

**Date:** February 9, 2025

**No. of Pages:** 4

**Project:** ICF Block Concept Review

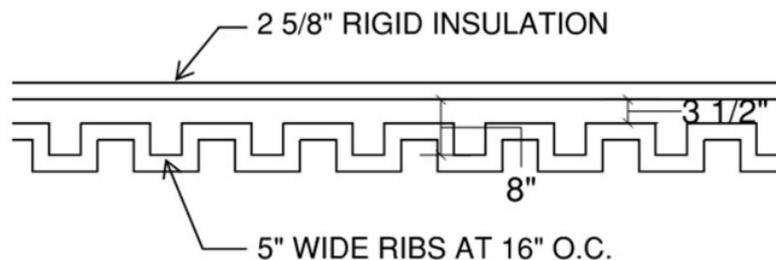
**Project No.:** TE-43657-24

**Client:** T-Core ICF

**Distribution:** T-Core ICF

### Background

Tacoma Engineers has been retained by T-Core ICF to complete an ICF block structural concept review. T-Core ICF is developing an ICF block for use in Part 9 residential or commercial buildings. This block concept has a 3 1/2" thick concrete wall with 5" wide, 6 1/2" deep ribs at 16" o.c. A typical plan view is shown in detail 1 below.



**Detail 1: ICF Block: Typical Plan View**

This ICF block would save concrete volume and therefore be more efficient in use of material.

Tacoma Engineers completed a structural review of the ICF block concept with the following scope of work:

### **ICF Block Structural Concept Review Scope:**

Review the ICF block dimensions and design concept by completing the following:

- Review of Part 9 of the National Building Code 2020 (NBC 2020) to determine whether there are any limitations or concerns in the code.
  - NBC 2020 is the model building code for Canada and is being implemented in all provinces in 2025.
- Review of the current concrete design standard, A23.3-19, to determine whether there are any limitations or concerns in the standard with respect to the size, shape or fit.
- Complete preliminary calculations for a few different wall types (basement wall, above grade wall, wall with windows).

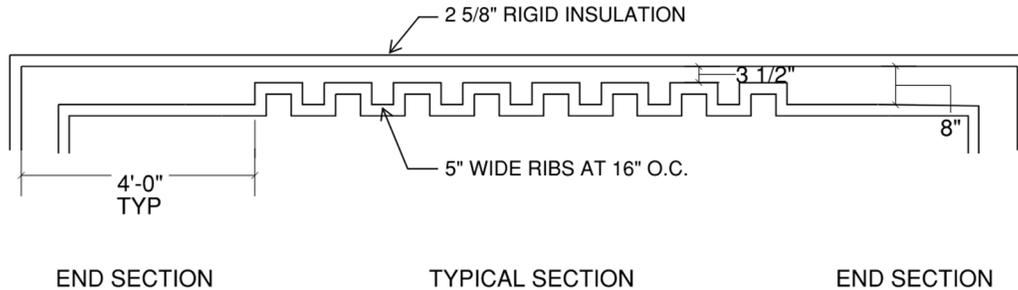
This concept review was conducted to identify any structural limitations in codes or standards that would require a re-design or limitation on the ICF blocks.

Tacoma Engineers has completed this work, and this report summarizes our findings.

## Executive Summary

Tacoma Engineers finds that the ICF block concept is a viable concept, provided:

1. A minimum of 3 ½" is used for the concrete face shell thickness.
2. Shear walls have end sections that are 6" to 8" thick to act as the shear elements, as seen in Detail 2.



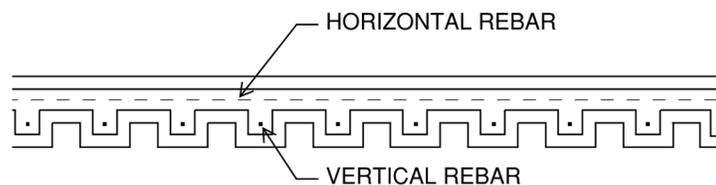
**Detail 2: ICF Block with End Shear Elements**

## Detailed Findings

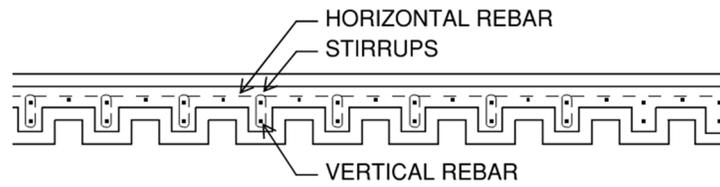
Tacoma Engineers checked the ICF block concept as seen in Detail 1 for the following checks in accordance with the NBC 2020 and CSA A23.3-19, for Part 9 buildings. The following checks were conducted:

1. Minimum dimensions
  - a. The wall meets the minimum dimensions for gravity and lateral loads.
  - b. The 5" wide ribs are large enough.
  - c. The 3 ½" flange thickness is large enough to provide adequate rebar cover to 10M rebar. We recommend keeping the flange at a minimum of 3 ½" thick.
  - d. To act as a shear wall a minimum thickness of 6" is required by CSA A23.3-19. This is satisfied by having end sections that are 6" to 8" thick and are designed to take the shear loads. We recommend starting with 4'-0" long end sections.
2. Typical rebar arrangement in the wall.
  - a. Vertical rebar and shear rebar (stirrups) can both fit in the wall.
  - b. Shear stirrups fit tightly and need to be tilted to keep adequate concrete cover, and this is OK.
  - c. When reinforcing for shear, a typical stirrup spacing would be 4" or smaller based on minimum spacing requirements. This would give lots of shear capacity.
3. Basement wall strength checks (Residential Part 9):
  - a. A basement wall would require reinforcing with vertical bars for bending to safely support the design loads. This can be easily done with the ICF block concept.

- b. A basement wall does not require reinforcing for shear, provided it is not more than 10'-6" tall with 20 MPa concrete, or 12'-0" tall with 35 MPa concrete.
      - c. Shear reinforcing can be added for higher loads or taller walls.
      - d. Shear wall sections 6" to 8" thick can be added at the ends.
  4. Above-grade wall strength checks (Residential Part 9):
    - a. Below grade walls control the system limitations, so above grade walls work.
  5. Compression resistance (axial load):
    - a. The walls work well for axial load.
    - b. High concentrated loads or large window openings may require localized wall thickening.
  6. Fire:
    - a. The ICF block concept equivalent wall thickness is 4.9" (124mm) which gives a 90-minute (1 1/2 hour) fire resistance rating, to OBC 2024 SB-2 Table 2.1.1.
    - b. Higher fire ratings can be achieved with layers of drywall or other materials.
    - c. Fire ratings are not required for most ICF houses but are required for some where they are too close to property lines.
  7. General:
    - a. These checks were conducted for a general system with common Part 9 uses. It is understood that additional design concept work would be required in order investigate the following:
      - i. Detailing for the top and bottom of wall sections.
      - ii. Detailing around window or door openings.
      - iii. Detailing for concentrated point loads.
      - iv. Detailing for attachment of floors and roofs, whether wood framed or other.
  8. Reinforcing arrangements:
    - a. Examples of possible reinforcing arrangements are shown in Detail 3 and 4 with low and high levels of rebar.



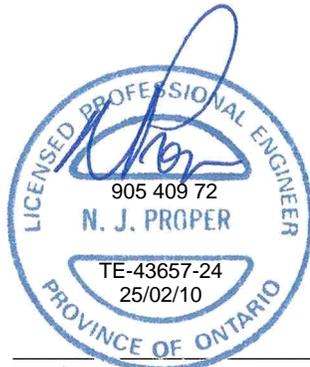
**Detail 3: Example Reinforcing – Low Level of Rebar**



**Detail 4: Example Reinforcing – High Level of Rebar**

**Conclusion**

Based on our structural review, it is our opinion that the ICF block as shown in Detail 1 is a viable concept, when compared to NBC 2020, A23.3-19, and when calculated for common design loads and scenarios for Part 9 buildings including Part 9 houses.



**Per**

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**Encl.**

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