

MOMENT-RESISTING BUILDING FRAMES

Moment-resisting frames are those in which a degree of rotational restraint is provided between vertical components (usually columns) and horizontal components (usually beams and/or spandrels). This system then resists lateral loads imposed on the structure.

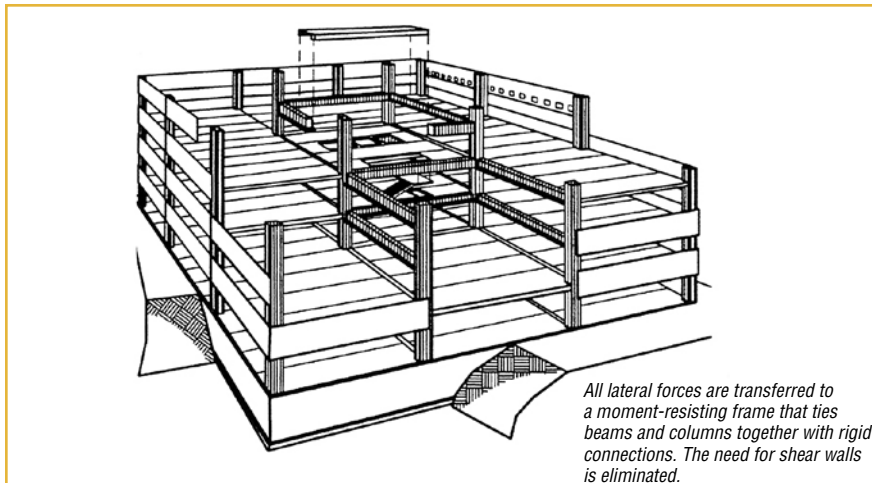
Precast, prestressed concrete beams and deck members are usually more economical when they are designed and connected into a structure as simple-span members. There are three reasons why this works most effectively:

- 1. Positive moment-resisting capacity is much easier and less expensive** to achieve with pretensioned members than negative-moment capacity at supports.
- 2. Connections that achieve continuity at the supports are usually complex.** Their cost is proportional to the complexity that makes moment-resistant frames less attractive for designers.

3. The restraint-to-volume changes that occur in rigid connections require serious consideration in the design of moment-resisting connections.

It is desirable to design precast, prestressed concrete structures with connections that allow lateral movement and rotation and to design the structure to achieve lateral stability through the use of floor and roof diaphragms and shear walls.

When moment connections between beams and columns are required to resist lateral loads, it is desirable to make the moment connections after most of the dead loads have been applied. This requires careful detailing, specification of the construction process, and inspection. If such details are possible, the moment connections should be designed to resist only the negative moments from live loads, additional dead loads imposed after construction, lateral loads, and volume changes. They will thus be less costly.



The ACI 318-05 Building Code defines three categories of moment frames: ordinary moment frames, intermediate moment frames, and special moment frames. Each type must comply with certain sections of the code. It is recommended that a qualified structural engineer with experience in designing moment frame structures be consulted early in the design stage.

Ordinary moment frames are the easiest to create and require only conventionally accepted detailing. They need only comply with Chapters 1 through 18 of the code.

Intermediate moment frames must comply with sections 21.2.2.3 and 21.12 of ACI 318-05 in addition to the requirements for ordinary moment frames. These provisions are relatively easy to satisfy using precast, prestressed concrete construction.

Special moment frames for seismic design must comply with other sections of Chapter 21 of the code. They will require more attention to detailing requirements, making the system more costly.

It is possible to emulate a monolithic, cast-in-place, intermediate moment-frame system with precast concrete components that meets all the requirements of ACI code.

Recently introduced designs use existing precast concrete components and technologies in new ways to create seismic-resistant systems that cannot be duplicated with other materials. The systems have been tested to satisfactory results in the Precast Seismic Structural Systems (PRESSS) research program.

HYBRID SYSTEMS



DESIGNING WITH PRECAST & PRESTRESSED CONCRETE