BRICK LEDGE BEARING CAPACITY DOCUMENTATION

FOR

NUDURA™ INTEGRATED BUILDING TECHNOLOGY
INSULATED CONCRETE FORMS

NOTE:

May 13, 2005

TO: ALL ARCHITECTS, ENGINEERS, CONTRACTORS AND BUILDING OFFICIALS

RE: BEARING CAPACITY OF CORBELLED LEDGES FORMED WITH NUDURA BRICK LEDGE FORM UNITS AND BRICK LEDGE EXTENSIONS

The attached documentation has been prepared to assist our distributors in helping our key client groups better understand the structural capabilities of performance of NUDURA’s Extended Brick Ledge Form Unit as well as the NUDURA Brick Ledge Extension.

The Extended Brick Ledge Form Unit and Brick Ledge Extension Form have been designed by NUDURA’s product engineers to provide a structurally reinforced 4 ½” (114mm) corbel stand-off from the face of any cavity width of NUDURA’s typical form units that will enable structural bearing of standard thicknesses of brick, block, or stone for heights specified below. As the attached documentation verifies, the ledge when constructed as specified is capable of supporting standard 3 ½” (89mm) thick brick or stone installed to a height of 27 feet (8.23 meters). The geometry of the ledge and reinforcing hook stirrup have been designed in accordance with the provisions of Section 11.9 (Special Provisions for Brackets and Corbels) of ACI 318 (USA) and with Section 11.5 (Strut and Tie Model) and Section 11.7 (Special Provisions for Brackets and Corbels) of CAN/CSA A23.3 (CAN) (copies of these documents if not accompanying this documentation are available from NUDURA through our distributors).

The attached letter from Trow Consulting Engineers (originally issued to NUDURA Corporation under its former corporate name of AIM Building Products) corroborates an ultimate (un-factored load) bearing capacity of 6,800 pounds/linear foot (100 kilo Newtons/meter). This ultimate capacity is based on the use of 3,000 psi (20 MPa) concrete and reinforcing with minimum #4 (10M) reinforcing bar and hook stirrups as detailed utilizing minimum 60 ksi (Grade 400) steel.

However, the brick ledge’s factored safe load capacity is recommended to be well below this loading limit. As noted in the letter from Trow Engineering – brick or stone can be safely be installed to a maximum of 3 stories in height or 27 feet (8.23 m) (as noted in the stamped brick ledge detail also attached).

Given this stated height limit and that the density of stone being set at approx. 165 lbs/ft³ (2,611 kg/m³) and that the stone is assumed to be exactly 3 ½” (89mm) thick, as such the stone will have a correlated unit weight of approx. 50 lbs/ft² (807.3 kg/m²) of finished wall area. Therefore, the factored safe load limit of the NUDURA brick ledge is set at approximately 1,350 lbs/lf (2013 kg/m) yielding a 5.037 safety factor in comparison to ultimate load capacity stated by Trow Engineering.
For Brick installations requiring masonry support ABOVE the height of 27 feet (8.23 meters), the connection shown in Detail D4 can be used which consists of a standard structural steel support angle connected with embedded bolts back into the wall cavity in accordance with the applicable table sized and spaced in accordance with the required height of wall. This connection then assures transference of the load through the angle bolts back into the wall condition itself as opposed to bearing directly on the corbelled ledge. Conditions beyond those shown will require professional engineer’s review.

Often the question is raised as to the suitability of the ledge to be used as a floor bearing ledger when inverted to the interior as show in the attached Detail No. C6A14 (final attachment).

This type of application can safely be considered for one or two story floor bearing conditions in low risk seismic areas (Seismic D and below –USA, Seismic Za or Zv ≤4 -CAN), so long as the calculated combined factored dead and live load totals do not exceed the above noted bearing limit of 1,350 lbs/lf (2013 kg/m) bearing on the ledge. Anchorage of the floor assembly into the top of the wall must be also in full accordance with applicable local codes (i.e. nailing and sill bolting) to assure that the wall is properly connected to and stayed in place by the floor diaphragm. NOTE: You must consult with a professional engineer if considering applications outside of these limits for seismic, load or any other custom or specialized conditions not noted above - for span limits and anchorage requirements. DO NOT consider utilizing a brick ledge for bearing a concrete floor of any kind without consulting with a structural engineer as to whether the application is suitable.

Any other questions that may arise regarding brick ledge capacity and applications can be directed to NUDURA Technical Support through your local NUDURA distributor.
Mr. Alain C Leger P.Eng.
Ottawa Regional Office
AIM Building Products
P.O. Box 189
Long Sault, Ontario
KOC 1P0

Dear Mr. Leger:

Capacity of Brick ledge Unit

We have determined the capacity of the brick ledge unit faxed to us on June 12, 2002. We are able to report that the maximum, unfactored, uniformly distributed load (UDL) that can be supported by the brick ledge is 100 kN/m (5.8 kip/ft). However, this value shall never be considered alone in the design of any combination of building components due to the number of other factors involved, such as, but not limited to the following:

- Axial and flexural capacity of wall (limited by cross-sectional properties, height, reinforcement, etc.),
- Capacity of footings,
- Capacity of soil,
- Capacity of any and all other components in load path,
- Serviceability criteria (e.g. deflection, cracking, etc.)

Calculations were performed only for the 150mm (6") nominal concrete core and various assumptions were made. These assumptions are that the concrete compressive strength is 20 MPa, reinforcement consists of Grade 400, #10M bars, no horizontal forces are applied to the ledge, an unreinforced brick wall of specified unit weight of 1.9 kPa and the ties are located at 200mm c/c.

Brick ledge capacity shall always be reviewed by a structural engineer when proposed use is other than a “brick ledge” supporting more than 3 storeys of brick.

Trow Consulting Engineers Ltd. accepts no responsibility for control of the use of the brick ledge for which we have not been consulted.

We trust that you find the above to your satisfaction and if you have any questions, please feel free to contact the undersigned.
AIM Building Products/ Capacity of Brick Ledge Unit

Yours truly,

Oliver, Mangione, McCalla & Associates
a division of Trow Consulting Engineers Ltd.

Kevin MacDonald
Associate
Cornwall Office

Michael Godard, P.Eng.
Manager,
Cornwall Office

Distribution: File: MU15730AW
TYPICAL DETAILS (C-5)

TOP OF FIRST CONCRETE POUR
MAX. 27”-0” (8230mm)
SUPPORTED BRICK VENEER
NUDURA 6” (150mm)
STANDARD FORM UNIT
BRICK VENEER 1”(25mm)
AIR SPACE w/BRICK TIES
AS PER CODE
FLASHING MATERIAL AND
WEEP HOLES AS PER
CODE
GRADE MINIMUM
2% SLOPE
FINISHED GRADE
MIN. 6” (150mm)
OR AS PER CODE
1/2” [13mm]
5”(127mm) 9 2” (241mm)
NUDURA WATERPROOFING
MEMBRANE
NOTES:
1. MINIMUM CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS 3000 psi (20 MPa).
2. REINFORCING STEEL SHALL BE HARD GRADE DEFORMED BARS CONFORMING TO
ASTM A615/A615M-05A-A65,000 psi YIELD STRENGTH (USA). (CSA G30.18-92
(R2002) Fy=400MPa (CAN)).
3. WALL REINFORCING SHALL BE IN ACCORDANCE WITH NUDURA INTEGRATED
BUILDING SYSTEM, LOCAL CODE OR ENGINEERINGDRAWINGS. (AS SPECIFIED)
4. BRICK UNIT WEIGHT: 41 lbs/ft³ (1.9kN/m³) IN VERTICAL PLANE.
5. MAXIMUM WALL HEIGHT: 27 ft (8.23m) UNLESS ENGINEERED OTHERWISE.
6. ASSUME BRICK INSTALLATION IN ACCORDANCE WITH APPLICABLE CODES
(CAN) OR EQUIVALENT PER IRC (USA).
7. BRICK LEDGE DETAIL ADEQUATE FOR SEISMIS AREA 2a and/or IV ≤ 4
(CAN) OR EQUIVALENT PER IRC (USA)

NUDURA INTEGRATED BUILDING TECHNOLOGY
Building Value.
TYPICAL DETAILS (C-10)

FLASHING MATERIAL AND WEEP HOLES AS SPEC'D PER CODE

1" (25.4mm) CONC. COVER

STEEL ANGLE (SEE TABLE)

NUDURA STANDARD FORM UNIT

FORMS TO BE CUT OUT AS NOTED PRIOR TO PLACING OF CONCRETE

ANCHOR BOLT W/2 (50mm) BEND (SEE TABLE)

BACKER ROD AND SEALANT

HEIGHT OF SUPPORTED BRICK ABOVE ANGLE

<table>
<thead>
<tr>
<th>ANGLE SIZE</th>
<th>10'-0&quot; (3050mm)</th>
<th>20'-0&quot; (6100mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; DIA. (12.5mm DIA.)</td>
<td>L4&quot; x 4&quot; x 1/4&quot; (L102 x 102 x 6.35)</td>
<td>L4&quot; x 4&quot; x 1/4&quot; (L102 x 102 x 6.35)</td>
</tr>
<tr>
<td>ANCHOR SPACING</td>
<td>24&quot; (610mm)</td>
<td>16&quot; (406mm)</td>
</tr>
</tbody>
</table>

NOTES:
1. ASSUMES BRICK INSTALLATION IN ACCORDANCE WITH APPLICABLE CODES.
2. MIN. STEEL Fy=43.5 ksi (300 MPa) YIELD STRENGTH FOR ANGLES.
3. ANGLES AND BOLTS TO BE GALVANIZED OR STAINLESS STEEL TO MEET THE REQUIREMENT OF TABLE 5.1 OF A370-04 (CONNECTIONS FOR MASONRY, OR EQUIVALENT STANDARD).
HILTI ANCHORS TO BE Sized AS PER TABLE

NOTE: MAINTAIN
u/s of ANCHOR SHAFT 2" (50mm)
min. CLEARANCE FROM WEBS AND
1" (25mm) COVER ALL AROUND

FLASHING MATERIAL AND WEEP HOLES AS SPEC’D PER CODE

STEEL ANGLE (SEE TABLE)

BRICK VENEER w/ BRICK TIES AS PER CODE

HEIGHT OF SUPPORTED BRICK ABOVE ANGLE

<table>
<thead>
<tr>
<th>ANGLE SIZE</th>
<th>BRICK SIZE</th>
<th>ANCHOR SIZE</th>
<th>EMBEDMENT</th>
<th>ANCHOR SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>10'-0&quot; (3050mm)</td>
<td>6&quot; x 4&quot; x 5/16&quot;</td>
<td>HSL M12/25</td>
<td>3.2&quot; (80mm)</td>
<td>16&quot; (406mm)</td>
</tr>
<tr>
<td>20'-0&quot; (6100mm)</td>
<td>6&quot; x 4&quot; x 3/8&quot;</td>
<td>HSL M16/25</td>
<td>4.2&quot; (105mm)</td>
<td>16&quot; (406mm)</td>
</tr>
</tbody>
</table>

* ANCHORS SPECIFIED ABOVE ARE HILTI HEAVY DUTY ANCHORS
NOTES:
1 CONTRACTOR TO INSTALL ANCHORS AS PER SUPPLIER’S SPECIFICATIONS.
2 ASSUMES BRICK INSTALLATION IN ACCORDANCE WITH APPLICABLE CODES.
3 MIN. STEEL Fy=43.5 ksi (300 MPa) YIELD STRENGTH FOR ANGLES
4 ANGLES AND BOLTS TO BE GALVANIZED OR STAINLESS STEEL TO MEET THE REQUIREMENT OF TABLE 5.1 OF A370-04 (CONNECTIONS FOR MASONRY, OR EQUIVALENT STANDARD)
NUDURA STANDARD 6" FORM UNIT

1/2" (13mm) GYPSUM BRD.

3/16" (5mm) ACRYLIC PARGE COAT

NUDURA WATERPROOF MEMBRANE OR OTHER EQUIVALENT

VERTICAL REINFORCEMENT AS PER CODE OR AS SPECIFIED

HORIZONTAL REINFORCEMENT AS PER CODE OR AS SPECIFIED

SUB FLOOR

WOOD JOIST

1/2" (13mm) GYPSUM BRD.

2x4 (38x89) SILL PLATE WITH ANCHOR BOLT

BULKHEAD WITH 1/2" (13mm) GYPSUM BRD.