

DRAFT



**REVIEW OF THE
HARRINGTON GRIST MILL**

HARRINGTON, ONTARIO

*Nick Associates
N.A.E. Inc.*



Harrington Mill

Prepared for:


**Harrington Grist Mill
Restoration Project**

**c/o Mr. Trent Littleton
68 Ingersoll Road
Woodstock, Ontario
N4S 2P9**

Project Number: 01-289

January 11, 2002

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1.0 INTRODUCTION

Terms of Reference

NA Engineering Associates Inc. was authorized by Arky Designs to proceed with a visual review of the Harrington Grist Mill for the purpose of determining what modifications are required to allow the building to be used as a 'working museum' and classroom facility. This report outlines what structural rehabilitation will be required to ensure compliance with the requirements of the 1997 Ontario Building Code (OBC). A building code review related to life safety issues such as exiting and fire safety was also performed. We will also include preliminary design sketches to be used to obtain cost estimates for any of the required modifications.

2.0 BUILDING STRUCTURE


Superstructure

The Harrington Grist Mill is a historically interesting timber structure that has undergone several renovations over the years. The main structure is composed of heavy timber post and beam construction, similar to many farm structures of its vintage. The exterior is clad in sheet metal on three sides and on the roof and in wood on the east elevation.

The pitched roof structure consists of metal deck on purlins supported by rough sawn 2x5 rafter members at approximately 2'-0" on center (Photograph 1). There is no center beam and the base of the rafters are supported by 9.5"x10" timbers. The roof sheathing and most of the purlins appear to be newly installed. The rafters appear to be original and are in good condition.

The mezzanine, or upper floor level, consists of 5/8" tongue & groove decking on 2x8 floor joists at 16" on center for the east span and 24" on center on the west span (Photograph 2). The decking and joists appear to be in good condition. The joists are supported by heavy timbers, notched to receive the joists at 16" o.c. (Photograph 3). The heavy timbers are in fair condition. The west beam appears to have a deep longitudinal crack (Photograph 4) These heavy timbers are reinforced with steel rods and supported on 9.5 x 9.5 timber columns.

The main floor is similar in framing to the mezzanine level, with the exception of some additional framing in the area of the hopper (Photograph 5). The east main floor beam spans the building width, similarly to the mezzanine beams. The central beam is supported by a column at the midspan. Additional framing and columns are provided in the hopper area where the penetration of the floor assembly exists. It appeared that an additional column was introduced and 'jacked' into place (Photograph 6). This lifted the existing joists from their bearing positions on the central beam and caused a noticeable 'heave' of the main floor sheathing in this area (Photograph 7).



The building elevations and floor plan drawings are contained in the appendix for reference.

Substructure

The building foundations are a combination of rubble stone and cast-in-place concrete. The majority of the spillway area consists of rubble stone foundations (Photograph 8). The foundations were constructed on the natural slope and are stepped on a 3:1 slope.

The rubble foundations are in very poor conditions, with collapsed sections of wall (Photograph 9) in the spillway area. The south and north concrete foundation walls are cracked (Photograph 10) and separated at the top of the slope. It appeared that the foundations are gradually moving down the slope.

3.0 FIRE AND LIFE SAFETY / ONTARIO BUILDING CODE ANALYSIS

The intended use for this building is as a museum or school. This would classify the building as an A-2 assembly occupancy under the Ontario Building Code (OBC). The building is arguably 2 storeys in height. Based on this the building would require a sprinkler system as per OBC clause 3.2.2.27.

With respect to exiting requirements, the mezzanine area is less than 2,150 square feet, which would require only one exit. Guard rails are required around all areas open to the main floor. Exit signs are also required at all exits.

Structural loading according to the OBC for assembly occupancy such as a museum is 100 pounds per square foot (psf). Our structural review has, therefore, assumed this load value in determining if the existing structure is adequate.


4.0 STRUCTURAL LOAD CAPACITY AND DEFICIENCIES

Based on our visual review, we offer the following opinions:

The roof structure is currently inadequate to support the snow and dead loads as prescribed in the OBC.

The mezzanine floor joists at 16" o.c. are capable of sustaining the required 100 psf live loads provided that the 5/8" decking is screwed to the joists at 12" on center to provide additional stiffness. The joists at 24" o.c. are not adequate to support these loads. The existing configuration should be removed and additional rough sawn joists should be introduced at the original 16" spacing as indicated on the main beams.

The beams supporting the mezzanine are grossly inadequate to support the 100 psf floor loading. The span of the two beams would have to be divided into 4 spans by the introduction of 3 new timber columns in order for the beam span to be sufficiently



small to support the loads. The reinforcing of the beam is not a viable option as this would require the introduction of a steel beam below the existing beam. Although this would be functionally adequate, headroom would be decreased and the historical aesthetic of the structure would be seriously compromised. Alternatively, the mezzanine area could be closed off to public use, with no reinforcement required.

Similarly, the main floor beams are also deficient and require the introduction of 2 or 3 new columns. The east beam has no additional columns and will require 3 new ones, whereas the west beam requires only two new columns. All of these columns should be 9.5" x 9.5" rough sawn timber columns in order to provide the required strength and blend into the existing structure.

The heaving of the existing floor where a new column was introduced should be corrected by shoring the floor and cutting down the column to the correct height.

Serious foundation problems exist. The cause of the foundation movement observed is likely due to shifting ground conditions and deteriorating foundations. We would recommend that a soils consultant be asked to give an opinion as to the stability of the slope prior to initiating remedial structural measures.

All foundations from the top of slope down require replacement. This process would involve the temporary shoring of the columns on a section by section basis.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The existing structure is an interesting and historically significant one. The degree of deterioration of the existing foundations is significant and will require extensive reconstruction.

The timber structure is in remarkably good condition, and can be modified in order to function as a working museum and part-time school. Should application for a heritage structure designation be pursued and achieved, some requirements of the building code, may be reduced or waived by the Chief Building Official with jurisdiction over this building. For the purposes of planning and budgeting, however, we would recommend the prudent approach, and assume that all requirements of the OBC will have to be met.

We trust that the foregoing is sufficient for your needs at this time. Should you have any questions, please contact the undersigned at your convenience.

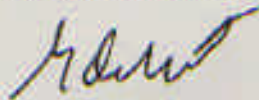
Yours truly,
NA Engineering Associates Inc.



Gordon W. Debbert, P. Eng.
Associate Structural Engineer

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Yours truly,
NA Engineering Associates Inc.



Gordon W. Debbert, P. Eng.
Associate Structural Engineer





Photograph 1: Roof purlins, rafters and metal deck



Photograph 2: Floor framing at mezzanine level.



Photograph 3: Mezzanine floor framing. Note the notching of the beam at 16" o.c. where the joists are placed at 2'-0" o.c.



Photograph 4: Large crack in existing beam. Note the steel reinforcing rod in the existing beam.



Photograph 5: Additional column and framing in the hopper area.



Photograph 6: New column near the hopper opening.



Photograph 7: Joists lifted from their bearing positions due to jacking of the floor system.



Photograph 8: Foundations consist of a combination of concrete and rubble stone.



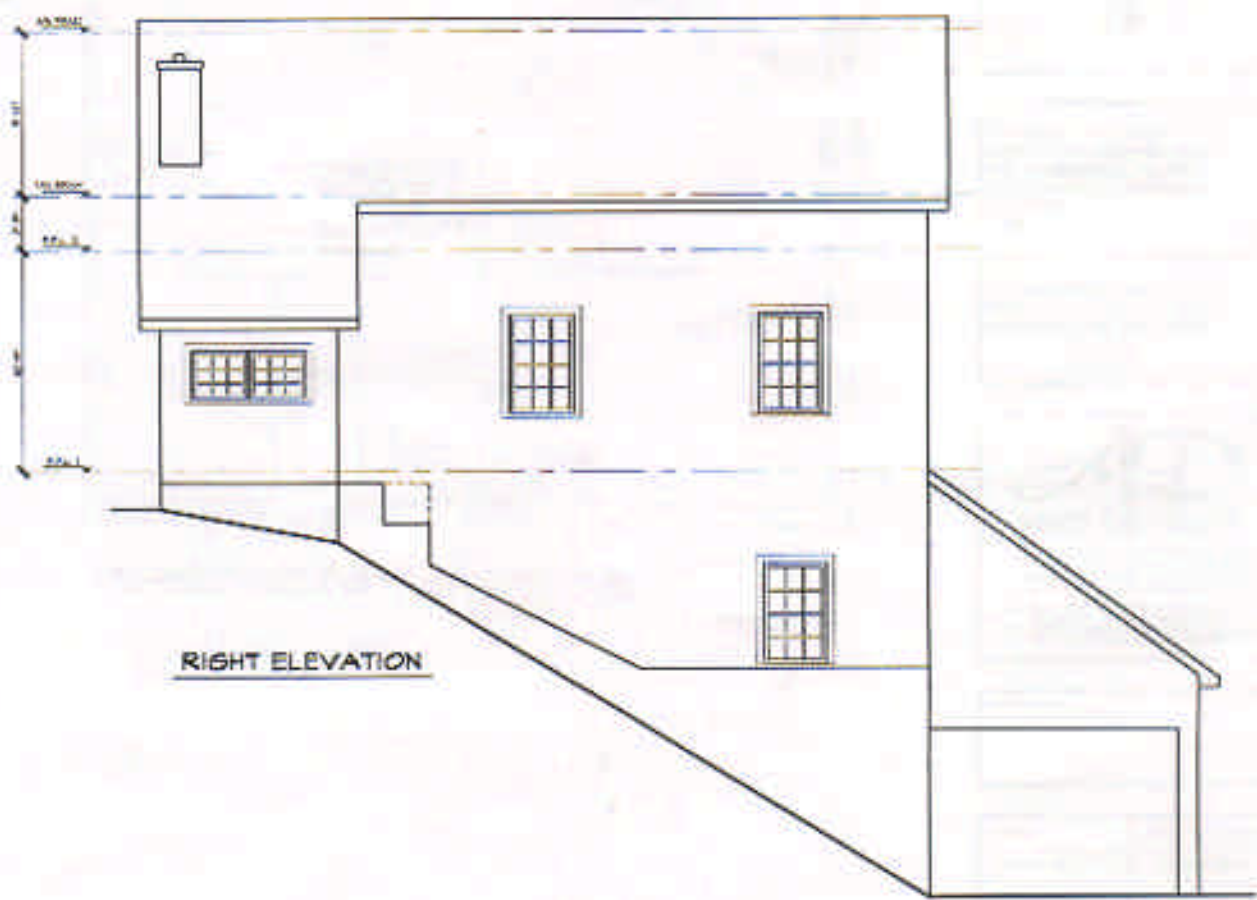
Photograph 9: Partial collapse of the rubble stone foundation in the spillway.



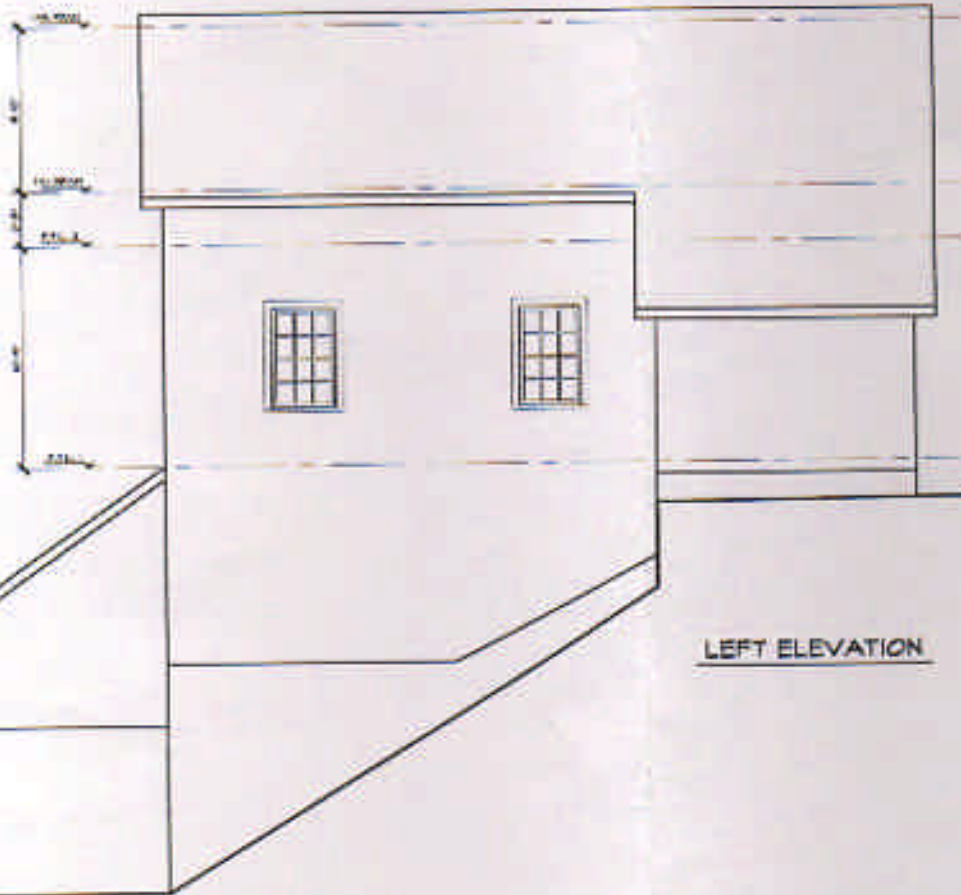
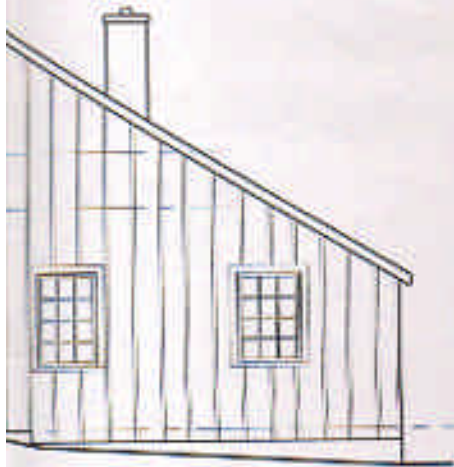
Photograph 10: Crack in existing concrete foundations. Note the loss of bearing under the footing indicating large footing movements.



FRONT ELEVATION



RIGHT ELEVATION



LEFT ELEVATION

NOTES

1. ALL DIMENSIONS ARE UNLESS OTHERWISE NOTED AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL DIMENSIONS AND LOCATIONS OF ALL UTILITIES AND STRUCTURES BEFORE ANY CONSTRUCTION BEGINS.
2. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CANADIAN BUILDING CODES AND ALL APPLICABLE REGULATIONS AND ORDINANCES.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE APPROPRIATE AUTHORITIES.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES AND STRUCTURES.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES AND STRUCTURES.

REVISIONS	
NO.	DATE

N/A
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RESTORATION PROJECT
86 INgersoll ROAD,
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N4S 2P4

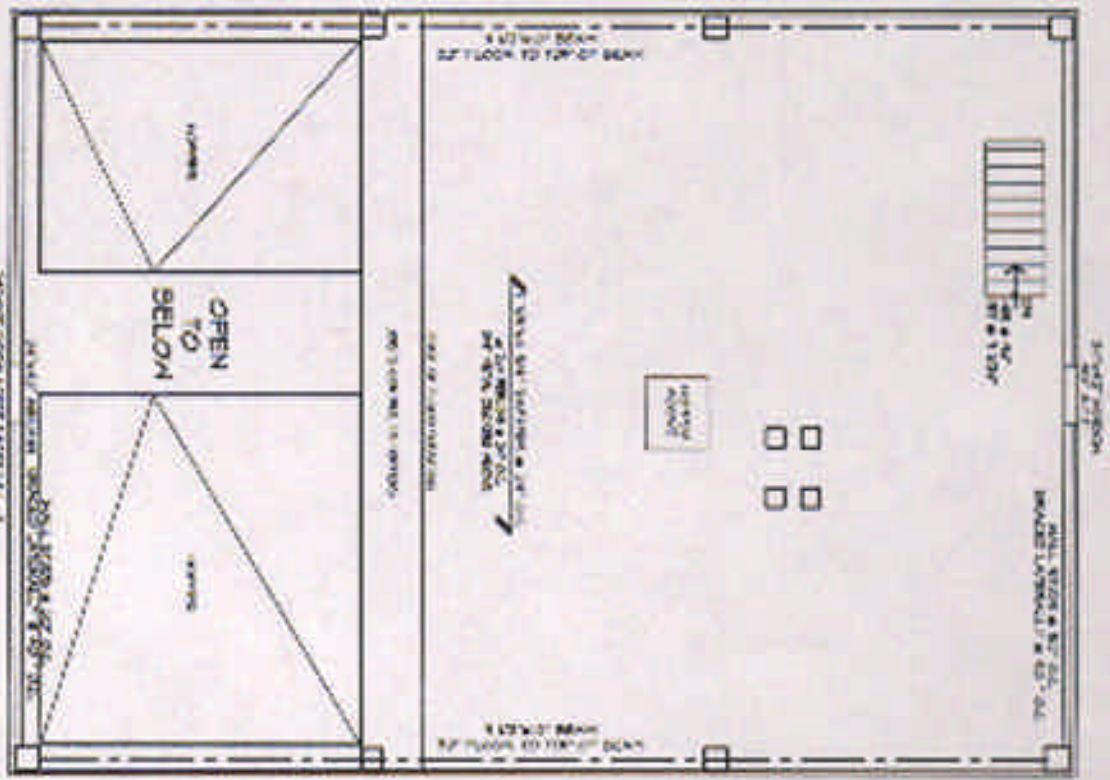
PROJECT
HARRINGTON BRIST MILL
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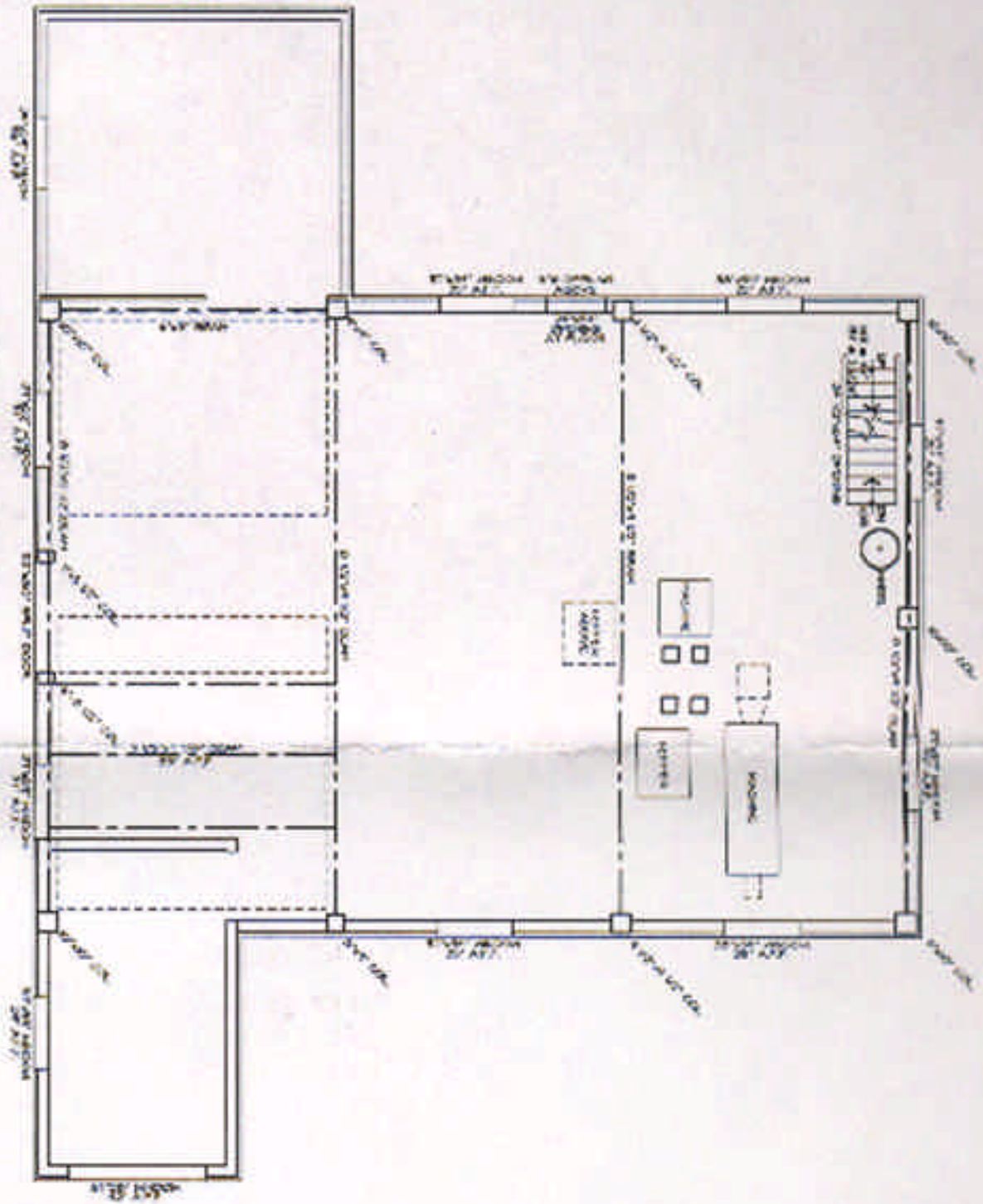
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BUILDING ELEVATIONS

DATE:	JAN. 9, 2002
DRAWN BY:	JOHN/JPH
CHECKED BY:	
SCALE:	AS SHOWN

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SECOND FLOOR PLAN



FIRST FLOOR PLAN

NOTES:

1. ALL DIMENSIONS AND RELATIVE DIMENSIONS ARE THE CONTRACTOR'S RESPONSIBILITY. THE ASSOCIATES OF ENGINEERS AND ARCHITECTS INC. IS NOT RESPONSIBLE FOR ANY ERRORS OR OMISSIONS IN THESE DRAWINGS UNLESS IT IS PROVEN THAT THE ASSOCIATES OF ENGINEERS AND ARCHITECTS INC. HAS BEEN ADVISED OF SUCH ERRORS OR OMISSIONS.
2. ALL WORKING MUST BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
3. THE CONTRACTOR MUST VERIFY THAT ALL CONSTRUCTION IS IN ACCORDANCE WITH THE NATIONAL BUILDING CODE, THE ONTARIO BUILDING CODE, LOCAL ZONING REGULATIONS AND ANY OTHER APPLICABLE AUTHORITIES.
4. DIMENSIONS NOT TO SCALE.
5. VERIFY ALL DIMENSIONS TO BE EXACTLY AS SHOWN PRIOR TO ANY CONSTRUCTION OR SHOP FABRICATION.

REVISIONS

NO.	DATE	DESCRIPTION



N/A ENGINEERING

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PROJECT
HARRINGTON GRIST MILL
RESTORATION PROJECT
HARRINGTON, ONTARIO.



ARKY DESIGNS

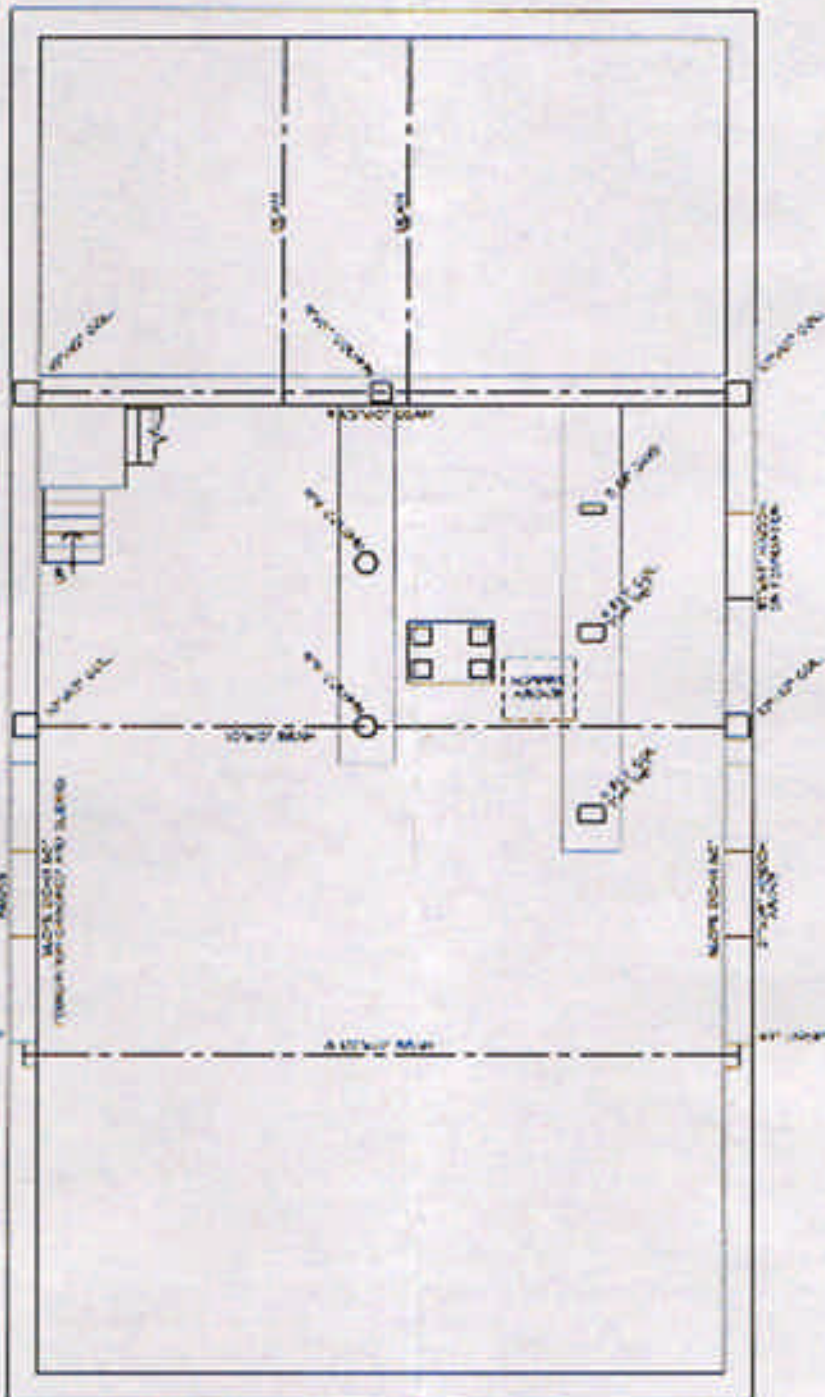
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DRAWING TITLE:
FLOOR PLANS

DATE:	JAN. 9, 2002
DRAWN BY:	JCHT/JPH
CHECKED BY:	
SCALE:	AS SHOWN

DRAWING NO. SHEET NO.
A01-T18-B



BASEMENT FLOOR PLAN



N Δ
ENGINEERING
ASSOCIATES INC

Structural ■ Civil ■ Environmental
Consulting Engineers

CLIENT

PHONE

HARRINGTON
MILL

PROJECT NAME

01-289

PROJECT NO.

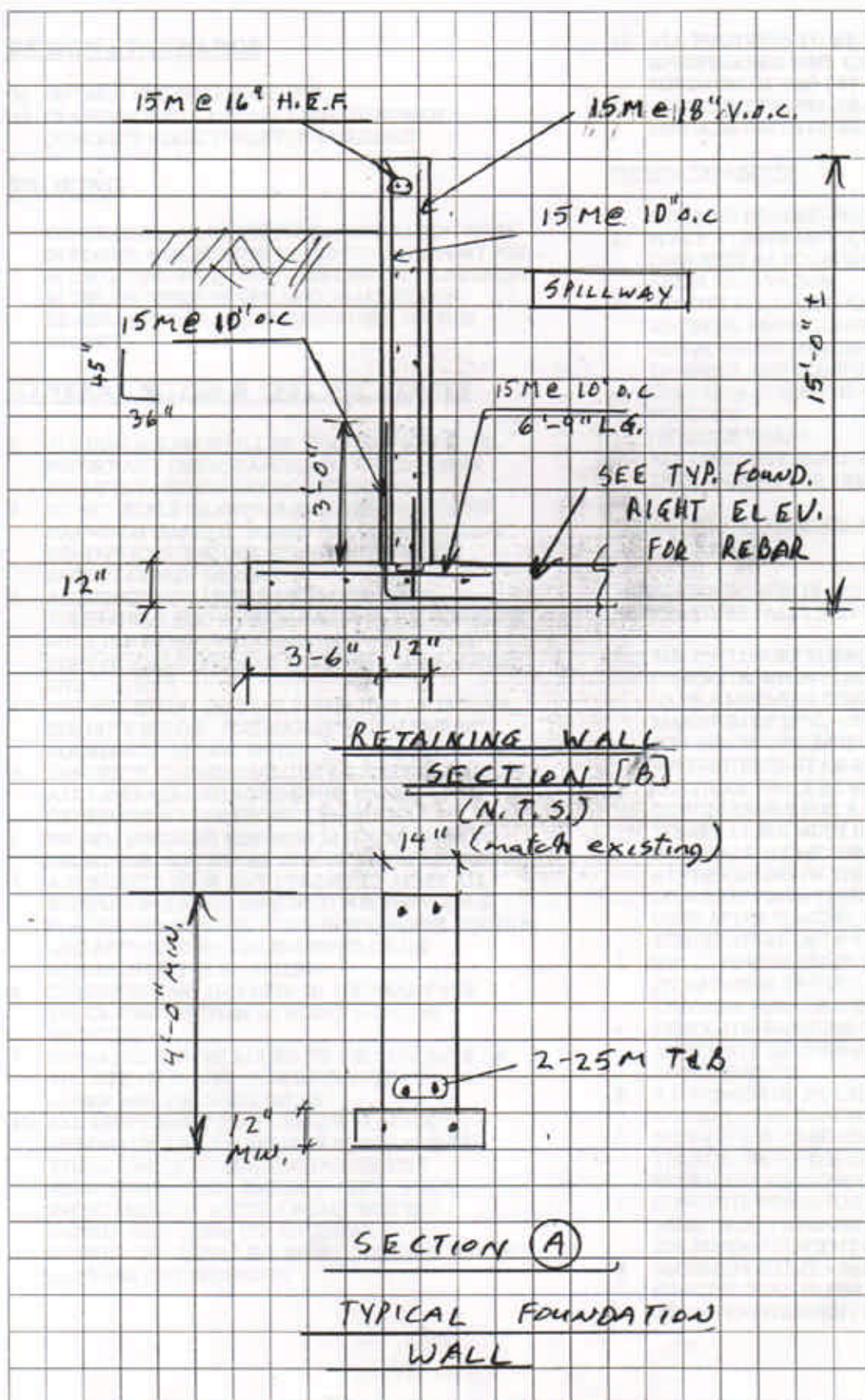
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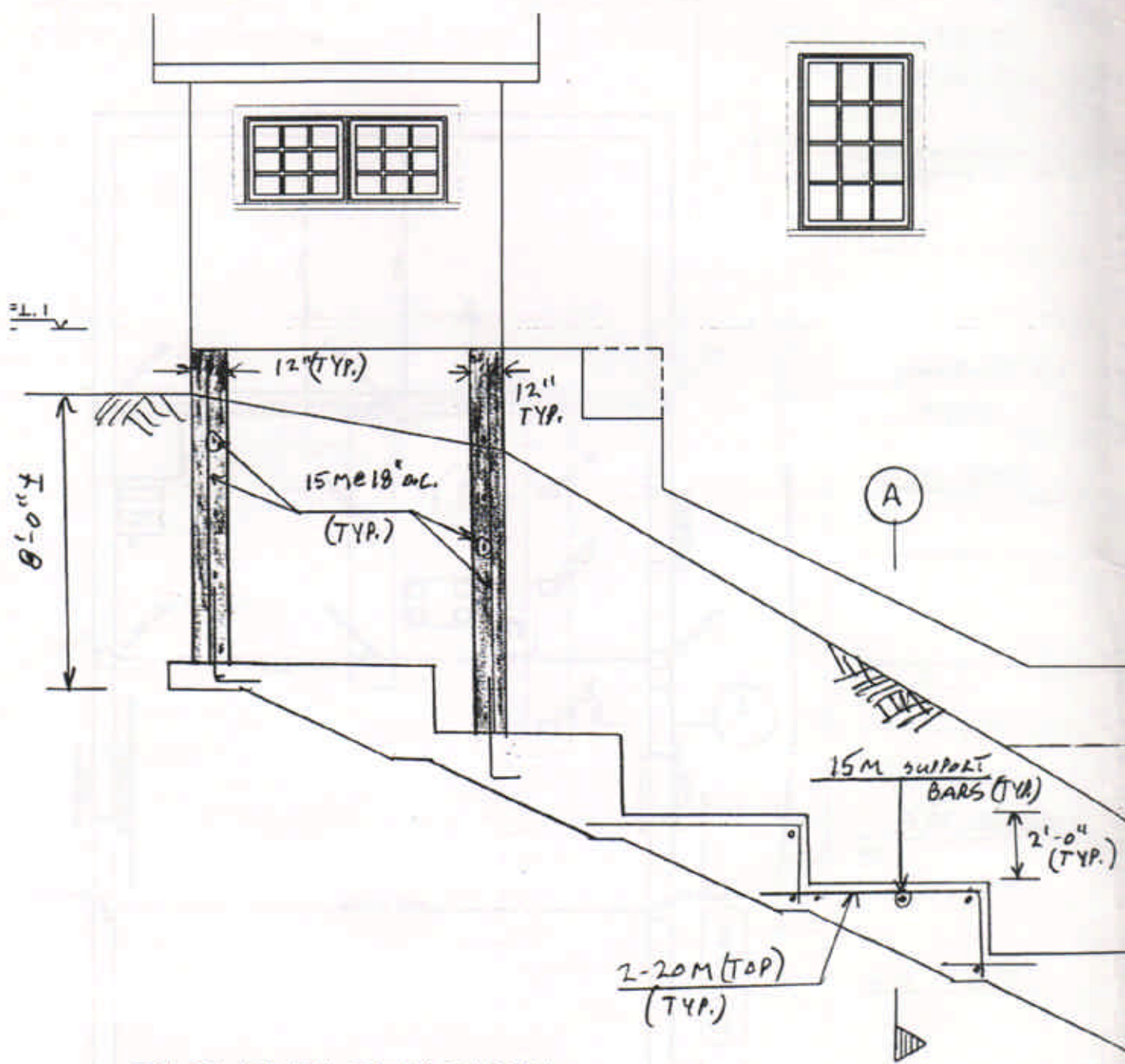
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PAGE NO. 3 of 4



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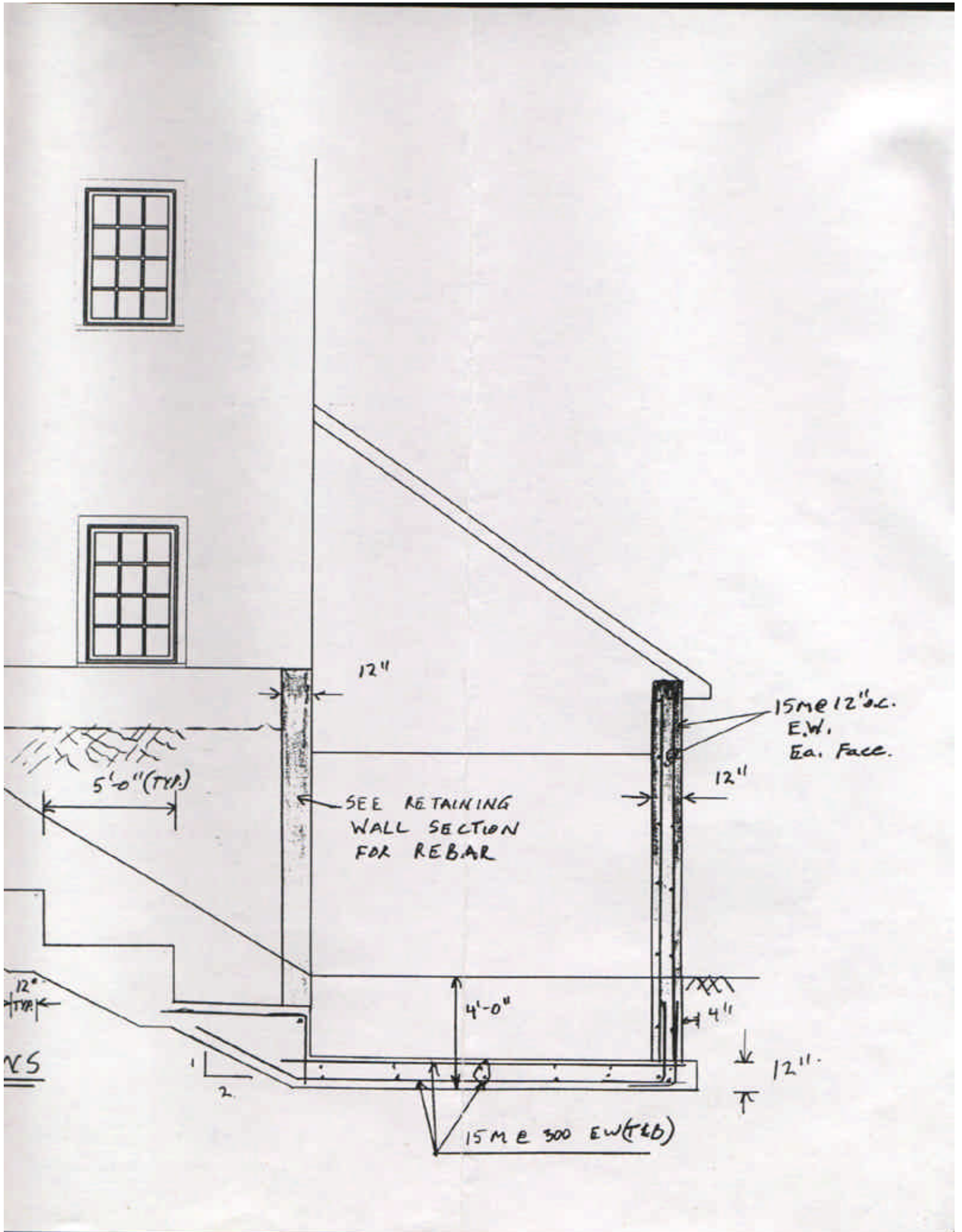
112 SPRINGBANK AVENUE
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FAX 519 539 7413



RIGHT ELEVATION
 SCALE: 1/4" = 1'-0"

TYPICAL FOUNDATION

SK-1
 APRIL 26, 2002
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DESIGN STANDARDS

- (a) ONTARIO BUILDING CODE 1991
- (b) CSA STANDARD CAN3-A23.3-M94 "DESIGN OF CONCRETE STRUCTURES FOR BUILDINGS".

SHORING

CONTRACTOR SHALL PERFORM FOUNDATION WORK IN STAGES AND PROVIDE CONTINUOUS SUPPORT FOR ALL EXISTING STRUCTURE. AN ENGINEER LICENCED IN THE PROVINCE OF ONTARIO SHALL DESIGN, REVIEW AND SEAL ALL SHORING USED ON THIS PROJECT.

GENERAL NOTES & SPECIFICATIONS

1. ALL DIMENSIONS SHALL BE VERIFIED ON THE JOB. REPORT ANY DISCREPANCIES TO THE ENGINEER PROMPTLY AND BEFORE CONSTRUCTION.
2. DO NOT SCALE DRAWINGS AND USE ONLY THOSE DRAWINGS MARKED "ISSUED FOR CONSTRUCTION." REMOVE EXISTING DRAWINGS FROM SITE, ON RECEIPT OF NEW REVISIONS.
3. ALL CONCRETE MATERIALS, PROCEDURES, TOLERANCES AND WORKMANSHIP SHALL CONFORM WITH THE LATEST ISSUE CAN3-A23-1 AND A23-2. A COPY OF THIS STANDARD SHALL BE AVAILABLE ON SITE.
4. FOR SPECIFIED CONCRETE STRENGTHS AT 28 DAYS, SEE NOTE BELOW. USE MAXIMUM 3" SLUMP, 1/4" AGGREGATE, UNLESS NOTED.
5. CONCRETE CURING SHALL BE ACCORDING TO CAN3-A23-1 AND A23-2 REQUIREMENTS, UNLESS APPROVED OTHERWISE BY THE PROJECT ENGINEER.
6. INFORM ENGINEER MINIMUM 24 HOURS PRIOR TO EACH POUR, FOR THE REVIEW OF THE REINFORCING.
7. A CONCRETE POUR MAY COMMENCE AFTER ALL REINFORCING STEEL REQUIRED FOR THE POUR IS PLACED AND SECURELY TIED IN ITS PROPER POSITION AND APPROVED BY THE ENGINEER OR HIS REPRESENTATIVE, IN WRITING.
8. CONCRETE THAT HAS BEEN IN THE READY MIX TRUCK LONGER THAN 1 1/2 HOURS SHALL BE REJECTED.
9. NO WATER IS TO BE ADDED TO THE CONCRETE ON THE SITE, OR TO THE CONCRETE IN THE TRUCK UNDER ANY CIRCUMSTANCES.
10. ALL REINFORCING SHALL BE G30.12 GRADE ($F_y = 400\text{MPa}$) USE ONLY CANADIAN MANUFACTURED STEEL. UNDER NO CIRCUMSTANCES MAY REINFORCING STEEL BE CUT ON SITE. WHEN INTERFERENCES OCCUR, OBTAIN WRITTEN INSTRUCTION FROM THE ENGINEER.
11. REINFORCING DETAILING SHALL CONFORM TO CAN3-A23.3-M94 REQUIREMENTS.

12. ALL FOOTINGS TO BE FOUNDED ON FIRM UNDISTURBED SOIL CAPABLE OF SUPPORTING A MINIMUM OF 3000 PSF ALLOWABLE.
13. ALL PERIMETER FOOTINGS TO BE FOUNDED @ A MINIMUM DEPTH OF 4'-0" BELOW FINISHED GRADE.

FOUNDATION NOTES

1. ASSUMED BEARING PRESSURE = 3000 P.S.F.
2. PLACE A LAYER OF 8" CRUSHED STONE OR LEAN CONCRETE AT FOUNDING LEVEL IMMEDIATELY AFTER EXCAVATION.
3. REMOVE ALL UNSUITABLE FILL AND ORGANIC MATERIAL FROM CONSTRUCTION AREA AND REPLACE WITH MATERIAL APPROVED BY SOILS ENGINEER AND COMPACTED TO HIS APPROVAL.
4. CONCRETE STRENGTH AT 28 DAYS:
FOOTINGS $f_c = 25\text{ MPa}$
EXTERIOR WALLS $f_c = 25\text{ MPa}$
ALL CONCRETE SHALL HAVE MINIMUM 5% AIR ENTRAINMENT FOR FREEZE THAW PROTECTION.

MINIMUM REQUIREMENTS FOR COLD WEATHER CONCRETE

THESE REQUIREMENTS ARE APPLICABLE WHEN THE AIR TEMPERATURE FALLS BELOW 5° C.

1. THE ENCLOSURE SURROUNDING THE WALLS AND CONCRETE, WHEN PLACED IN THE FORMS, SHALL HAVE A MINIMUM TEMPERATURE OF 20° C AND A MAXIMUM OF 25° C. CONCRETE DELIVERED TO THE SITE BELOW 20° C MUST BE REJECTED BY THE JOB SUPERINTENDENT OR HIS REPRESENTATIVE.
2. PILASTERS, SHALL BE MAINTAINED TO 25° C TO 27° C CONTINUOUSLY FOR A MINIMUM OF 3 DAYS. THIS TEMPERATURE MUST BE CHECKED AT 2 HOUR INTERVALS, BY MEANS OF A THERMOMETER PLACED AT THE CEILING OF THE ENCLOSURE. KEEP THE CONCRETE FROM FREEZING FOR A MINIMUM OF 7 DAYS AFTER PLACING, BY MAINTAINING A TEMPERATURE OF 10° C IN THE ENCLOSURE.
3. USE COMPRESSED AIR TO CLEAR THE ICE OR SNOW FROM FORMS OR STEEL. DO NOT USE CALCIUM CHLORIDE FOR CLEARING ICE AND SNOW.
4. CHECK THE WEATHER FORECAST DAILY IN ORDER TO ANTICIPATE HEATING AND PROTECTION REQUIREMENTS.
5. A MAXIMUM OF 2% CALCIUM CHLORIDE MAY BE ADDED TO THE CONCRETE IN THE PLANT.
6. NO WATER IS TO BE ADDED TO THE CONCRETE ON THE SITE, OR TO THE CONCRETE IN THE TRUCK UNDER ANY CIRCUMSTANCES.
7. CONCRETE WHICH HAS BEEN IN THE TRUCK FOR MORE THAN 1 1/2 HOURS SHALL BE REJECTED BY THE JOB SUPERINTENDENT OR HIS REPRESENTATIVE.
8. MAXIMUM SLUMP = 90 MM. CONCRETE WITH SLUMP GREATER THAN 90 MM MUST BE REJECTED BY THE JOB SUPERINTENDENT OR HIS REPRESENTATIVE.