


A SUCCESS STORY

LONGER LASTING TUNNELS AND LOWER MAINTENANCE COSTS THROUGH COMPOSITE REINFORCEMENTS

Road tunnels play an essential role in the circulation of people and products. One commonly used construction method involves tunnel boring machines, which requires the use of prefabricated reinforced concrete shoring elements known as "voussoirs". This approach has proven to be both effective and economical when compared to traditional shoring methods. However, reinforced concrete voussoirs are often subject to premature deterioration, primarily due to corrosion on the steel reinforcements. This deterioration requires frequent repairs and costly maintenance, leading many to consider alternative solutions. With this in mind, a research project was launched to replace steel reinforcement bars with glass fibre reinforced polymer (GFRP) composite bars. The project was conducted by Pultrall Inc., working jointly with **Sym-Tech Béton Préfabriqué** and the **Université de Sherbrooke**. Serving as industrial partner, **Pultrall** developed and assembled a new production line dedicated to the manufacture of curvilinear GFRP reinforcements, while Sym-Tech Béton Préfabriqué lent its expertise to the manufacturing of prefabricated reinforced concrete tunnel voussoirs.

This research project led to the development of new curvilinear reinforcements made of GFRP composite material specifically designed for tunnel voussoirs. These innovative reinforcements underwent rigorous testing to assess their physico-chemical, mechanical and durability properties. The extremely positive results successfully demonstrated the feasibility and effectiveness of using GFRP bars over traditional steel bars in prefabricated reinforced concrete tunnel voussoirs. Based on these promising results, the professor and industrialists involved intend to pursue their work by collaborating with several other partners. These collaborations and advances will help develop design and calculation methodologies for GFRP reinforced concrete tunnel voussoirs, paving the way to their practical use and integration into calculation standards. The research will therefore contribute to the development of sustainable and innovative solutions for tunnel infrastructures, creating advantages like corrosion resistance, greater longevity and reduced maintenance costs.

 The PRIMA project went very well thanks to Professor Brahim Benmokrane from the Université de Sherbrooke; we are very satisfied with this collaboration. There were frequent communications and we managed to bring this project to a successful conclusion. The collaboration led to wide recognition and made very significant contributions to the advancement of GFRP composite reinforcement technology and fibrous concrete with synthetic microfibres.

Professor Benmokrane intends to pursue this fruitful collaboration alongside other partners.

- **Luc Tremblay**,
President and CEO at
Sym-Tech Béton Préfabriqué

Pultrall Inc. (Thetford Mines, Quebec) was delighted to collaborate and work closely with Professor Brahim Benmokrane of the Université de Sherbrooke on the PRIMA project, which focused on the development and testing of new reinforced precast concrete tunnel segments made of GFRP composites. It was an immense pleasure to work with one of the world's top engineers and researchers in this particular field of research. The research project was very successful and will help our company increase its international exports in a rapidly expanding market. 

- **Bernard Drouin**,
President and CEO at Pultrall Inc.



SECTORS

High-performance formulated materials or finished products



APPLICATIONS

Transport Infrastructure



TRL

4-5



DURATION

28 months (2020-2023)