

on the floors. For a sprinklered building, a Type 1-C classification required a 2 h fire resistance rating on the columns and a 1.5 h fire resistance rating on the floors.

Based on the SFRM measurements and project correspondence, the columns had SFRM thicknesses consistent with a 3 h fire resistance rating, the metal deck had SFRM thicknesses consistent with a 2 h fire resistance rating, and the floor framing (beams and girders) had SFRM thicknesses consistent with a 2 h fire resistance rating. The SFRM for the structural system is presented in Section 2.5. In this report, Type 1-C classification was assumed, but the actual classification may have been type 1-B.

2.3 CON EDISON SUBSTATION BUILDING DESCRIPTION

The Con Edison substation was constructed in 1967 and consisted of a three-story steel framed structure with cast-in-place concrete floors and walls. It was located on the north side of the site and extended approximately 40 ft beyond the north face of WTC 7, as shown in Figure 2-2. Its southern boundary was irregular.

Some of the WTC 7 columns framed into the substation columns. During the construction of WTC 7, heavy plates were welded to the tops of the existing substation columns, which then supported the new building columns. The exterior columns above the Con Edison structure that did not align with the columns of the Con Edison structure were supported by a series of transfer trusses, girders, and cantilever girders located between Floors 5 and 7. The arrangements of the transfer trusses and girders are described in Section 2.4.5.

2.4 WTC 7 BUILDING DESCRIPTION

2.4.1 Foundations

WTC 7 and the electrical substation were supported on caisson foundations. When the substation was constructed in 1967, provision was made for a future office tower by including capacity to carry both the substation and the future building. Caissons were also installed in the property adjacent to the substation for the proposed future building. When WTC 7 was constructed approximately 20 years later, it was significantly larger than the originally proposed building, and required additional caissons to be installed, as shown in Figure 2-2.

The typical caisson consisted of several components: a 30 in., 36 in., or 42 in. diameter steel casing, a heavy rolled or built-up steel core shape, vertical reinforcing bars, spiral reinforcing, and concrete fill. At the base of the caisson core, a pattern of shear studs was placed to transfer the load from the steel caisson core into the encompassing concrete, from which it passed into the rock. The caissons were socketed (seated) in the bedrock, approximately 60 ft below the surface. There were vertical caissons as well as battered (or sloped) caissons to carry the lateral load. Above the caissons were heavy grillages composed of built up steel girders. Grillages transferred loads between the building columns and the caissons.

The distance between the caisson grillages and the first floor varied between 8 ft and 30 ft. This region was braced by reinforced concrete walls with thicknesses varying from 1 ft to 2.5 ft. Many of the WTC 7 steel columns were embedded in these walls, and supporting steel braces were made composite by the addition of shear studs along the height of the embedment.