

# US Pentagon Remote Delivery Facility (RDF)

## Abstract



Highly reinforced, mass-cast concrete structures present surface imperfections in the substrate, which present difficulties to the coating contractor. The coating of the Remote Delivery Facility at the Pentagon will illustrate these problems and solutions.

## Introduction



The primary function of the Remote Delivery Facility is security. The building is constructed of highly reinforced concrete.

In the summer of 1941, large sections of Europe and Asia were years into the titanic struggle that became World War II. The Roosevelt administration, and many in the United States, knew it was only a matter of time before the U.S., had to enter the war. During the pre-war build-up, the management of the U.S. military was spread all over the city of Washington DC, and the rest of the country. In order to prepare for the war, the military planned to establish a centralized headquarters facility to increase the services joint efficiency. In July 1941, four months before Pearl Harbor, Brigadier General Brehon B. Sommervell ordered the construction of the largest office building in the world; the Pentagon. The Pentagon takes its common name from the unique, 5 sided geometry of the building. The Pentagon is actually composed of 5 distinct Pentagon shaped buildings, nested one inside the other.

General Sommervell called on General Leslie Groves, one of the army's most experienced engineers to head the project. Groves was to prove a most able organizer, and his next project after the Pentagon was the Manhattan project that would end World War II.

Construction began on September 11, 1941 and, just 16 months later, in January 1943 the Pentagon was in service. Today, 58 years later, the Pentagon is undergoing an enormously complex rehabilitation of the entire structure. One of the primary mandates of the rehabilitation is that the

Pentagon cannot be shutdown during the construction.

The building has National Landmark status, encompasses 29 acres and has 6.6 million square feet of office space. Since the middle of World War II, the Pentagon has never shutdown or been empty. Because of this intense duty, by the late 1980's, the Pentagon was not compliant with any government building codes. Most of the buildings systems and infrastructure; electrical, heating and cooling and communications had been stretched far beyond their technical limits.

In 1993, the Congress authorized \$1.222 billion to renovate this national symbol. The construction was broken down into 5 sections or "wedges". In 1998 truck bomb terrorist attacks on the U.S. Embassies in Tanzania and Kenya alarmed those involved with the Pentagon renovation. The Pentagon was vulnerable to truck bomb attacks as there was no isolated delivery facility for the Pentagon. To address this problem the Pentagon Remote Delivery Facility (RDF) was authorized.

The RDF will provide a remote, secure and centralized location for receiving and screening everything shipped to and from the Pentagon. The RDF will be a 250,000 square foot blunt, squat, hardened, single storied building of highly reinforced blast-directing concrete. 30 truck bays arranged on one side will facilitate deliveries and shipments.

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## Discussion



The areas beneath the raised deck will be fitted with gratings and are actually blast directing louvers.

The RDF represents the first Design/Build contract for the Pentagon renovation team. Walker Lee Evey is the Pentagon Renovation (PenRen) program manager. Evey, a former procurement official with NASA was responsible for most of the International Space Station contracts. Evey has successfully brought his wealth of contract negotiating skill and new procurement approaches to the daunting task.

Evey feels that Design/Build procurement is more fiscally responsible because, "the lowest bidder on bid projects is not necessarily the best value".<sup>1</sup> Eveys common sense philosophy is to select contractors



Views of both un-primed (above) and primed (below) tree planter box on upper section of RDF.



through a “best value” selection process. Evey and his procurement teams conduct oral and written proposals on each portion of the entire project. Though this type of procurement is more time consuming; Evey feels that the quality results are reflective of the time investment.

Atop the RDF is an enormous garden, complete with irrigation system. The PenRen team was looking for a durable waterproofing coating for the roof deck, as repairs would entail moving the landscaping to effect repairs. Wendy Thompson of PenRen along with Tom Miller of General Contractor Hensel-Phelps were instrumental in bringing polyurea spray coatings to the attention of the project. Among the advantages of durability and seamless application, polyurea was chosen because it cures fast and is 100% solids, containing zero voc’s. Solvent containing coatings are not the most cost effective delivery system, cure slowly and are harmful to the environment.

Highly reinforced mass cast concrete presents the coating applicator with some problems. The primary problem is the large voids referred to as “bug holes”. The bug holes usually have a film or window of concrete over the voids, which hide the true size of the void. The first step is to water blast the deck surface to remove any dust or contamination and to open these voids.

The RDF project consisted of vertical as well as horizontal surfaces to be coated. Additionally, because of the garden irrigation, slope and drainage of the surfaces was a concern.

The concrete surfaces were water blasted at 3500 psi. When the surfaces were clean and dry, they were primed with a low viscosity, 100% solids, epoxy based primer. The low viscosity is critical to the priming operation as it penetrates into the concrete surface.

The polyurea coating was specified at 80 mils thickness. Polyurea Coating Systems, Inc manufactured the polyurea we used. The polyurea was PCS-355, which is a flexible aromatic with an elongation of 500%, and pigmented gray.

The quality control consisted of taking periodic samples before application and analyzing them, and doing adhesion studies by Elcometer. Additionally, the finished



The above picture of the RDF was taken after the 9/11 attacks. American Airlines flight 77 hit the Pentagon on the right hand section of the above picture. In the picture you can see the intense construction activity and the outer rings of the structure are already rebuilt.

coated areas had to withstand a flood test. In many cases the flooded areas were underwater for weeks.

## Summary

The Pentagon Remote Delivery Facility became operational in November 2000. The RDF is presently screening deliveries and providing another level of security to the many people who work in the Pentagon.