



Bridge Reestablishment Solutions – Super Fast Telescopic Launching System (SF-TLS)

Summary description of project context and objectives

This project aims to develop a new superfast launching system capable of launching an innovative modular bridge solution, based in a telescopic boom that can reduce the assembling and launching time up to 70%.

In our days, the effect of weather conditions, natural disasters, conflicts between peoples, refurbishment of degraded / weal structures requires daily bypasses to allow the freedom of movement of people. When a bridge collapse, the modular bridges available on the market are one of the conventional solutions that allows to restore the damaged infrastructures. In addition to the tragic human losses that these events often cause, there is always a high social and economic impact/cost due to the time between collapse and the bridge complete installation, that can reach several weeks or even months. However, the response capacity of existing solutions is currently limited - in many situations, the installation of a modular bridge is not a viable alternative to minimize the impact caused by the lack or loss of circulation. This is due to the limitations of existing solutions, within which we identify those that, in our understanding, are the most relevant:

- × Assembly times are increasingly higher as spans get longer and it is necessary to use very significant human and mechanical means during assembly;
- × There are no solutions for spans greater than 90m;
- × From spans of 50m on, existing solutions impose incrementally operating constraints (vehicle weight and traffic speeds);
- × Current solutions need equal conditions of access and means in both margins, generally leading to the requirement for preparatory work in the two margins.

Modular bridges have as their central objectives the rapid reestablishment of damaged infrastructure, the creation / improvement of major routes or the temporary access to construction sites and special events. The main challenge underlying the development of a modular bridge is the combination of the conditions that must be met in the replacement or materialization of a connection between two margins in one of the mentioned situations.

A new superfast launching system (SF-TLS), guarantees a significant technological advance on modular bridge assembly and launching:

- Complete launching in once;
- Operation can be done from one of the banks with no need to make previous works on the opposite bank;
- Super fast launching comparing with conventional increment launching method;
- Elimination of structural risk and safety of the operation – bridge is supported along all the path;
- Current conventional modular bridge compatible.

Description of the work performed since the beginning of the project and the main results achieved so far

The SF-TLS with a range of up to 120m was designed to be thrown horizontally over a river or valley. After reaching the opposite margin, the system self-propels its own support, which is capable of adjusting to the natural terrain conditions.

As a bi-supported temporary structure, the equipment constitutes the bearing path for placing the modular bridge in the desired final position. During extension, and while operating in cantilever, the telescopic system will be capable of transporting the support to the bi-supported phase.

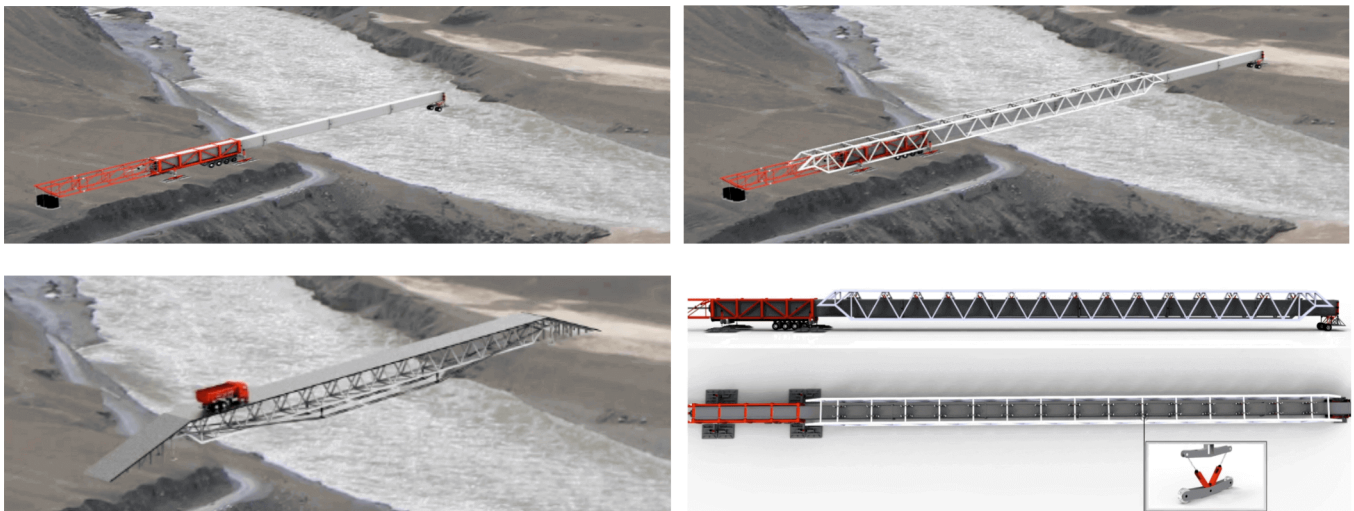
The modules of the bridge are connected to each other by quick connections (bolted and pinned) together with the base module of the boom. The usage of an assembly platform will be determinant for the rapid assembly. After bridge installation, the telescopic boom will be shortened without recourse to any external means other than those required for the assembly of telescopic boom and bridge. Thus, it will be available for use in the installation of other modular bridges.

The telescopic system will also be used to dismantle the modular bridge in a reverse process to the launching.

BERD will commercialize two types of solution:

- > SF-TLS + Bridge (Solution A) - Launching system with a BERD's modular bridge
- > SF-TLS + Conventional Bridge (Solution B) - Launching system for the installation and deinstallation of conventional bridges

The design of the bridge launching system was validated through non-linear stress analysis. Considering the type of structure and the detail needed for its analysis, a structural and mechanical validation at the designing level were undertaken. Considering the level of stresses verified in the various models and analysis methodologies, and the indicated oil-hydraulic and mechanical equipment, the concept is validated (TRL5). Among others, it was concluded that it will be necessary to use ultra-high strength steels in areas of contact between modules of the telescopic boom, as is the case, for example, in telescopic booms of mobile cranes; the launching module will adjust their supports length to compensate the boom deflection during the launching that reach 2,20m; 110ton counterweight located 16m far from the launching module is needed while the boom is in cantilever.



Description of the final results and their potential impacts and use (including socio economic impact and the wider societal implications of the project so far)

We've intended to mature our solution's business plan and define future strategies to enhance the solution market introduction.

BERD evaluated several feasibility aspects in terms of operations, technical, legal/standards, costs and schedule. There are some details that need to be better evaluated such as precise pricing of SF-TLS. A detailed market study involving the direct contact with the potential buyers - infrastructure managers, civil protection responsible and contractors' procurement in developed markets were partially done and introduced importante data to accurate the SF-TLS business plan.

Result expectations and future work

Our solution, a new superfast launching system, guarantees a significant technological advance on modular bridge assembly and launching, and, in the case of the using BERD's innovative modular bridge solution, a new range of spans.

The present project intends to validate a specific assembly equipment that allows the bridge to be rapidly assembled from one of the banks.

This project will make a significant leap in relation to the current state of art of modular bridges systems, both in the time of assembly and in the span that can be achieved. In concrete terms, the present solution has the following technical advances:

- ✓ Reduction of assembly time for new modular bridges (BERD innovative solution), designing an integrated solution (SF-TLS + Berd modular bridge) which allows the rapid installation of a bridge starting at 60m up to 120m span, reaching a reduction up to 70% in time comparing with current solutions (60m span conventional modular bridge is usually assembled in 5-7 days; SF-TLS ables assembling in 1 day);
- ✓ Reduction of assembly time for current conventional modular bridges (SF-TLS + client bridge) which allows the rapid installation of a bridge up to 60m span, reaching a reduction up to 40% in time comparing with current solutions;
- ✓ To enable the bridge assembly and launching only from a bank - which means an increase in versatility and range of application compared to conventional solutions.

The market for modular bridges can be briefly characterized as mature, experienced and oligopoly by heavily industrialized companies in the production of solutions designed over decades with little flexibility in adapting to new approaches to products and systems. However, there are some economic benefits for the user with this innovation that will help BERD to penetrate in the market:

- **Flexibility:** BERD will introduce in the market a new product with higher skills and that can even be used on the assembly of current conventional modular bridges that clients might have. There are 2 important opportunities related with product value: 1 – Rapid assembly system including modular bridge up to 120m; 2 – Rapid assembly system to be applied on the launching of current conventional modular bridges.
- **Rapid Operation:** The new solution manages to reduce up to 70% the time needed for the installation of a bridge.
- **Larger spans:** Bridges with spans larger than 80 m are nowadays barely inexistent, this new solution can install bridges with spans up to 120 m.
- **Technological innovation:** The total "release" of preconceived solutions, investments or industrial structure combined with natural and permanent search to integrate innovation in all work developed by BERD now makes it possible to explore the incorporation of several innovative aspects to reach lighter and strengthened equipment such as ultra-high strength steel, structural aluminium and OPS (Organic Prestressing System), among others.
- **Assembling and Launching Conditions:** The currently existing solutions on the market do not give the answer it should in the assembling and launching operations. It is noted, namely, the requirement of use in equal conditions of access and means on both sides, the large number of components and connections, operations which require a high number of means and the long assembly times.

It was also possible to conclude that a new service can be introduce for infrastructure managements. **None Disruption Service (NDS)** can be implemented in toll highways or any other infrastructure that is managed taking in consideration the huge direct financial cost for the managing company and also the relevant social-economical cost (indirect) for drivers/users. This service, charged as a fixed fee, will consist in guarantee availability of SF-TLS for emergency situations or conventional modular bridges solutions for scheduled maintenance, with the yearly budget well known, similar to ensurance service.