



Company: MSD Co.

Project: Sample Project

Title: Sample Beam Str.

Section Name: RBeam-Sample

1- Input Data

1-1- Existing Beam Properties:

Name:							
b _w	h	C _c		Main Bar		Add Bar	
		Top	Bot	Top	Bot	Top	Bot
mm	mm	mm		-	-	-	-
600	800	50	90	5 T 20	5 T 20	---	8 T 25

1-2- Existing Material Properties:

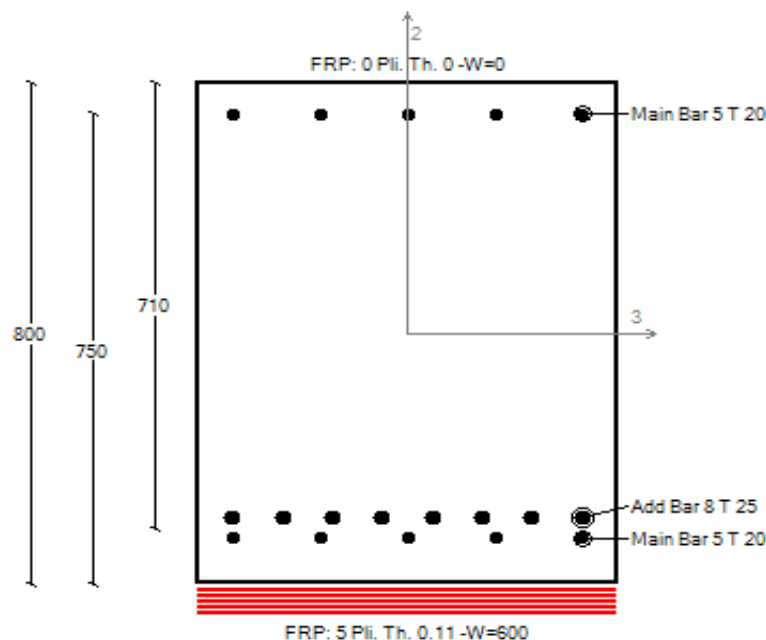
f' _c	f _y	E _c	E _s
Mpa	Mpa	Mpa	Mpa
30	400	25742.96	200000

1-3- FRP Material Properties:

Ultimate Tensile Strength (f* _{fu})	Modulus of Elasticity (E _f)	C _E	Ψ _f
Mpa	Gpa	-	-
3800	230000	0.95	0.95

1-4- Initial Moment at Time of FRP Installation:

m₁= 44 T-m





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2- Positive Flexural Strengthening by FRP System**2-a- FRP Properties:**

n	t _f	w _f	Sustained Plus Cyclic Stress Limit
-	mm	mm	-
5	0.11	600	0.55 ffu

2-b- Flexural Strengthening Calculations

(1) Strain level in concrete substrate at time of FRP installation:

$$\varepsilon_{bi} = 0.00069 \text{ mm/mm}$$

(2) Debonding strain of externally bonded FRP reinforcement:

$$\varepsilon_{fd} = 0.0063 \text{ mm/mm}$$

(3) Distance from extreme compression fiber to the neutral axis:

$$c = 181 \text{ mm}$$

(4) Strain level in concrete:

$$\varepsilon_c = 0.0021 \text{ mm/mm}$$

(5) Net tensile strain in extreme tension steel at nominal strength:

$$\varepsilon_t = 0.006 \text{ mm/mm}$$

(6) Effective stress in the FRP:

$$f_{fe} = 1452 \text{ Mpa}$$

(7) Stress in steel reinforcement:

$$f_s = 400 \text{ Mpa}$$

2-c- Flexural Strengthening Results

(1) Contribution of steel reinforcement to nominal flexural strength:

$$M_{ns} = 143.83 \text{ T-m}$$

(2) Contribution of FRP reinforcement to nominal flexural strength:

$$M_{nf} = 35.74 \text{ T-m}$$

Nominal flexural strength:

$$M_n = 175.09 \text{ T-m}$$

Design flexural strength:

$$\phi M_n = 157.58 \text{ T-m}$$

Service moment at section:

$$M_s = 118.44 \text{ T-m}$$

Failure Mode: Yielding of steel followed by rupture of FRP**Increase in overall Flexural Strength:** 19%