante bridge

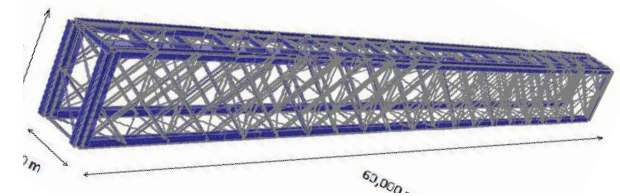
01-**Talagante**: Steel Bridge 300 m long, composed by 5 spans solved with a Brown Truss of 2nd order.

03- **Puangue**: Steel Bridge 90 m long, composed by 2 spans solved with a simple Brown truss.

04-**P.I.Sepultura**: Composite bridge 50 m long with 2 spans.

08-**Llolleo**: Steel Bridge 44 m long with 4 spans, which responds to a Plate Girder Bridge.

09-**Maipo-Lonquén**: Concrete Bridge, 675 m long with 45 spans, solved with  $\pi$  reinforced concrete beams and columns with a double Freysinnet hinge in order to be able to resist seismic actions.



## Engineering Bridges Master Plan North Area Bridges Chile



Suiza bridge

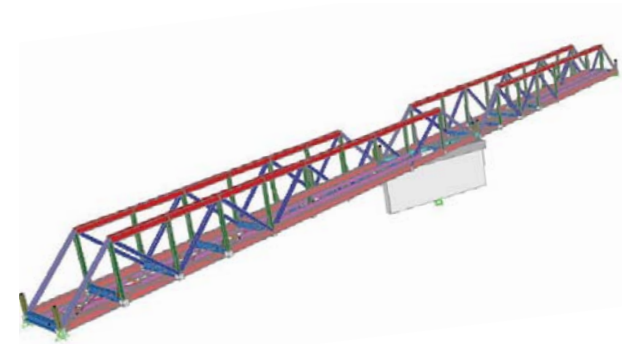


**12-P.I. Suiza:** Skewed Steel Bridge 78 m long with 2 spans, which responds to a Warren Truss Bridge.

**13-P.I. Vespucio Sur:** Concrete Bridge, 62 m long with 3 spans, solved with prestressed reinforced concrete beams.

**17-San Felipe:** Skewed Steel Bridge 60 m long with 2 spans, which responds to a Plate Girder Bridge.

**24-Aconcagua:** Steel Bridge 304 m long with 20 spans solved with a Plate Girder and with a Pratt Truss typology.



**28-Mantagua:** Concrete Bridge, 81 m long with 12 spans, solved with  $\pi$  reinforced concrete beams, which has been substituted by a single Brown Truss typology due to bearing capacity limitations of the soil where it is located.

**55-Las Cucharas:** Composed by a Cantiliver Truss, a Brown Truss and two reinforced concrete Arches at each side. The bridge is 159 m long having 7 spans.

The project involves the reinforcement of the bridges or its replacement for a new typology in order to support all the real trains expected to circulate through the different lines, plus the design train called C+.

For such matter, 3D models have been undertaken of all the bridges with SAP 2000 software, where the current condition of the different elements has been taken into account. The stresses obtained from these models has been contrasted with handmade checks and assessed following the AREMA Standards. As result of the analysis the following documentation has been developed for each bridge:

Cadastre report: It collects an analysis of all the existing information, a description of the structural bridge configuration, materials, foundation, geotechnical properties, etc... and a detailed analysis of its current conditions listing the damage it presents and its location. It is supported with as built drawings defining the current geometry and damage drawings.



Las cucharas bridge



Aconcagua bridge

## Engineering Bridges Master Plan North Area Bridges Chile



Las cucharas bridge



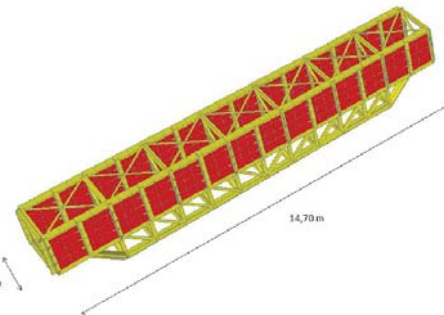
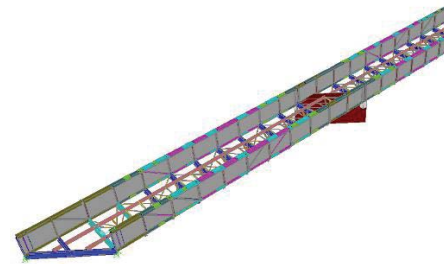
San Felipe bridge



Lolleo bridge



Limache bridge



## Engineering Bridges Master Plan North Area Bridges Chile

**Model report:** It describes the assumptions undertaken for developing the 3D model, definition of the different elements composing the bridge structure, materials, damage repercussion, boundary conditions, etc. **Diagnosis report:** It describes the current structural bearing capacity of the bridge, analyzing individually each of its elements. It ends by determining which real and design trains accepts without putting in danger its safety.

**Rehabilitation project:** It defines the measures to be undertaken for adapting the existing structure to be able of supporting the design train called C. Besides the calculation justifications it includes: Technical Specifications, Drawings, Bill of Quantities and Cost Estimate for all the required measures to be implemented.

**Reinforcement/ replacement project:** It defines the measures to be undertaken for adapting the existing structure to be able of supporting the design train called C+. Besides the calculation justifications it includes: Technical Specifications, Drawings, Bill of Quantities and Cost Estimate for all the required measures to be implemented.