

6.5 Furniture, Fixtures, Equipment and Contents

6.5.3 Computer and Communication Equipment

6.5.3.1 Computer Access Floors and Equipment

Computer access floors are raised floor systems used in many facilities with heavy use of computer equipment; these provide space to run the equipment cables under the flooring.

Provisions

BUILDING CODE PROVISIONS

Seismic loads for computer access floors are determined using ASCE/SEI 7-10, *Minimum Design Loads for Buildings and Other Structures*, (ASCE, 2010) Chapter 13. The principal objective is to prevent the floor from displacing or buckling under seismic loads. ASCE/SEI 7-10 requires that 100 percent of the weight of all equipment fastened to the floor, and 25 percent of the weight of all equipment supported by, but not fastened to the floor, be used when calculating the design seismic force. The effects of overturning of equipment attached to the floor must be considered, and a complete load path for vertical and lateral forces is required,

Improved performance may be obtained by specifying Special Access Floors. To be considered “special,” access floors must meet specific design and detailing requirements.

RETROFIT STANDARD PROVISIONS

ASCE/SEI 41-06, *Seismic Rehabilitation of Existing Buildings*, (ASCE, 2007) classifies access floors as both acceleration and deformation sensitive. ASCE/SEI 41-06 requires compliance with the anchorage provisions of the standard when the performance level is Immediate Occupancy. Retrofit of access floors may utilize prescriptive procedures or project specific analysis. The analysis should consider buckling and racking of the floor supports, connections, and the effects of mounted equipment.

Typical Causes of Damage

- Access floors may collapse if not adequately braced and anchored.
- Equipment located on access floors that are not anchored or tethered may slide and hit a wall or other equipment and may suffer internal damage. Equipment castors can get lodged in floor openings.

DAMAGE EXAMPLES



Figure 6.5.3.1-1 Temporary bracing for access floor collapsed in the 1994 magnitude-6.7 Northridge Earthquake (Photo courtesy of Wiss, Janney, Elstner Associates).

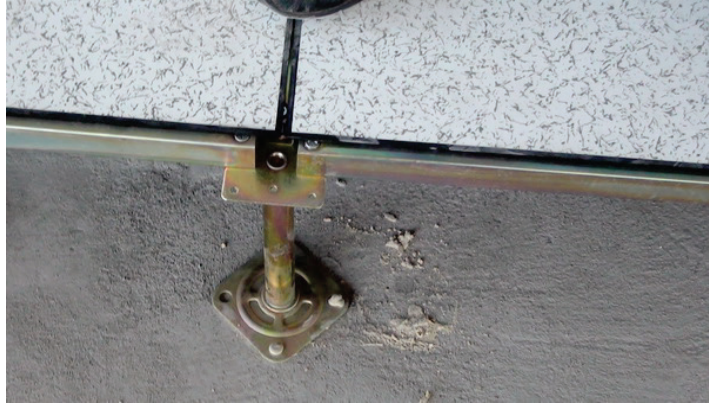


Figure 6.5.3.1-2 Damage to access floor with short anchored pedestals in the 2010 magnitude-6.7 Chile Earthquake; floor did not have lateral bracing. Note many tiles misaligned (Photos courtesy of Antonio Iruretagoyena, Rubén Boroschek & Associates).



Figure 6.5.3.1-3 Undamaged access floor with braced pedestals in the 2010 Chile Earthquake (Photo courtesy of Rodrigo Retamales, Rubén Boroschek & Associates).

Seismic Mitigation Considerations

- Access floor base pedestals should be anchored to the floor slab; taller pedestals may also need diagonal bracing. In zones of low or moderate seismicity, or where the floor height is less than 12 inches high, it may be feasible to adhere the pedestals to the floor slab rather than anchoring them. Check the internet for vendors who supply access floors with a seismic capacity rating.
- Equipment placed on access floors should be tethered; heavy equipment should be anchored to structural slab below. Anchorage may be accomplished through installation of an independent frame beneath the equipment. Alternatively, the equipment may be anchored to properly designed access floor framing, or supplemental bracing components.
- If unrestrained equipment on castors is present, cable openings through access floor should have lips to prevent the wheels from getting stuck.
- Proprietary base isolation systems are also available. The equipment is anchored to the isolation base and the isolation base is anchored to the structural slab.

MITIGATION EXAMPLES

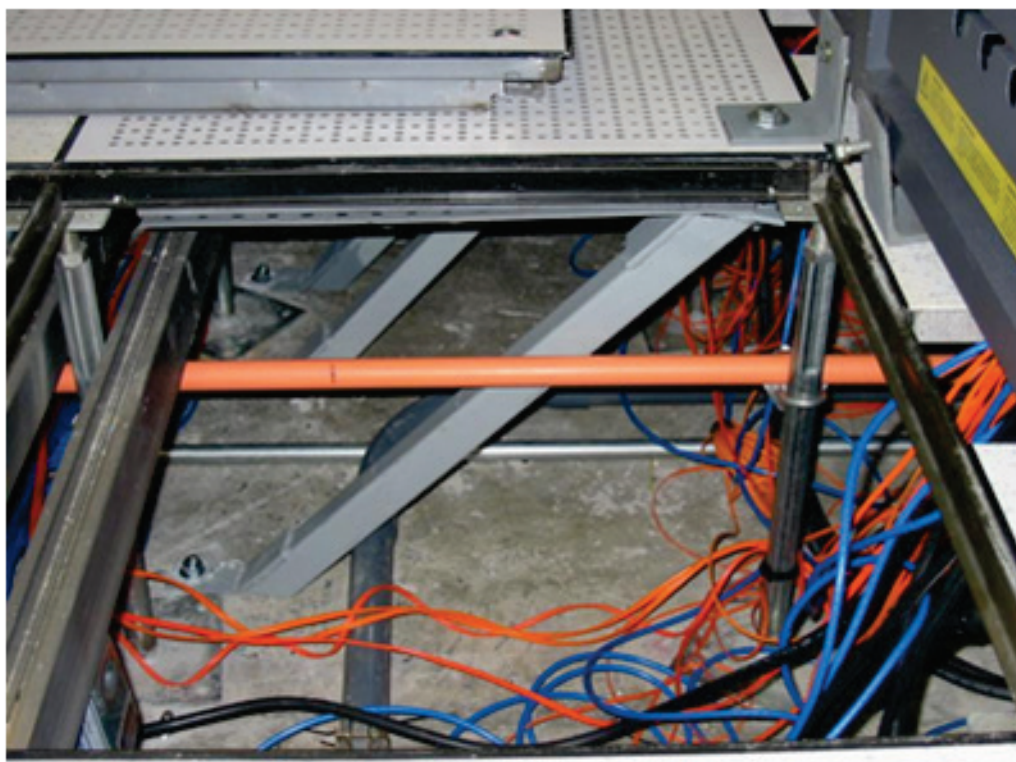


Figure 6.5.3.1-4 Raised floor braced with strut (Photo courtesy of Maryann Phipps, Estructure).



Figure 6.5.3.1-5 Data rack bolted through access floor to supplemental strut bracing below (Photo courtesy of Maryann Phipps, Estructure).

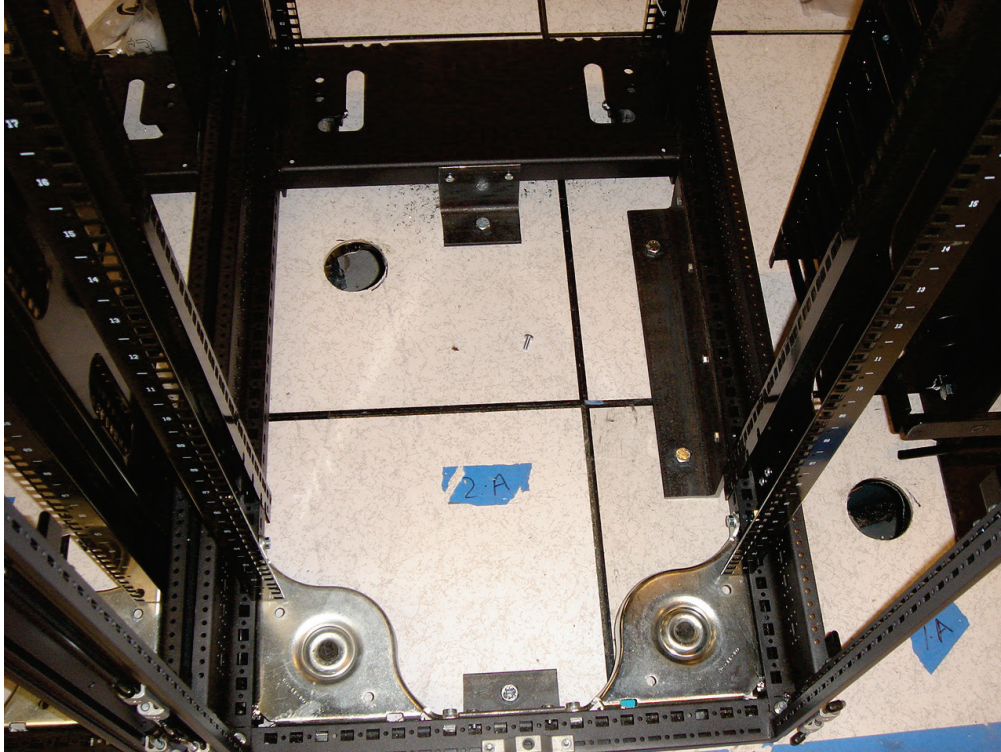


Figure 6.5.3.1-6 Base of data cabinet with supplemental angles bolted to strut bracing below floor (Photo courtesy of Maryann Phipps, Estructure).

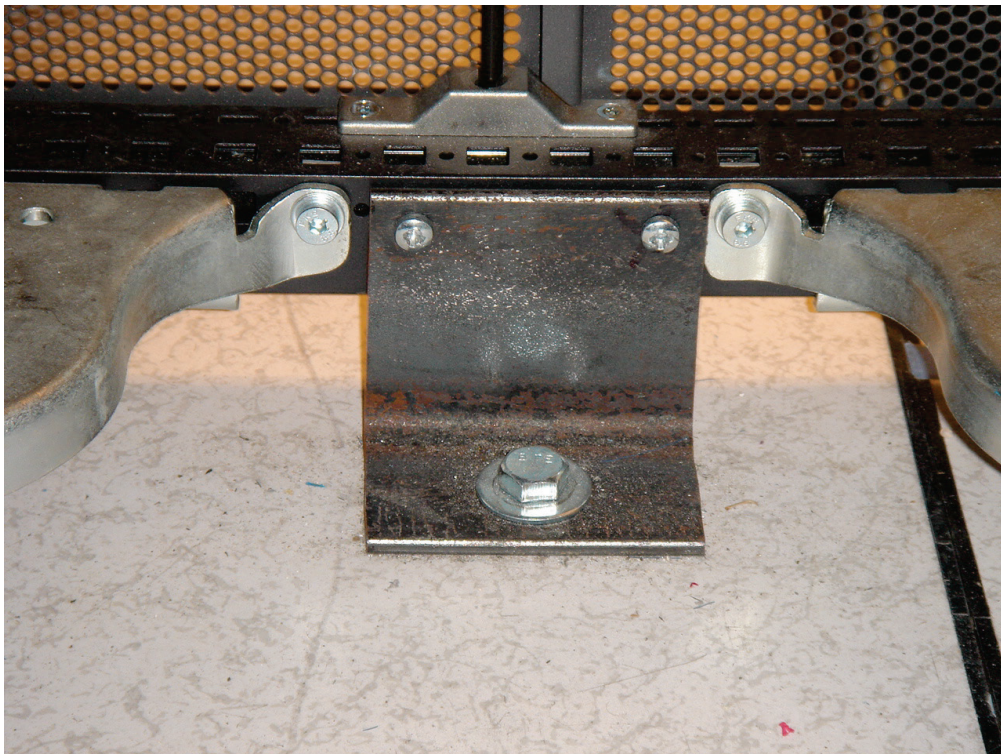
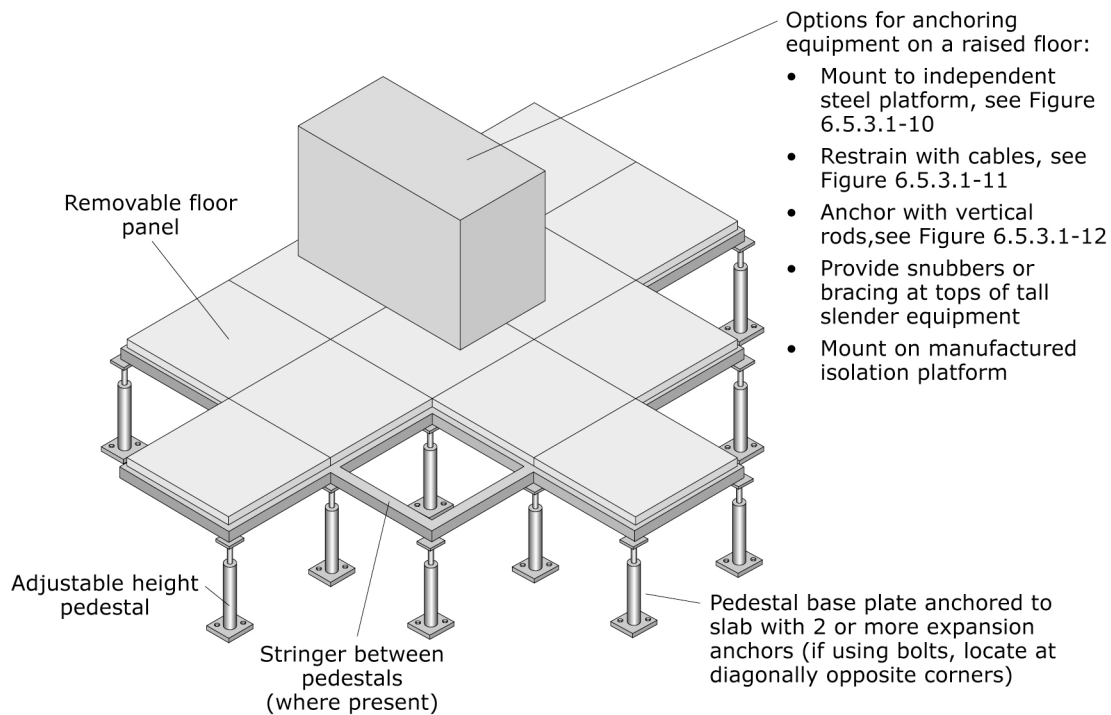


Figure 6.5.3.1-7 Close-up of supplemental angles connecting data cabinet to strut bracing below floor (Photo courtesy of Maryann Phipps, Estructure).

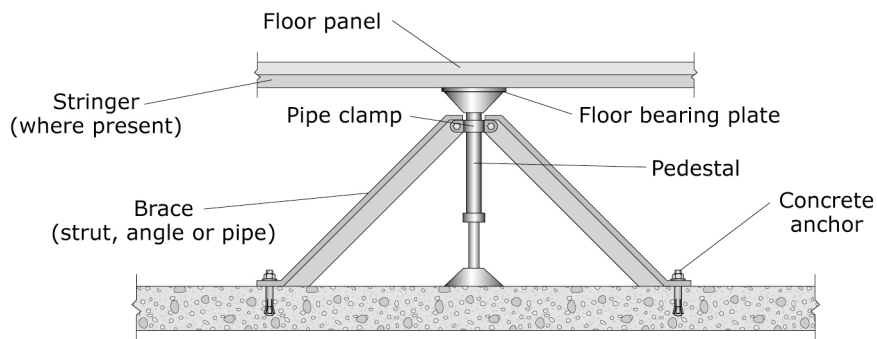


Figure 6.5.3.1-8 Strut framing added to brace data cabinet located on access floor. Bolts from angles above are connected to strut framing below (Photo courtesy of Maryann Phipps, Estructure).

MITIGATION DETAILS



Cantilevered Access Floor Pedestal

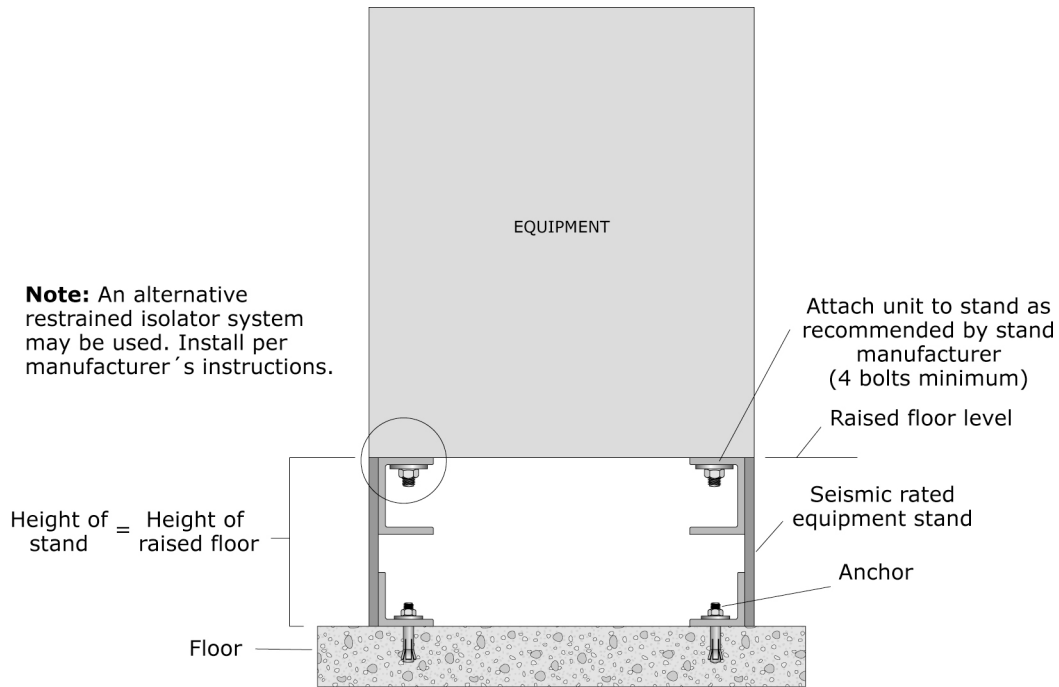


Braced Access Floor Pedestal

(use for tall floors or where pedestals are not strong enough to resist seismic forces)

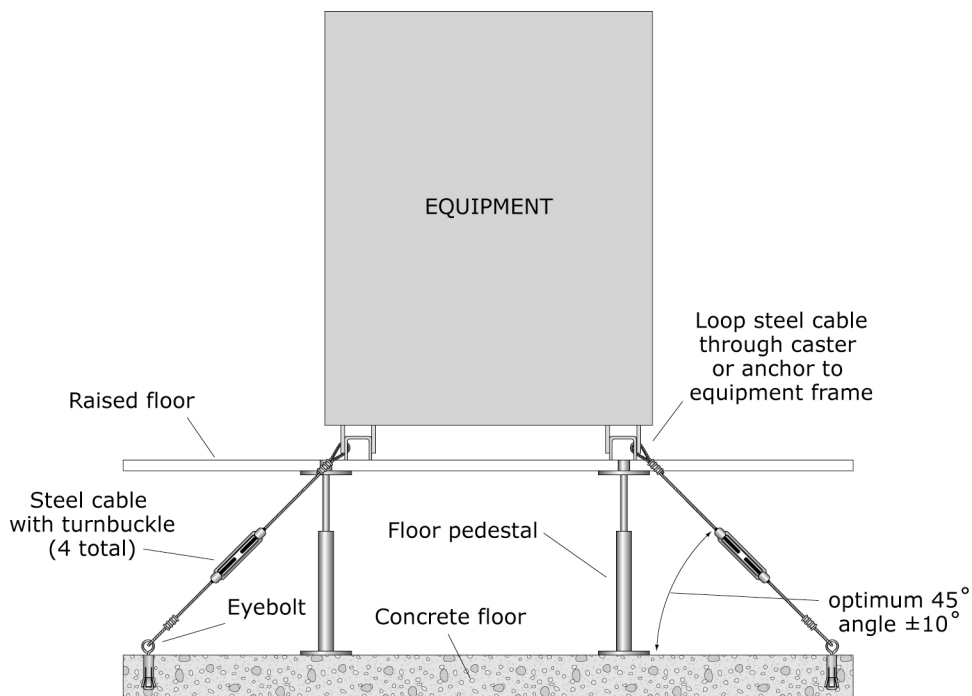
Note: For new floors in areas of high seismicity, purchase and install systems that meet the applicable code provisions for "special access floors."

Figure 6.5.3.1-9 Equipment mounted on access floor (ER).



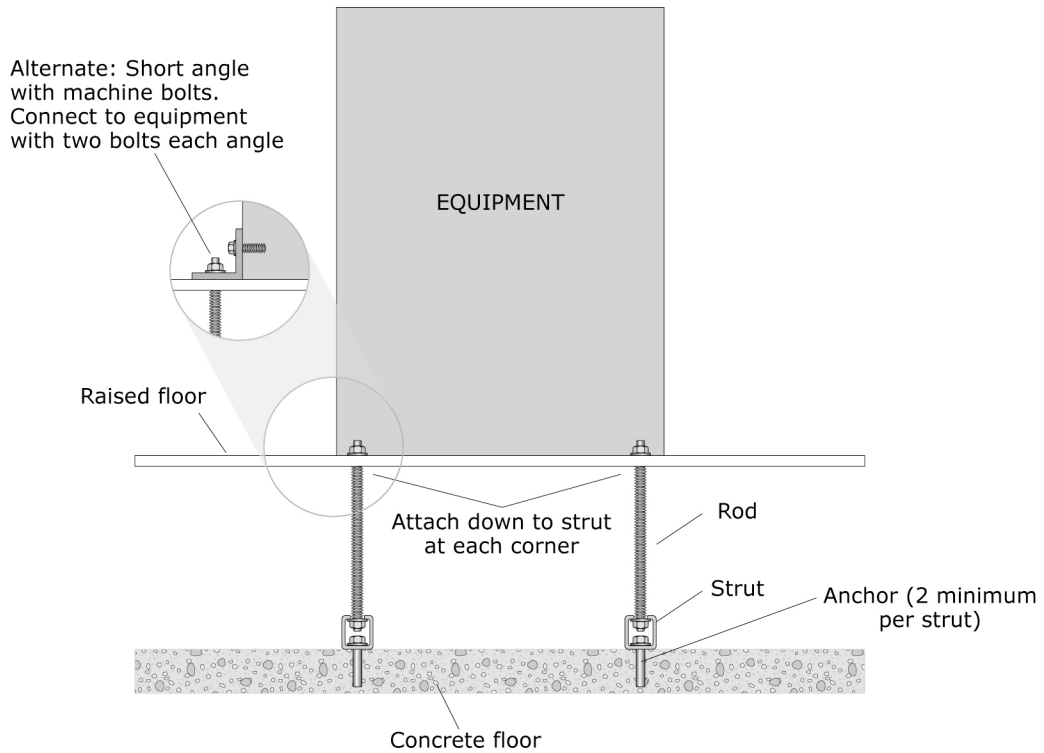
Equipment installed on an independent steel platform within a raised floor

Figure 6.5.3.1-10 Equipment mounted on access floor - independent base (ER).



Equipment restrained with cables beneath a raised floor

Figure 6.5.3.1-11 Equipment mounted on access floor – cable braced (ER).



Equipment anchored with vertical rods beneath a raised floor

Figure 6.5.3.1-12 Equipment mounted on access floor – tiedown rods (ER).