



Designing with

TUF-BAR

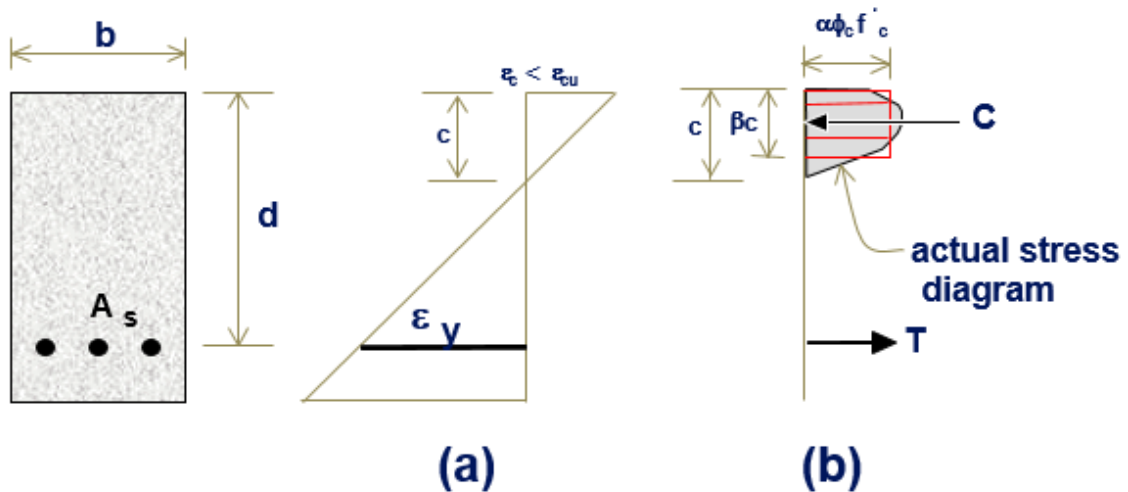
**100 YEAR LIFESPAN
ZERO CORROSION**

**COMPOSITE REBAR FOR
CONCRETE STRUCTURES**

Designing with Tuf-Bar is slightly different than designing with steel. Here are the differences:

- ❖ FRP Reinforcing bars have **High Strength** but low modulus of elasticity compared to steel
- ❖ The design of concrete elements reinforced with FRP bars is Governed by the Serviceability Requirements: **Deflection and crack width**
- ❖ FRP Reinforced concrete elements should be designed **as over-reinforced sections**
- ❖ Material resistance factors similar to those used for conventional steel reinforced concrete elements taking into account the durability issues
- ❖ Design equations for flexure and shear are introduced in these codes and guides (CAN/CSA-S806, ACI 440.1R)

Design of GFRP Reinforced Structures

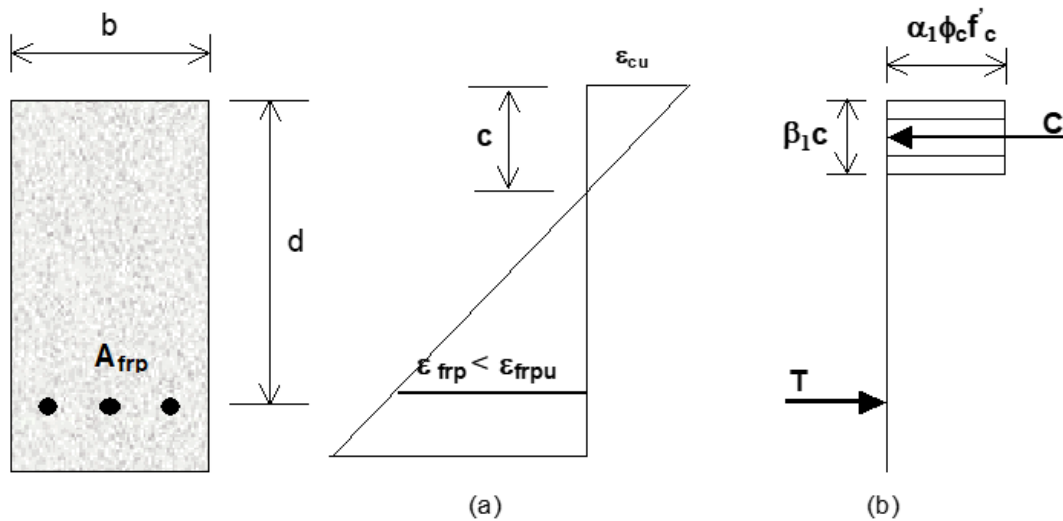


Design Philosophy

Under reinforced section (Steel yielding at ultimate)

Steel Reinforced concrete Section

Design of GFRP Reinforced Structures



Design Philosophy

Over reinforced section (crushing of concrete at ultimate)

GFRP Reinforced concrete Section

Flexural Design

Load Factors and Load Combinations

- ❖ Uses the same load factors as in the building code
- ❖ Load combinations are also the same

Material Resistance Factors

- ❖ Concrete and steel resistance factors remain the same
- ❖ FRP resistance factor $\phi_F = 0.65$, for all FRP reinforced or prestressed

Serviceability Limit Status

The maximum stress in FRP bars or grids under loads at serviceability limit state shall not be more than: **0.30 of the Characteristic tensile strength**

Cracking – FRP RC

- ❖ No need to control crack width to prevent corrosion
- ❖ Crack width needs to be prevented from an aesthetic point of view and to control stresses in the reinforcement

In steel reinforcement concrete it is necessary to reduce the crack width to inhibit the corrosion of steel reinforcement

This is not a requirement for FRP reinforced concrete due to the excellent corrosion resistance of FRP materials