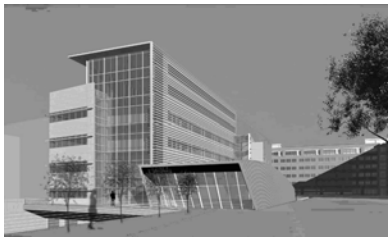
Timothy Mueller
Structural Option
Ali Memari, Advisor

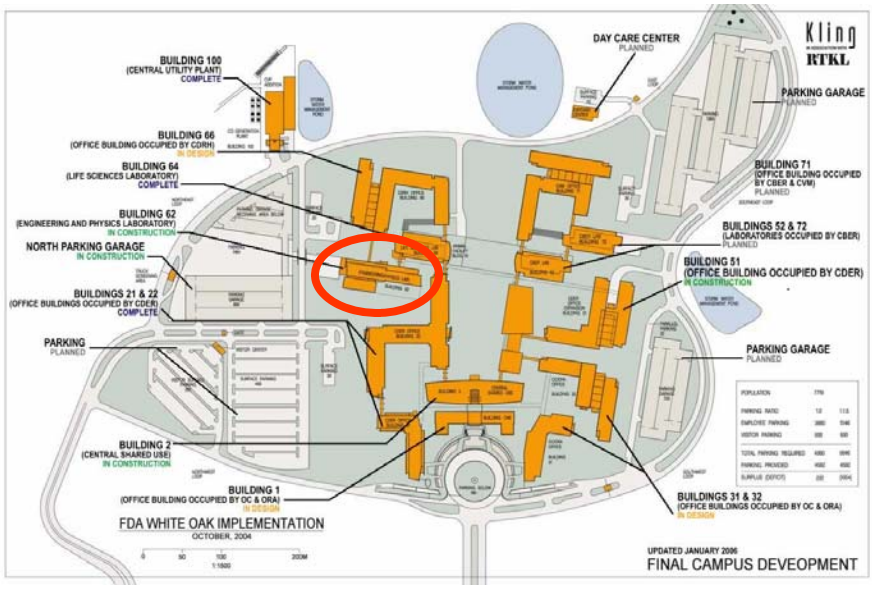


FDA CDRH Laboratory
Silver Spring, Maryland

Project Background

The FDA CDRH Laboratory is an office and laboratory space located on the Food and Drug Administration's White Oak Consolidation Campus. The campus, which was originally the naval ordinance testing grounds, is now being leased by the FDA to consolidate its many offices throughout the capital region. The site, when completed, will include one existing building that is to be completely renovated, several new laboratory and office buildings, parking garages, and a central utility plant, which powers the entire site.

The White Oak Campus is owned by the U.S. General Services Administration (GSA), the government's premier acquisition agency. The site was designed by Greenhorn and O'Mara. The CDRH Laboratory, seen circled in red in the image to the left, is to be used as the Center for Devices and Radiological Health Laboratory and Office Building. Construction on the laboratory began on March 22, 2005, and is scheduled for completion on November 1, 2006 at a cost of $63 million. The architect for this laboratory is Kling in Association with RTKL, with Kling acting as the structural engineer, and RTKL as the MEP engineer, designed the CDRH Laboratory using the IBC 2000 as their primary code. The general contractor, Tomkins Construction, will be delivering the building using a design-bid-build, process with Heerey-Tishman, as the construction manager.



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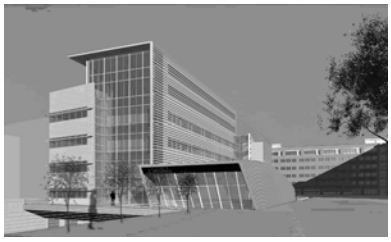

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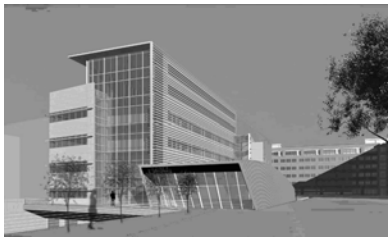
General Architecture

The CDRH Laboratory building is a 139,805 square foot space made up of a five-story central core, with the top story reserved for the penthouse suite, and a four-story section on the east side. The main entrance to the building is centered on the east side, while the delivery and ground level entrance is located on the north side. The below grade ground floor through the fourth floor are combined use spaces; a perimeter of individual offices and the core of the building are used for laboratory spaces. A large high bay laboratory, displayed in the image below, is the signature for the CDRH Laboratory. This laboratory is to be used for larger equipment, including an anechoic chamber, which is capped with a decorative curved roof on the west side of the building.

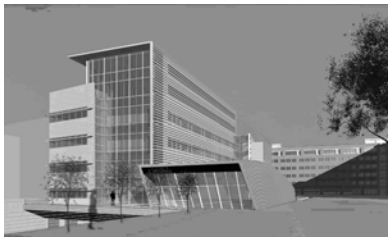
There are three roof systems found at the CDRH laboratory. The first is a planted roof that is at grade over a section of the ground floor. The second level is a sheet metal roof assembly that is over the specialized high bay laboratory space. The third roof system is over the fourth floor and penthouse, and is termed an inverted roof assembly. It is made of metal deck, concrete deck, waterproofing membrane, protection sheet, rigid insulation, filter fabric, and stone ballast. The exterior of the laboratory is mostly made of metal panels that incorporate a metal exterior shell and insulation.



There are also horizontal metal pieces that act as both sun shields over ribbon windows on the north and east walls, and full façade elements that run horizontally the entire height of the building on the west elevation. The north wall also has a cast stone ground floor façade and, as with the south elevation, an aluminum window curtain wall, constructed completely of glazing with and aluminum mullions, dominates the above grade levels.

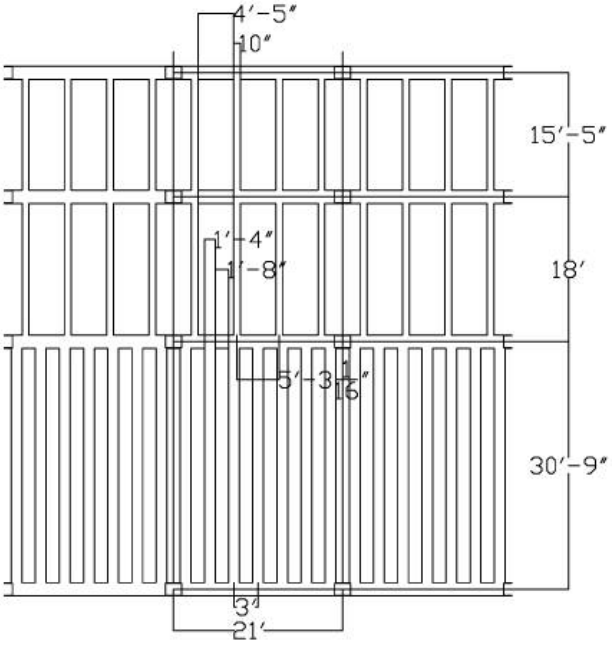
Existing Structural System

The structure of the CDRH Laboratory, with the exception of the roofing systems, is typically made of cast-in-place concrete with a one way slab system. The foundation system is made of a stepped footing lining the entire perimeter of the building with a maximum step depth of 3' (900mm). Spread footings with a typical dimension of 10' (3050mm) X 10' (3050mm) X 3' (920mm) are located below each of the columns and are placed within the main building grid line. The main grid line is made of 15 bays at an average spacing of 21' (6,400mm) spanning in the north-south direction, and three bays, increasing from east to west with 15'-5" (4700mm), 18' (5500mm) and 30'-9" (9375mm) spans. There is a 287KPa

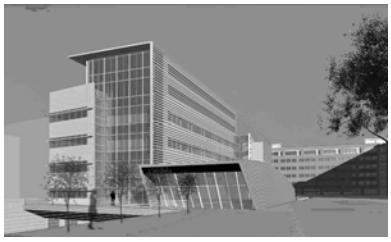


bearing minimum required for all footings. The ground floor varies between a 6" (150mm) and 8" (200mm) deep slab-on-grade with 150X150/MW19XMW19 W.W.F. on 8" (200mm) porous fill on a compacted sub-grade.

The typical floor system throughout the building is made of 4.5" thick one way slabs, spanning in the north to south direction. There are two typical joist layouts, both of which are pan-joist systems due to the monolithic pour of the slab and joist. The first typical bay is made of 10" wide by 16" deep joists, spaced 5'-3" on center. These joists span either 18' or 15'–5" and are designed with the same requirements as the beams due to their large size and spacing. They are reinforced with #3 top reinforcement and #6 bottom reinforcement. The shear forces are resisted with #3 rebar. The second typical bay is also a pan-joist system with the joist dimension of 16"X16". They are spaced 3' on center and span a distance of 30'-9". They too must be designed like a beam due to their large size and spacing. The top and shear reinforcement is #3 rebar, with the bottom being #8 reinforcement. These bays feed into a system of beams, also poured monolithically. The image to the right is a representation of the typical layout of the one-way cast-in-place concrete bays found in the CDRH laboratory.



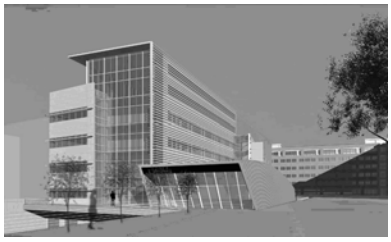
The typical beam is 19.7" wide by 20.5" deep and spans 21'. The reinforcement at the



midspan is comprised of 3 - #9 rebar with endspan reinforcement of 6 - #9 rebar. The shear forces are resisted with #3 rebar at 6" and then R rebar at 9". All elements used in the pan-joist system, as well as the beams are made of 4000psi concrete. The beams then feed into the typical 24" (600mm) X 18" (450mm) columns, which are made of 5000psi concrete and 6-#8 rebar. This is a fixed connection causing for resistance against moments, which make up the entire lateral resistive system. The total weight of the current system is quite large, at 163.83K per controlling (30'-9" span) bay, with a total depth of 20.5".

The current system also has steel construction in the penthouse area with the typical steel column being either W14X122 or W10X73. The steel beams in the penthouse roof, as well as the high-bay laboratory are typically a W14X32, W12X21 with secondary beams typically being either a W10X17 or a W8X15.

In the greater Washington, D.C. metro area one will find a great deal of concrete construction. This is due to the height restriction found in the District itself, and the ability to increase the number of floors because of a thinner structural sandwich than typical steel



construction. Although the Silver Spring area is not under this same height restriction, the location does play a part in the local skilled labor and customary design in the area, utilizing the high demand of concrete.

The high density of concrete is advantageous to control vibration, which is a major concern in a laboratory situation. There is also no need for fireproofing and the use of normal weight concrete helps to protect against blasts. Other forms of blast protection are progressive collapse beams which are 20" (500mm) X 30" (760mm), used at the north end of the building. This is the location of the loading dock (the location most susceptible to an attack). The beams were made to be large enough to support the load of the building for a short period of time if the center columns were removed.

For more information on the current Laboratory structural system please refer to Technical Report 1.