



Center-North bridge's area map

Engineering Bridges Master Plan Center-North Area Bridges Chile

CLIENT	EFE: Chile's National Railway Administration
PROJECT DATE	2014-2015
LOCATION	Chile
FIELD OF ACTION	71 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 second of these lots corresponds to the Center North Area, which was awarded to INES and KV joint venture team.

Such lot has got 71 bridges of which 70% were built at the end of the XIX century or at the beginning of the XX century. Within the 71 bridges, most of them are steel bridges, existing bridges with different typologies, spanning from 6m to 80 m. In the following list the most representative bridges of the contract are briefly introduced:

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01- **Maipo**: Steel Bridge 363 m long, composed by 11 spans solved with a simple Brown Truss.

03- **Angostura**: Steel Bridge 147.45 m long with 4 spans, which responds to a Brown Truss and a Bowstring Truss.

10- **Cachapoal**: Steel Bridge 22 m long with 2 spans, which responds to a Plate Girder Bridge.

20- **Tinguiririca**: Steel Bridge 168.32 m long with 3 spans, which responds to a Bowstring Truss.

33- **Viaducto Rio Claro**: Steel Bridge 99.75 m long with 3 spans, which responds to a Truss Arch.

38- **Panguilemo**: Steel Bridge 91.63 m long with 3 spans, which responds to π reinforced concrete beams and a Brown Truss.

39- **Lircay**: Steel Bridge 133.20 m long with 6 spans, which responds to a Brown Truss Bridge with variable thickness and with cantilever truss at localized sections.

49- **Maule**: Steel Bridge 440 m long with 8 spans, which responds to a Warren Truss Bridge with variable thickness.

57- **Putagan**: Steel Bridge 127.80 m long with 4 spans, which responds to a Bowstring Truss.



Angostura bridge



Maipo bridge



Rio Claro bridge

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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 hand-made 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.

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.



Putagan bridge



Cachapoal bridge

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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.

