

Mr. André Fournier
Abzac Canada inc.
2945. Lemire boulevard
Drummondville, Qc. J2B 6Y8

May 23, 2011

Project : Ecoform Abzac rectangular formwork
Compliance analysis of prefabricated wooden panels
File 105,01

Dear sir,

The manufacturer of prefabricated formwork Abzac Canada, has mandated *PGECI* Consulting to analyse the strength (resistance) and rigidity of the walls and assemblies of wooden prefabricated formwork for rectangular columns distributed under the patented Ecoform system.

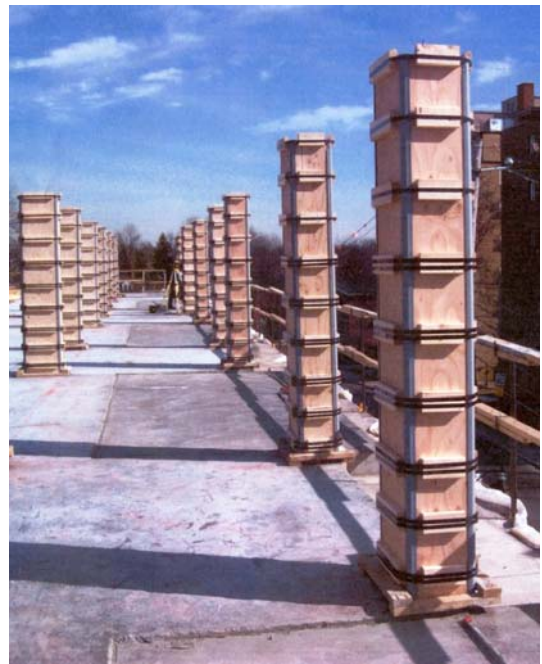
The analysis of the thrust (pressure) of fresh concrete was performed according to the requirements of *CAN/CSA-S269.3-FM92 (C2008)-formwork* standards. The strengths (resistances) of the various formwork components: panels, stiffeners and belts, were analyzed using two methods:

1. Strengths (resistances) established by - *Design rules for wooden structures-CSA 086-09*
2. Bending tests conducted in 2009 at CRIQ on walls of stiffened formwork.

The formwork system considered for the study consists of plywood panels *S.P.F.* 5/8", with stiffeners 2"x4" laid flat and up to a height of 9 feet. The panels have a width of 12", 18" and 24".

The following implementation assumptions were used to establish the thrust (pressure) of concrete on the formwork :

- Type of cement : GU or HU (10 or 30)
- Maximum Slump : $\leq 4"$
- Speed of implementation : $\leq 10'/h$
- Concrete temperature: $\geq 70^{\circ}F$
- Unit weight (density): = 150 lb/ft³
- Drop height of concrete: 5 ft

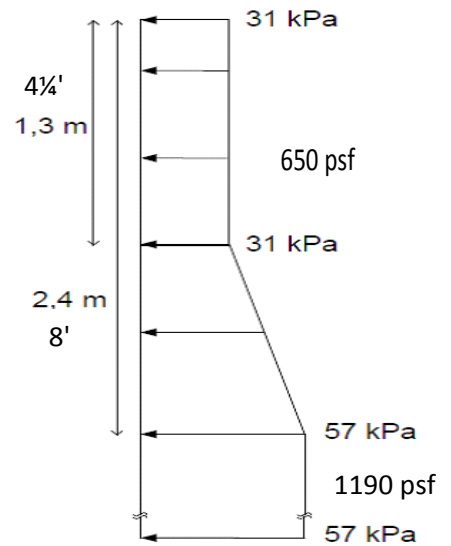


2...

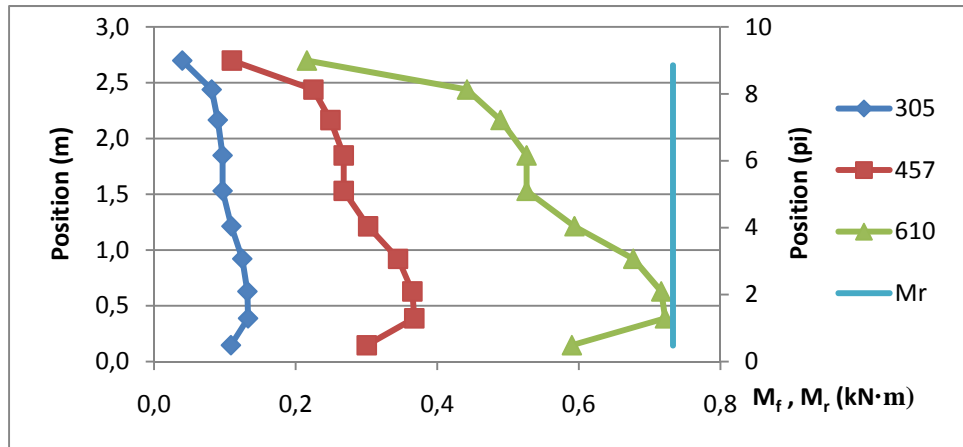
...2

These assumptions applied to the calculation rules prescribed by the Canadian standard *CAN/CSA-S269.3-Fm92 (R2008)-Formwork* have established the thrust (pressure) of fresh concrete during implementation to 650 psf on the first 4,25' with a linear increase up to 8' high to reach a maximum pressure of 1190 psf for a depth of over 8'. The pressure varying linearly between these two positions, as presented in the adjoining figure.

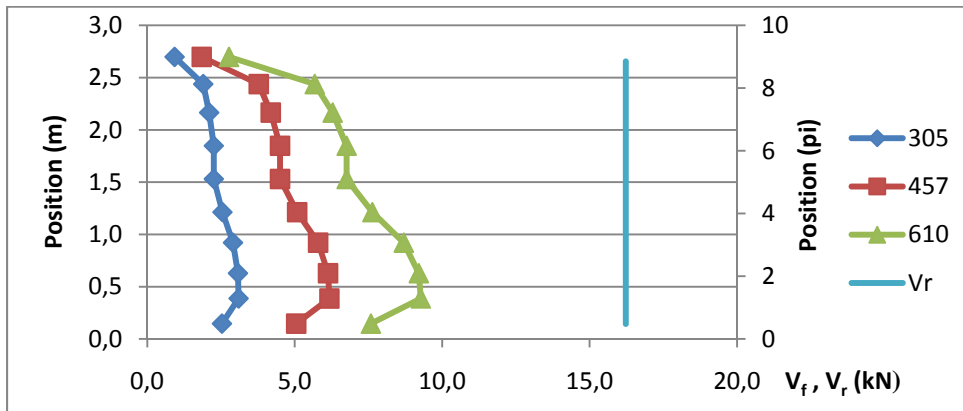
Thrust of fresh concrete on the walls of the formwork



The results are presented in the following figures:



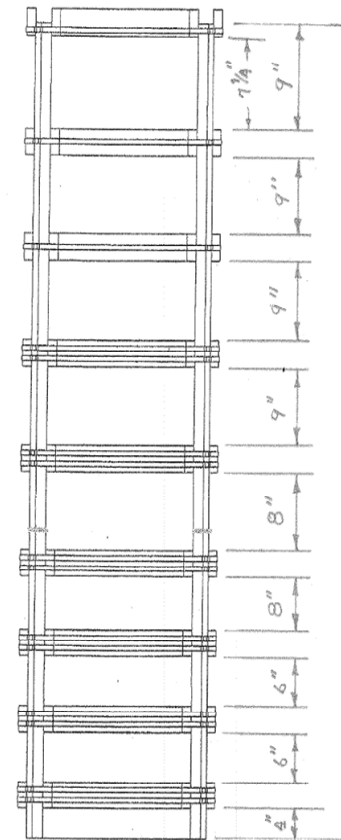
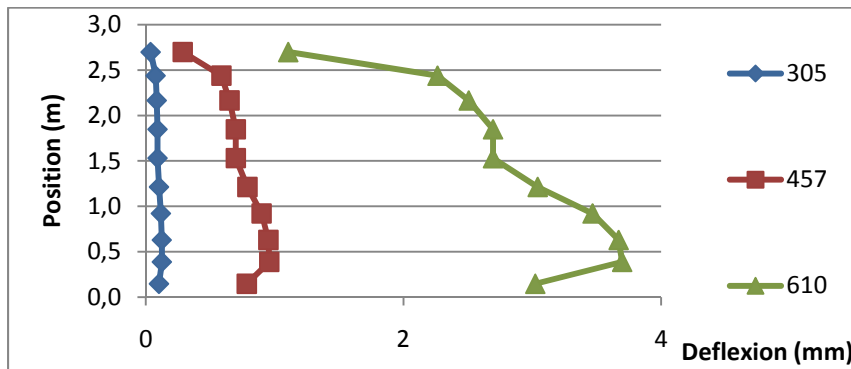
Applied bending stress and bending strength of the stiffener (2"x4")



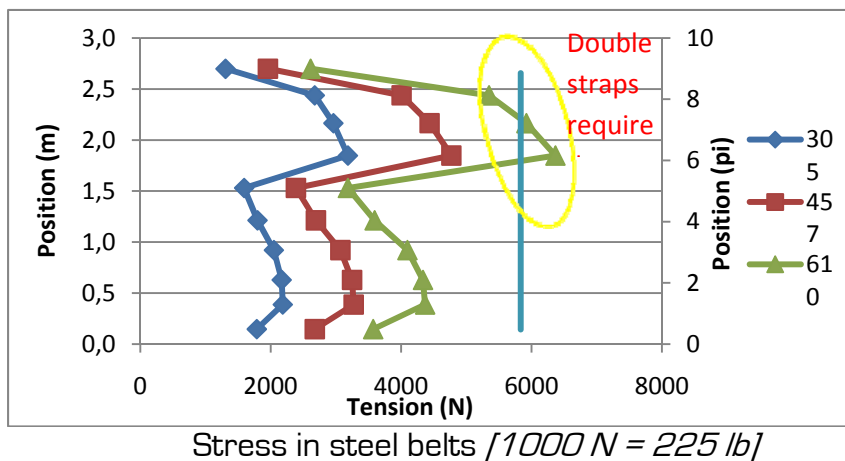
Applied shear stress and resistance of the stiffener (2"x4")

Conversion: 1 kN/m = 737 lb-ft 1 kN = 225 lbs

...3



Sag of wall stiffeners $1\text{mm} = 1/25\text{ inch}$



Stress in steel belts $[1000\text{ N} = 225\text{ lb}]$

Our analyses showed that the 5/8 inch [16mm] prefabricated plywood reinforced with 2"x4" stiffeners laid flat of the *ECOFORM* rectangular formwork under 10 feet do not require tie-beams or intervening reinforcements when the faces of the columns do not exceed 24", this by considering the conditions of implementation outlined above.

For rectangular forms with sides greater than 20 inches double straps should be placed above the three upper stiffeners.

We hope that you find the recommendations presented in this study sufficiently clear and that they meet your expectations. We remain as your disposal for any additional information that you might feel useful.



Philippe Provencher, ing. jr, M.Sc.



Pierre Gauvreau, p eng.