

*The Solution for Corrosion*

**V•ROD**

Composite Rebar  
for Concrete Structures

Increased Security.  
Reduced Life Cycle Cost.



## More Advantages, Less Problems, Same Work Method

The technology of reinforced concrete is facing a serious degradation problem in structures due to the corrosion of steel rebar. In North America, the repair costs are estimated to be close to 300 billion dollars.

Several options have been explored, most notably the use of galvanized steel rebar, epoxy coated or stainless steel. The results, however, have been disappointing as these solutions have turned out to be less than effective or cost prohibitive.

Fibre-reinforced polymer (FRP) rebar has proven to be the solution. Lightweight, corrosion resistant, and offering excellent tensile strength and high mechanical performance, V•ROD rebar is installed much like steel rebar, but with fewer handling and storage problems.

## V•ROD Raises the Bar

V•ROD rebar gives designers, contractors and owners of structures the following advantages:

### Corrosion Resistance.

V•ROD rebar does not rust, even in the harshest environments. It does not react to salt, chemical products or the alkaline present in concrete.

### Superior Tensile Strength.

V•ROD rebar produced by pultrusion offers a tensile strength up to twice that of steel.

### Thermal Expansion.

V•ROD rebar offers a level of thermal expansion comparable to concrete due to its 80% silica content.

### Electrical and Magnetic Neutrality.

V•ROD rebar does not contain any metal; it will not cause any interference in contact with strong magnetic fields or when operating sensitive electronic instruments.

### Thermal Insulation.

V•ROD rebar does not create a thermal bridge within structures.

### Lightweight.

V•ROD rebar is 4 times lighter than steel rebar. It is much easier to handle, and in most cases, one truck load will be sufficient to supply the rebar even for an entire project.

### Simplified On-Site Management.

V•ROD rebar can be delivered at the right time and in the exact quantity needed at the site. Various specifications such as the length, angles or bends of special sections are prepared in the plant.



◀ After a comparable service life, the corrosion of the oxidized steel rebar has degraded the concrete around it, while the V•ROD rebar is intact and surrounded by healthy concrete.

## Advantages in the Field

It has now been established with documented proof that V•ROD rebar represents an advantageous solution in a wide range of reinforced concrete applications. What's more, it is possible to integrate fibre optic sensors (fiber Bragg gratings) into this rebar to enable real time remote monitoring of structural integrity.

Engineers have now standardized the product and its applications, enabling the validation of their quality.



*Parapets and Barriers*



*Slabs and Overlays*



*Precast*



*Bridges and Overpasses*



*Sea Walls*



*Aluminum Smelters*



*Waterfront Structures*

## The Most Remarkable Evolution since the Beginning of Reinforced Concrete

There is no way around the use of reinforced concrete in the construction of buildings and structures. However, steel reinforcement can cause expensive problems both in terms of logistics and in length of service life.

At last, thanks to V•ROD, builders and owners of structures can take advantage of a major evolution in reinforced concrete technology. This means:

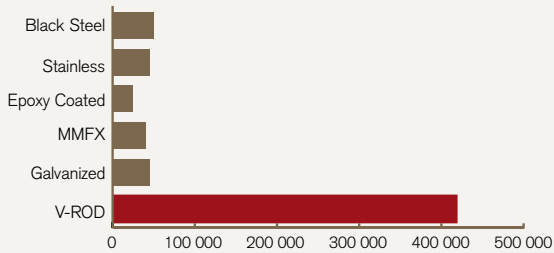
- More secure structures
- Non-existent corrosion
- Reduced life cycle cost of 15 to 30%

The advantages of V•ROD rebar are backed by years of testing and actual field results in the most demanding conditions. From now on, limitations will lie with the concrete, and not the reinforcement.



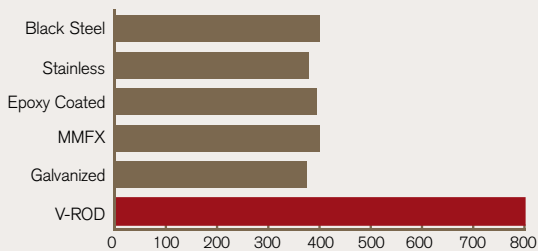
## When Safety and Savings Go Together

### Fatigue Behaviour (cycles)

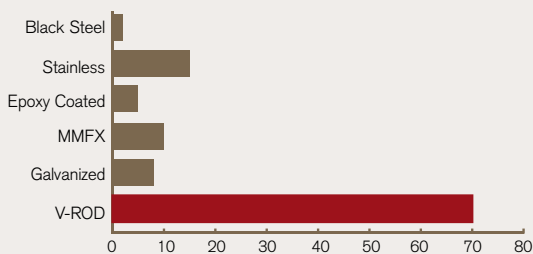


Adimi, M.R., Rahman, A.H., and Benmokrane, B. 2000

### Tensile Strength (Mpa)

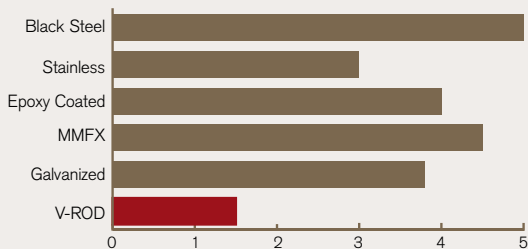


### Corrosion Resistance (% of residual strength)



Nemkumar Benthia, UBC, M. Boulfiza, U. Saskatchewan. 2004

### Life Cycle Cost over 100 Years (relative cost)



Gordon Spark, U. Manitoba, ISIS Canada. 2005

The use of V•ROD rebar provides very significant savings while increasing safety for users.

### Savings on Life Cycle Cost

- Given the present value for total costs of maintenance and demolition, using V•ROD technology represents a savings of 45 to 60%.
- Given the present value of the overall life cycle cost, using V•ROD technology represents a savings of roughly 15 to 25%.
- If we add unknown factors such as the fact that fragile epoxy coating may be compromised due to impact when installing rebar, the savings provided by using FRP increases from 15 to 30%.

### Construction Savings

- V•ROD rebar allows costs to be eliminated related to the use of expensive membranes.
- It is possible to use conventional concrete instead of low permeability concrete with added corrosion inhibitors.
- Reduced weight allows for the handling of more rebar at the same time and reduces installation time.

### Increased Safety for Owners and Users

- V•ROD rebar is manufactured according to set standards, has been approved by ISIS Canada and is included in CSA design standards.
- Standard specifications are now available to engineering firms for quality control of projects, including independent on-site inspection.
- Installation methods in concrete have been standardized in accordance with those of steel.







## A Future with Confidence

As a solution for the future, V•ROD rebar is also a solution we can be confident in as attested by its qualification for and presence in the CSA codes for bridge and building construction, as well as its adoption under the specific standards of related authorities in many Canadian provinces, American states and North American cities.

Project design methods have been developed thanks to many pilot projects completed by the best of Quebec and Canadian expertise under the control of ISIS Canada and with the participation of reputable researchers such as Mr. Brahim Benmokrane, PhD Engineering.

## Pultrall, The Pultrusion Specialist

Pultrall is dedicated to the manufacturing of composite products using the processes of pultrusion and compression moulding (sheet moulding compound). Our passion and our goal is to develop, manufacture and market composite structures produced by pultrusion in an innovative, competitive and profitable way, thereby working for the success of our clients, employees and suppliers, while maintaining a respect for the environment.

## Get Your Information Right from the Source

Evaluate the real advantages of V•ROD rebar for your project using precise and comprehensive information. For more information, including white paper data, contact:



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