



Design Examples of Multi Family Housing

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 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

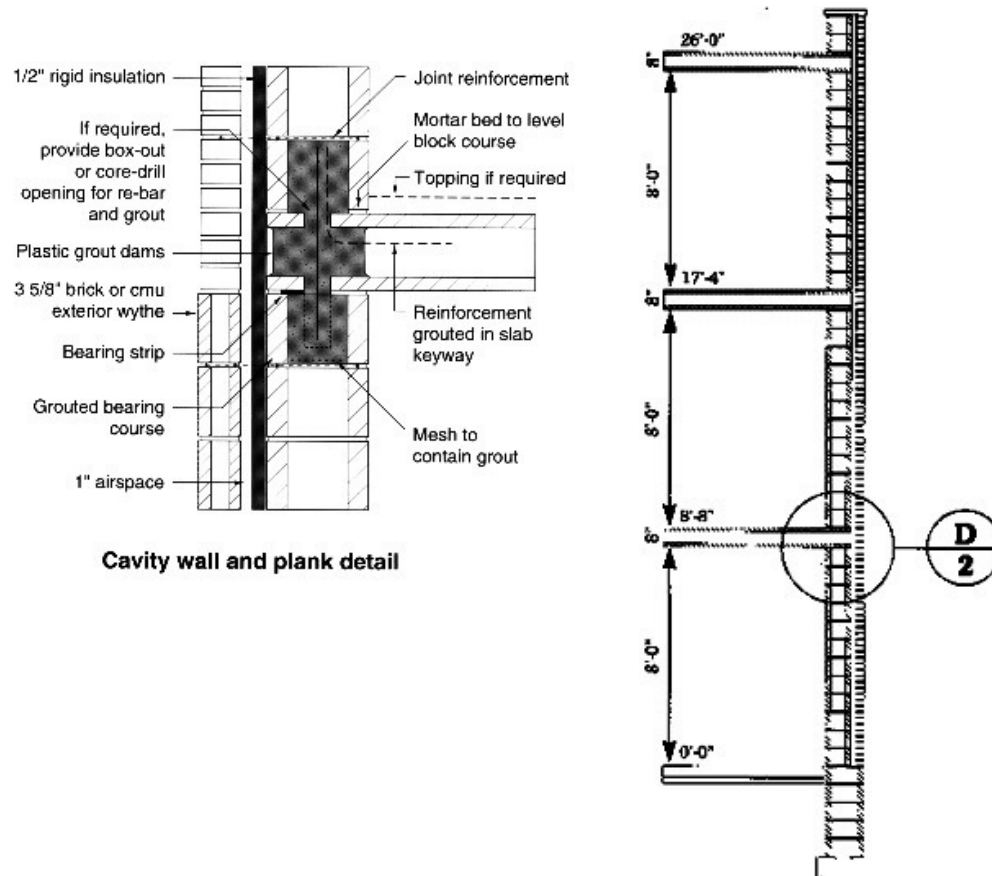
$$F_a = 0.25f_m \left[1 - \left(\frac{h}{140r} \right)^4 \right], \text{ for } \frac{h}{r} \leq 99.$$

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.

ECONOMIC CONSIDERATIONS / Multi- Wythe Walls

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.



Block Building Capacity

TABLE 1

8" CMU 8' High Wall					P (allowable) (kips/ft of wall) f'm				
% Solid	An	r	$1 - \left(\frac{h}{140r}\right)^2$	P' x 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%	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	31.04	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	$1 - \left(\frac{h}{140r}\right)^2$	P' x 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	29.16	38.88	48.60	58.32

TABLE 3

10" CMU 8' High Wall					P (allowable) (kips/ft of wall) f'm			
% Solid	An	r	$1 - \left(\frac{h}{140r}\right)^2$	P' x 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% (100% grouted)	115.5	2.78	.94	27.14 f'm	40.71	54.28	67.85	81.42

TABLE 4

12" CMU 8' High Wall					P (allowable) (kips/ft of wall) f'm			
% Solid	An	r	$1 - \left(\frac{h}{140r}\right)^2$	P' x 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% (100% grouted)	139.5	3.36	.96	33.48 f'm	50.23	68.34	83.70	102.51

Reference: The System Magazine