Proposed Code Change
State Form 41186R

RETURN TO:
INDIANA DEPARTMENT OF HOMELAND SECURITY
CODE SERVICES SECTION
302 W. Washington Street Room W246
Indianapolis, IN 46204

FOR OFFICE USE ONLY
Received 12/29/09
Code 48.8.8.1-09

INSTRUCTIONS: *Only TYPED copy accepted.*
(KEY- ~~Dashed line through material to be deleted~~, underline material to be added)
Use second sheet for any material requiring more space.

Code Title	Edition
Indiana Residential Code	2009
Section R 404.1.1.1 Masonry Foundation Walls	Page

Proponent	Title
William Fox / IBA/For a Builder member	Code Committee Member

Address	Phone
6125 W 29th Place, Speedway, IN. 46224	317-291-7575

PROPOSED CODE CHANGE (Check One)

☐ Change to read as follows ☑ Add to read as follows ☐ Delete and substitue as follows ☐ Delete without substitution

Add Exception to R 404.1.1.1 to read as follows: **A**
double course of 4 inch (102 mm) wide concrete blocks. The top course shall be of solid concrete or fully grouted masonry. The unbalanced vertical load is a maximum of 8 (203 mm) inches in height. One story structures shall not exceed 60 feet (mm) of roof span or 38 (mm) feet of floor joist span. Two story structures shall not exceed a roof span of 54 (mm) feet or 30 (mm) feet of floor joist span. The footing widths will comply with Table R 403.1. For this exception Section R 606.2.1 shall not apply. The minimum roof slope will not be less than a 5 on 12.

Reason

The purpose of this change order is to allow this footing and foundation to be included in the IRC. It is a well thought out system that has been used in Central Indiana but has not been accepted in some Building Departments without certofication each time it is used. Attached are 7 pages that develop the engineering basis of this poposal.

REVIEW RECOMMENDATION

Approve
Disapprove
Approve as amended
Further Study

(1)

Silver Creek Engineering, Inc.

December 3, 2009

Paul Shoopman Home Building Group
6500 Technology Center Drive
Suite #100
Indianapolis, IN 46278

Attn: Paul Shoopman
Re: 4" CMU Foundation Wall Evaluation
SCE Job #09347

Dear Paul:

Per your request, we have evaluated the use of 4" CMU as a foundation wall. It is our understanding that you would like to provide two courses of 4" CMU on top of a cast in place concrete footing to support the exterior walls of your slab on grade one and two story single family residences. You asked us to evaluate the structural adequacy of this construction.

Our analysis shows that the 4" CMU is structurally adequate to support the loads required by the 2005 Indiana Residential Code (IRC). The attached drawings have been reviewed and are acceptable per the IRC. Our analysis is subject to the following limitations:

1. Foundation wall was analyzed for gravity and wind uplift loads on the roof only. Construction for lateral loads shall be per the IRC prescriptive method for braced wall lines.
2. The top course of CMU shall be solid or fully grouted and the lower course may be grouted or ungrouted line block or solid.
3. The specified compressive strength of the masonry, f'm, shall be a minimum of 1500 psi, using property type "M" mortar.
4. The maximum clear span of roof trusses analyzed was 54 feet.
5. The maximum clear span of floor framing analyzed was 30 feet.
6. The minimum roof slope shall be 5 on 12.
7. The wall plate anchors shall have a minimum G185 galvanized coating. Anchor bolts shall be ½" diameter, ASTM A36 with minimum 7" embedment, such as the Illinois Products Company IPCOTE HDG A-100, or approved equal, and spaced a maximum of 6 foot on center. Installation shall conform to the requirements of the IRC (see attachment), the manufacturer, and any local ordinances (in case of discrepancy, the most stringent shall apply).

If you have any questions please let me know.

Sincerely,
Silver Creek Engineering, Inc.

Mark Frossard, P.E.

MARK E. FROSSARD
REGISTERED
No. 10809027
STATE OF INDIANA
PROFESSIONAL ENGINEER

Attahments: Calculations (by SCE) – 4 pages
4" CMU Foundation Wall Drawings (by Shoopman) – 3 pages
IRC Section R403.1.6, Foundation Anchorage
IPCO Masonry Anchor Bolts technical information

7225 Woodland Drive, Suite 200, Indianapolis, Indiana 46278 · (317) 297-5610 · FAX (317) 297-2942
www.sceindy.com

OBJECTIVE: REVIEW USE OF 4" CMU FOR USE AS FOUNDATION WALL, 2 COURSES HIGH FOR ONE AND TWO STORY RESIDENCES.

LOADS: ROOF

DL: Asph. Shingles (2 layers)	6 psf	
Sheathing	3 psf	
Framing	5 psf	
Insulation	2 psf	
Gyp. Board Ceiling	3 psf	
	19 psf	USE 20 psf

LL: 20 psf

WALLS: Studs	3 psf	
Sheathing	3 psf	
Insulation	1 psf	
Gyp. Board	3 psf	
Siding	2 psf	
	12 psf	USE 15 psf

FLOOR:

DL: Carpet / Laminate	4 psf	
Sheathing	3 psf	
Framing	4 psf	
Ceiling: Gyp Board	3 psf	
	14 psf	USE 15 psf

LL: 40 psf

WIND LOAD: per ASCE 7-02
V = 90 mph
Exposure C (assume subdivision borders a farm field)
Importance factor, I = 1.0
h ≈ 25' mean roof height (assumed)

$p_z = \lambda I q_{zcen}$

$\lambda = 1.35$

pg. 30 NET WINDWARD + LEEWARD PRESSURES

WALLS: END ZONE 17.8 psf
INTERIOR ZONE 11.9 psf
VERTICAL ON ROOF: END ZONE −15.4 psf, +5.6 psf
INTERIOR ZONE −10.7 psf, +4.8 psf
OVERHANG: END ZONE −21.6 psf
INTERIOR ZONE −16.9 psf

DESIGN PRESSURES

WALLS: END ZONE = 24.0 psf
INT. ZONE = 16.1 psf
VERT. ON ROOF: END ZONE = −20.8 psf, +7.6 psf
INT. ZONE = −14.4 psf, +6.5 psf
OVERHANG: END ZONE = −29.2 psf
INT. ZONE = −22.8 psf ← USE MINIMUM 10 psf

END ZONE = 2a = 10 ft

$$a = \begin{cases} \min \begin{cases} 0.10\,\ell_{min} = 0.10\,(50\text{ ft}) = 5\text{ ft} \leftarrow \text{CONTROLS} \\ 0.4h = 0.4\,(25\text{ ft}) = 10\text{ ft} \end{cases} \\ \max \begin{cases} 0.04\,\ell_{min} = 0.04\,(50\text{ ft}) = 2\text{ ft} \\ 3\text{ ft} \end{cases} \end{cases}$$

COMPRESSION ON BLOCK

ASSUME ROOF TRUSSES SPAN 60 ft

ASSUME MAXIMUM ALLOWABLE I-JOIST FRAMING SPAN = 38'

DL + LL + W CONTROLS

w = ROOF = (20 psf + 20 psf) × 30' = 1200 plf
WALLS = (15 psf) × 20' = 300 plf
FLOOR = (15 psf + 40 psf) × 19' = 1045 plf
WIND = 10 psf × 36' = 300 plf
2845 plf

$$f_c = \frac{2845\text{ plf}}{(3.5\text{ in})(12\text{ in/ft})} = 67.7\text{ psi}$$

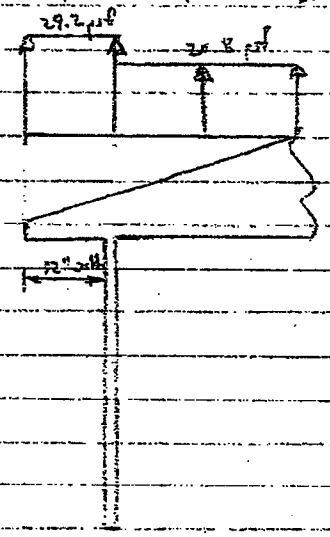
MASONRY – ASSUME 1000 psi w/ Type S Mortar
$f'_m = 1000$ psi

$F_a = \phi 0.25 f'_m (2.5) = 0.8(0.25)(1000\ psi)(2.5) = 500$ psi

4" BLOCK IS ADEQUATE FOR COMPRESSION

TENSION DUE TO WIND UPLIFT

WORST CASE IS SINGLE STORY HOME



0.6 DL + W → LOOK AT WIND ON END ZONE

w =	ROOF	0.6 (20 psf) × 30' =	360 plf
	WALLS	0.6 (15 psf) × 10' =	90 plf
	WIND	(−29.2 psf × 1') + (−20.8 psf × 30') =	−653 plf
			−203 plf

No DIRECT CONNECTION TO FOUNDATION ∴ n.G.

CAN WIND LOAD BE REDUCED?

IF ROOF SLOPE ≥ 20° → 4.4/12

LOOK AT 5/12 SLOPE (22.6°)

VERTICAL LOAD ON ROOF

p_{roof} = END ZONE =

20° = 15.4 psf > 22.6° = 11.1 psf

25° = 7.2 psf

OVERHANG

20° = 21.6 psf > 22.6° = 17.3 psf

25° = 12.3 psf

CHECK NET UPLIFT

w =	ROOF =		360 plf
	WALLS =		90 plf
	WIND =	(−17.3 psf × 1') + (−11.1 psf × 30') =	−350 plf
			100 plf ∴ NO NET UPLIFT

FLEXURE

ASSUME AXIAL LOAD IS ECCENTRIC BY 1/2"

$$M = 2845\ plf\ (1/2") = 1423\ in\cdot lb/ft$$

$$S = \frac{1}{6}bh^2 = \frac{1}{6}(12")(3.625")^2 = 26.28\ in^3/ft$$

$$f_b = \frac{M}{S} = \frac{1423\ in\cdot lb/ft}{26.28\ in^3/ft} = 54\ psi$$

$$F_b = \frac{1}{3}f'_m = \frac{1}{3}(1000\ psi) = 333\ psi$$

$$f_b < F_b \quad O.K.$$

COMBINED AXIAL COMPRESSION AND FLEXURAL COMPRESSION

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} \leq 1 \Rightarrow \frac{67.7\ psi}{500\ psi} + \frac{54\ psi}{333\ psi} = 0.30 \leq 1.0 \quad ✓$$

COMBINED AXIAL COMPRESSION AND FLEXURAL TENSION

$$f_a + f_b = 67.7\ psi - 54\ psi = 13.7\ psi > 0 \quad \therefore \text{ no NET TENSION}$$

<u>4" CMU IS ADEQUATE FOR FLEXURE</u>

FOOTING WIDTH

1 STORY - $w = 1200\ plf + 300\ plf + 300\ plf = 1800\ plf$

FTG WIDTH: ASSUME ALLOWABLE BEARING PRESSURE = 2000 psf

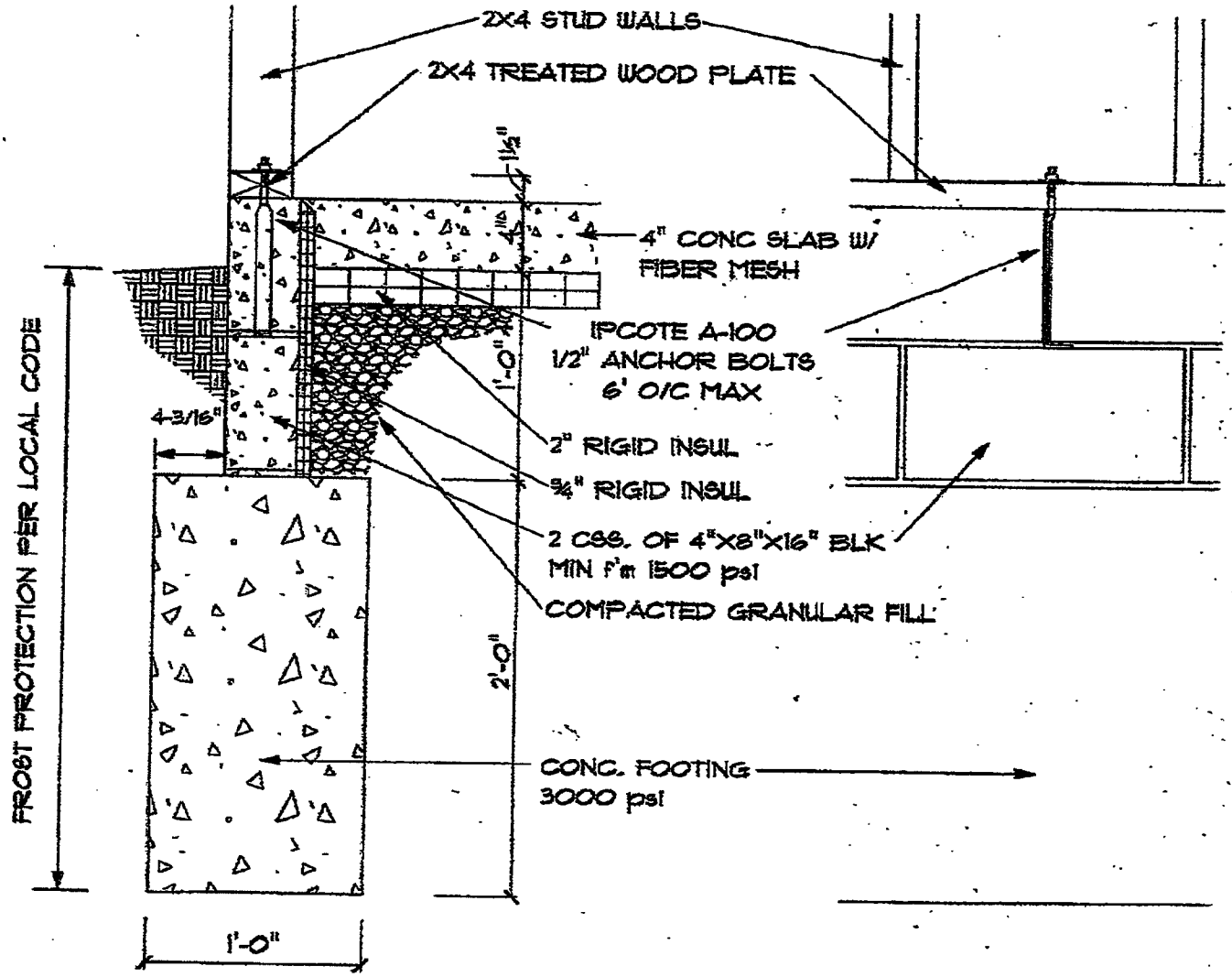
$$W_f = \frac{1800\ plf}{2000\ psf} = 0.9\ ft < 1'-0" \quad ✓$$

2 STORY $w = 2845\ plf$

$$W_f = \frac{2845\ plf}{2000\ psf} = 1.423\ ft > 1'-3"$$

$\therefore$ INCREASE FOOTING WIDTH OF EACH FLOOR/ROOF SPANS

W/ ROOF SPAN = 54' AND FLOOR SPAN = 30' $w = 2505\ plf$



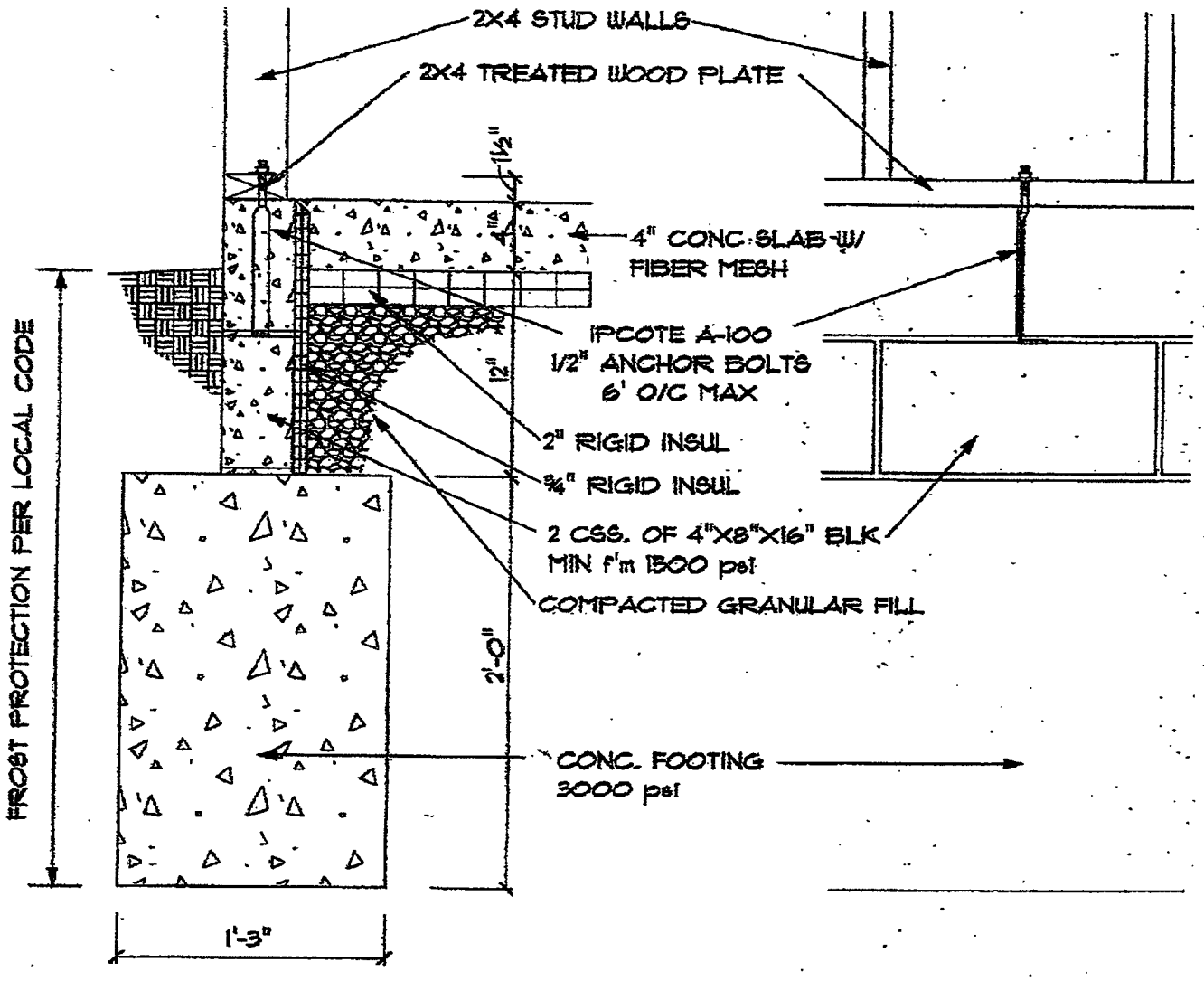
SECTION

FRONT VIEW

REVISED 12/3/09

FOUNDATION - ONE STORY
SLAB ON GRADE

SCALE: 1½" = 1'-0"



SECTION

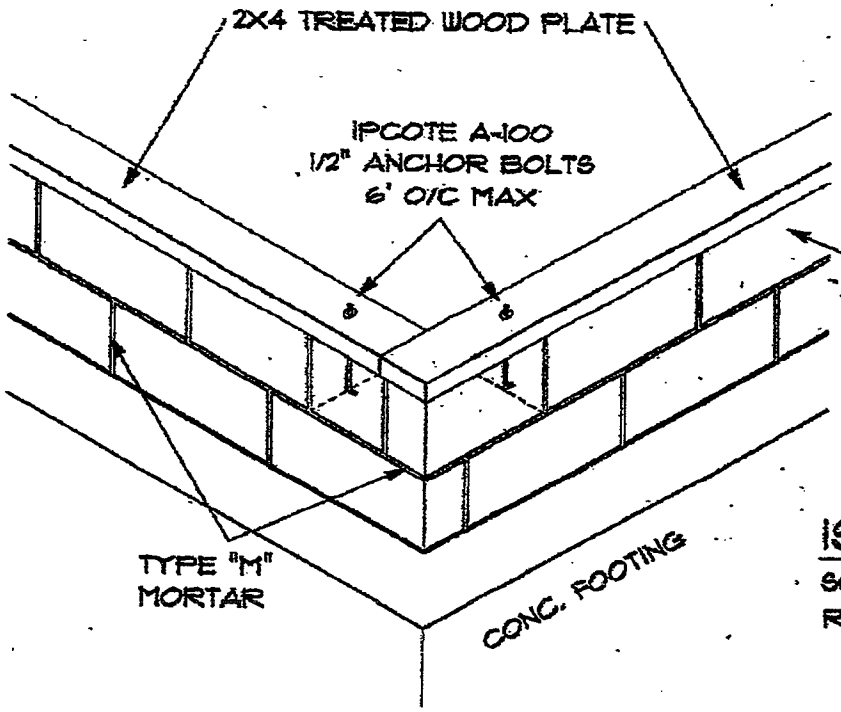
FRONT VIEW

REVISED 12/3/09

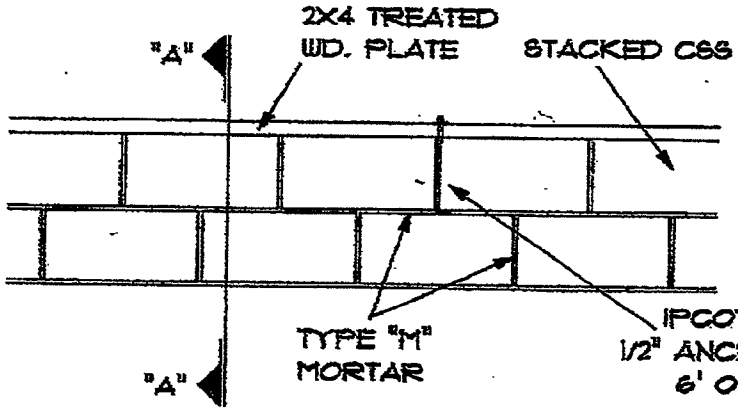
FOUNDATION - TWO STORY SLAB ON GRADE

SCALE: 1½" = 1'-0"

FOUNDATION INVESTIGATION

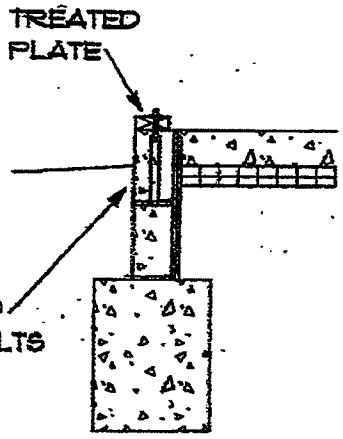


ISOMETRIC
SCALE: 3/4" = 1'-0"
REVISED 12/3/09



ELEVATION
SCALE: 3/4" = 1'-0"

NOTE: USE PROPERTY
TYPE "M" MORTAR



SECTION "A"

NOTE: IPCOTE A-100 GALVANIZED G185 1/2"ANCHOR BOLTS w/NUT AND WASHER TO BE INSTALLED AT 6' O/C MAXIMUM SPACING. INSTALL A MINIMUM OF (2) ANCHOR STRAPS PER SILL PLATE SEGMENT AND WITHIN 12" FROM EACH BUILDING CORNER.