



"The System"

**Precast Hollow Core Slabs
and Masonry Design Guide
for Low Rise Multifamily Buildings**



INTRODUCTION

Combining the inherent structural capabilities of masonry with precast hollow core slabs generates the most effective and economical building system available today. In addition to structural integrity, this type of construction creates compartmentalization, providing low-rise multi-family buildings with non-combustible separation walls and floor assemblies between all dwelling units.

STRUCTURAL CONSIDERATIONS

The hollow core slab and masonry should be individually analyzed to determine the most effective system.

The design of masonry bearing walls is governed by the Building Code Requirements for Masonry Structures (ACI 530-92/ASCE 5-92/TMS 402-92). Allowable axial loads for 8", 10" and 12" thick concrete masonry bearing walls have been developed from the formula:

$$F_a = .25f'm \left[1 - \left(\frac{h}{140r} \right)^2 \right], \text{ for } \frac{h}{r} \leq 99.$$

and are listed in tables 1 thru 4. The information contained within these tables indicate that unreinforced 8" thick concrete masonry walls can be utilized for most design conditions.

The design of precast hollow core slabs is governed by the ACI (318) Building Code Requirements for Reinforced Concrete. Slab thickness is determined by span and load conditions. Precast slabs are produced to the

desired length for each individual project. Usually 8" thick slabs, capable of spanning 28'-0", or 10" thick slabs capable of spanning 33'-0" are required for low-rise multi-family construction.

Openings in the hollow core floor system for plumbing, HVAC and stairways can easily be accommodated. These openings can be created by a variety of methods: core drilling, field sawing and manufactured block outs. All openings should be coordinated with your hollow core supplier.

The direction in which bearing walls span determines the length of the slab necessary. Both 10" thick and 8" thick hollow core slabs can be beneficial in buildings where the bearing walls have been designed to span longitudinal to the building's main axis. The overall width of the building may be the deciding factor. See figure 1a and 1b. In buildings where bearing walls have been designed to span transverse to the building's main axis, 8" thick slabs are more beneficial regardless of the building's width. See Figure 1c.

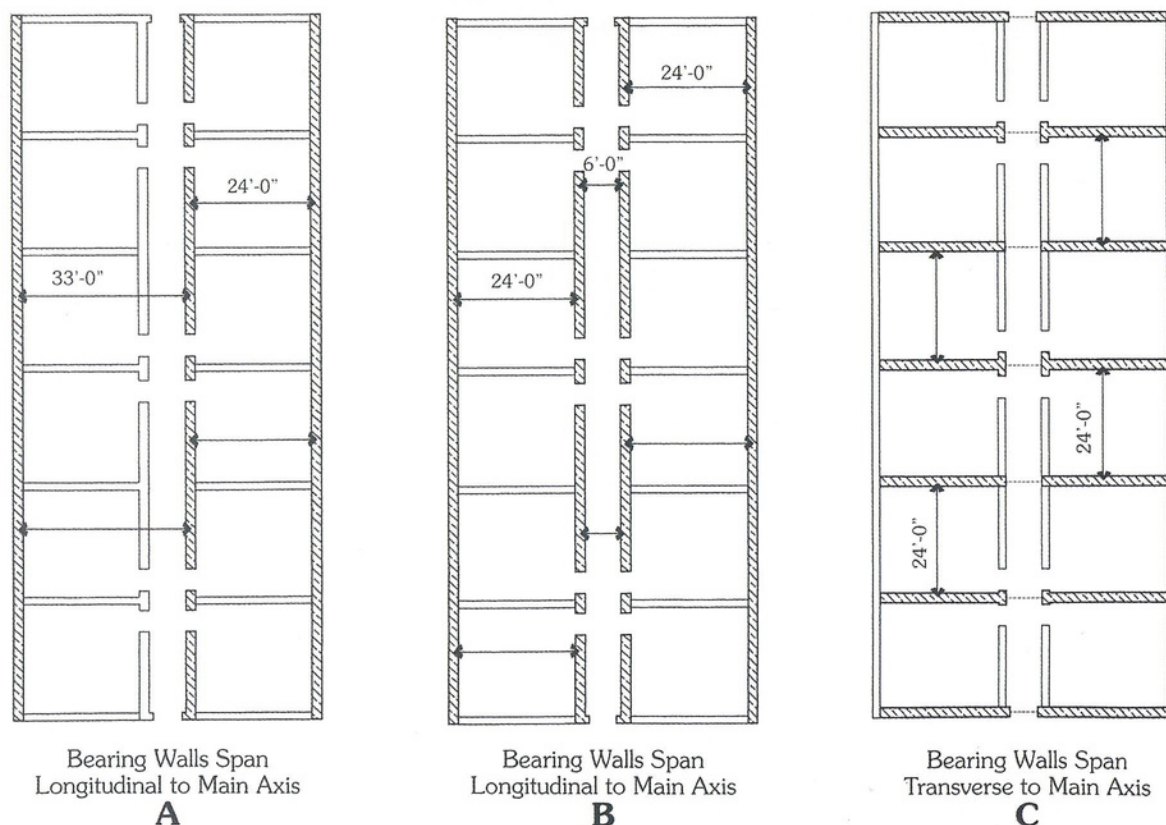


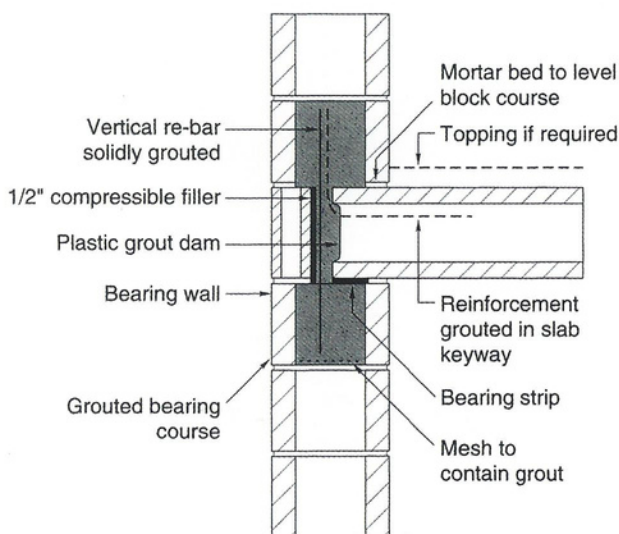
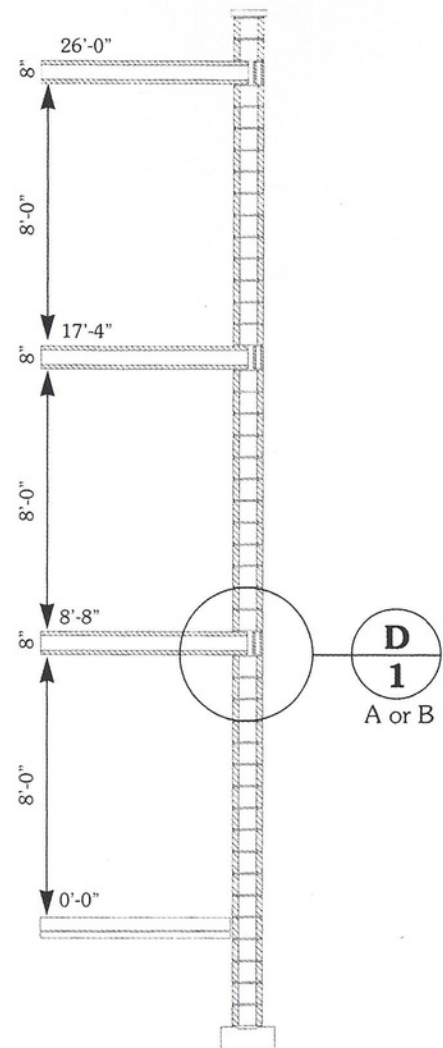
Figure 1: Floor Plans of Bearing Wall Layout

ECONOMIC CONSIDERATIONS

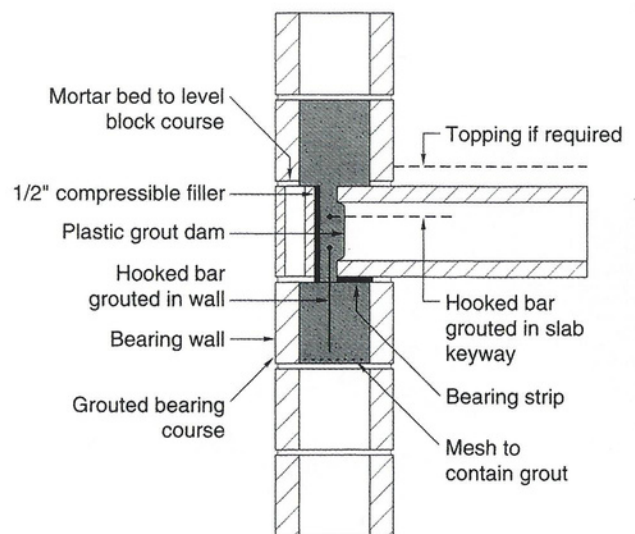
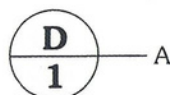
In addition to load conditions and span requirements, concrete masonry's modular layout should be considered when determining hollow core slab thickness.

Concrete masonry units typically are manufactured in 7 $\frac{1}{2}$ " heights. An 8" module is established when concrete masonry is constructed with a standard $\frac{3}{8}$ " mortar joint. Concrete masonry may be saw cut to produce units of varying heights. This is a labor intensive procedure which can significantly affect the efficiency of the masonry construction. Concrete masonry soaps may also be used to keep the coursing masonry bonded.

Utilizing 8" thick hollow core slab retains the concrete masonry walls modular layout. The construction of single wythe walls is now possible because the



Single wythe wall and plank detail



Single wythe wall and plank detail

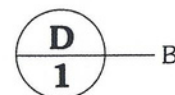
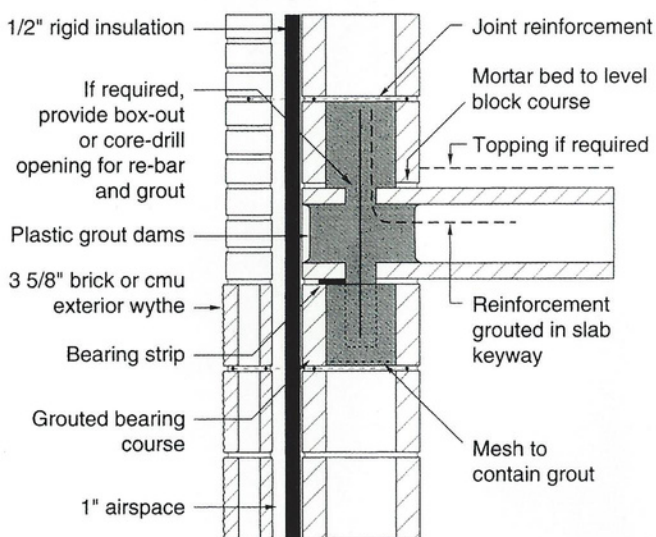
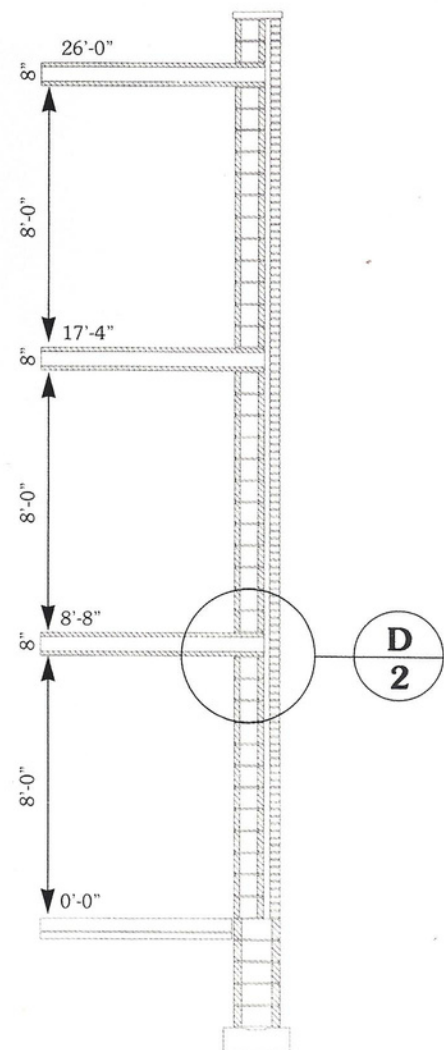


Figure 2: 8" Precast Concrete Slab with Single Wythe CMU Wall

masonry "courses out" vertically, eliminating any unsightly irregularities in masonry coursing. See Figure 2.

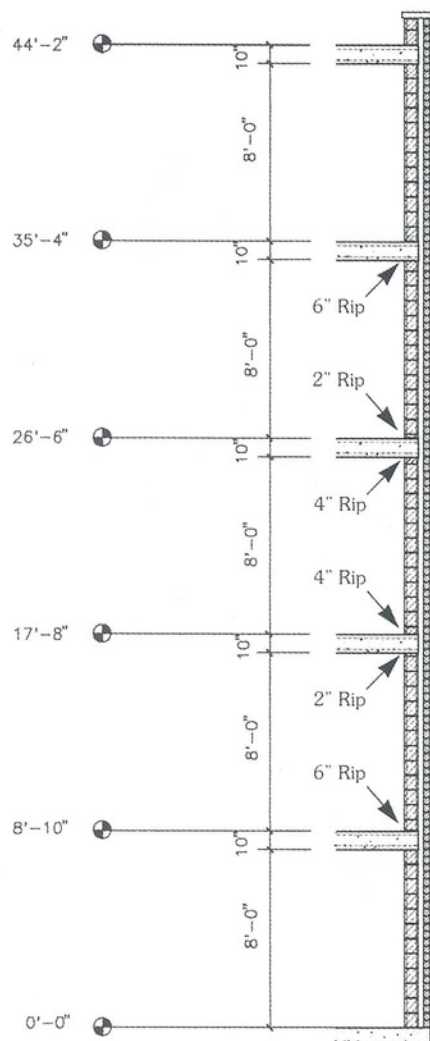
It is also beneficial to maintain a modular layout in multiple wythe masonry wall construction. Utilizing an 8" thick slab produces mortar joint alignment between the inner and outer wythe of masonry. Standard joint reinforcement can be used to tie the two wythes of masonry together. See Figure 3.

If a 10" thick hollow core plank is required, a 2", 4" or 6" misalignment of mortar joints may occur depending on the desired floor to floor height. But to keep the coursing universal throughout the building's elevator shafts and stairwell, ribs or soaps will be required as shown in Figure 4. This will also allow the concrete masonry and brick wythe to course out. Standard joint reinforcement or adjustable joint reinforcing can now be used to tie the two wythes together.

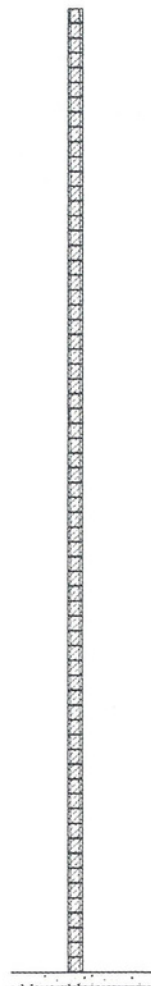


Cavity wall and plank detail

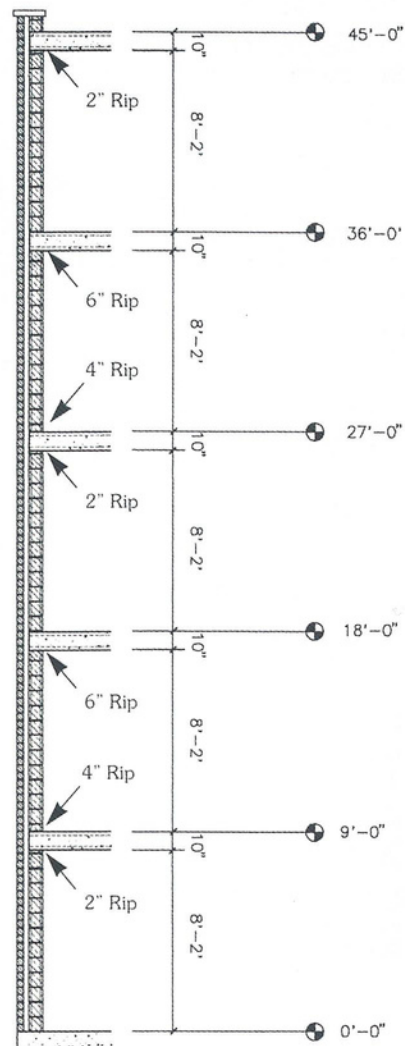
D
2 — Detail at Floor Line



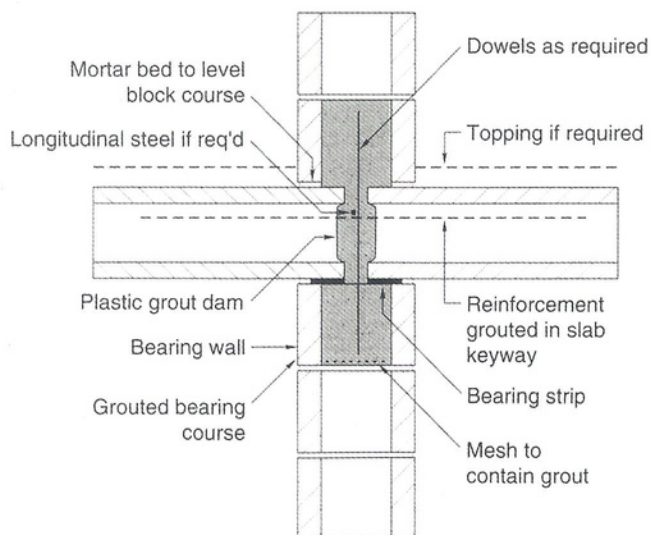
8'-0" Clear Story with 10" Hollow Core Plank (8'-10" Floor to Floor)



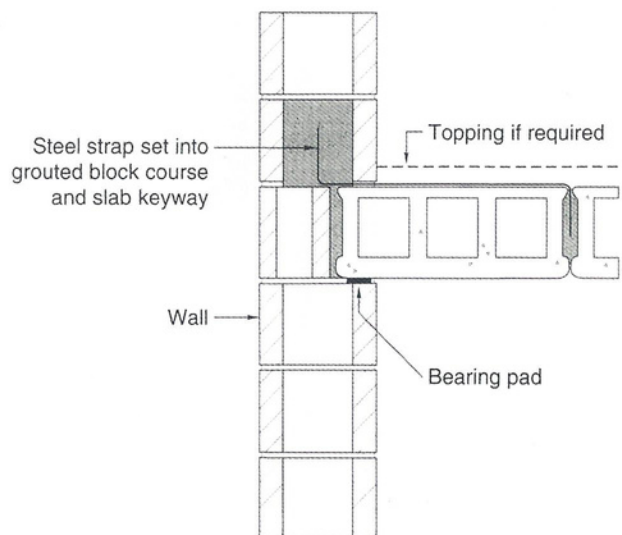
Stairwell or Elevator Shaft Wall



8'-2" Clear Story Height with 10" Hollow Core Plank (9'-0" Floor to Floor)



Double loaded wall and plank detail



Wall and plank steel strap section

Figure 4: 10" Precast Concrete Slab with coursing for 8'-0" height and 8'-2" height

BLOCK BEARING CAPACITY

TABLE 1

8"CMU 8' High Wall					P (allowable) (kips/ft of wall) f'm				
% Solid	An	r	$\frac{1}{(-h)2140}$	$P' \times f'm$ all	1500	2000	2250	2500	3000
52%	30	2.84	.942	7.07 f'm	10.61 (k/ft)	14.14	15.90	17.68	21.21
63%	42	2.98	.947	9.94 f'm	14.91	19.88	22.37	24.85	29.82
76 1/4%	60	2.66	.933	14.00 f'm	21.00	28.00	31.50	35.00	42.00
50% (100% grouted)	91.5	2.22	.905	20.69 f'm	29.04	41.38	46.55	51.73	62.07

TABLE 2

8"CMU 10' High Wall					P (allowable) (kips/ft of wall) f'm			
%Solid	An	r	$\frac{1}{(-h)2140}$	$P' \times f'm$ all	1500	2000	2500	3000
52%	30	2.84	.91	6.83 f'm	10.25	13.66	17.07	20.50
63%	42	2.98	.92	9.66 f'm	14.49	19.32	24.15	28.98
76%	60	2.66	.90	13.50 f'm	20.25	27.00	33.75	40.50
50% (100% grouted)	91.5	2.22	.85	19.44 f'm	29.06	38.88	48.60	58.32

TABLE 3

10"C MU 8' High Wall					P (allowable) (kips/ft of wall) f'm			
%Solid	An	r	$\frac{1}{(-h)1402}$	$P' \times f'm$ all	1500	2000	2500	3000
49%	36	3.97	.97	8.73 f'm	13.10	17.46	21.83	26.19
76% 78		3.32	.96	18.72 f'm	28.08	37.44	46.80	56.16
49% 115.5 (100% grouted)		2.78	.94	27.14 f'm	40.71	54.28	67.85	81.42

TABLE 4

12"C MU 8' High Wall					P (allowable) (kips/ft of wall) f'm			
%Solid	An	r	$\frac{1}{(-h)1402}$	$P' \times f'm$ all	1500	2000	2500	3000
47% 36		4.29	.97	8.73 f'm	13.10	17.46	21.82	26.19
47% 139.5 (100% grouted)		3.36	.96	33.48 f'm	50.23	68.34	83.70	102.51



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DISCLAIMER NOTICE

This guide contains technical information on masonry wall systems. It provides some of the basic information required to properly design and detail these systems. This booklet does not cover all designs or conditions. The information presented illustrates the only principles that are involved.

The information contained in this booklet is based on the available data and experience of the technical staff of the Multifamily Construction Advisory Committee of Illinois. This



information should be recognized as suggestions which, if followed with good judgement, should produce positive results.

Final decisions on the use of information, details and materials as discussed in this booklet are not within the purview of the Multifamily Construction Advisory Committee of Illinois, and must rest with the project designer, owner, or both.

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