

Roller-Compacted Concrete at the Choctaw Point Terminal, Mobile, AL

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Auto Parts. Electronics. Clothing. Food. Toys. What do these seemingly different products have in common (need a hint, find the labels)? The answer is surprisingly simple—all of them were imported into this country. Products historically manufactured in U.S. factories are now produced in foreign countries with more competitive labor rates. As a result, U.S. cargo is expected to double in volume by 2020 and drastically exceed the current capacity of many U.S. intermodal facilities. With the trend for intermodal facilities to move toward larger ships, longer trains, higher throughput volumes and heavier loads, the need handle goods efficiently is of paramount importance.

Two of the companies faced with meeting this challenge are APM Terminals, a subsidiary of AP Moller—Maersk Group, and Terminal Link, a division of CMA CGM. APM Terminals is a multinational container terminal operator headquartered in Denmark that operates more than 50 terminals in 31 countries. CMA CGM is headquartered in France and is the third largest shipping line in the world, with more than 240 vessels calling on 130 countries worldwide. In November of 2005, APM Terminals North America (80%) and Terminal Link (20%) announced a joint venture to develop a new container facility in conjunction with the Alabama Port Authority at Choctaw Point in Mobile, AL. The new company, Mobile Container Terminal, LLC, selected the Port of Mobile due to its excellent location as a distribution hub, with immediate access to two interstates, five Class I railroads, and nearly 15,000 miles of inland waterways. The plan is to build the new facility in phases, with an initial build-out of 95 acres capable of handling 350,000 TEUs (twenty foot equivalent units) and an ultimate container capacity of 800,000 TEUs.

With more than 90 acres of the terminal utilized to transfer goods, both local and regional PCA representatives actively



Figure 1—RCC paving at Choctaw Point Terminal in Mobile, Alabama

investigated opportunities to utilize roller-compacted concrete (RCC) as the pavement of choice at the facility. RCC is a cost competitive, long-term paving option which takes its name from the construction method used to build it. RCC is typically placed with high-density paving equipment and compacted with vibratory rollers. Paving widths of 30-feet wide at a 10-inch depth are possible in a single pass.

RCC has the same basic ingredients as conventional concrete: cement, aggregate, and water, but it has a much drier consistency than conventional concrete. RCC also does not require forms, finishing, dowels, or steel reinforcement and, consequently, can be constructed quickly and economically. These attributes make it an excellent paving option for these large projects where strength and durability are paramount but economic considerations are still a driving factor. Container terminals, which deal with issues such as heavy point

Table – 1 – Mobile Container Terminal – Pavement Design (Excerpt from Bid Documents C-208)

<i>Preliminary Paving Design</i>	<i>Option 1</i>	<i>Option 2</i>	<i>Option 3</i>
Section A – Heavy Duty	2 ½" HMA Surface Course 12 ½" HMA Base 13" Granular Base	2 ½" HMA Surface Course 11 ½" HMA Base 13" Stabilized Sand	15" RCC 6" Stabilized Sand
Section B – Medium Duty	2 ½" HMA Surface Course 5 1/2" HMA Base 12" Granular Base	2 ½" HMA Surface Course 4 ½" HMA Base 10" Stabilized Sand	8" RCC 6" Stabilized Sand
Section C – Light Duty	1 ½" HMA Surface Course 3" HMA Base 8" Granular Base	1 ½" HMA Surface Course 3" HMA Base 6" Stabilized Sand	6" RCC 6" Stabilized Sand
CONTAINER STACKING: BPA MANUAL REQUIRES A MIN 15" RCC FOR STACKING LOADED CONTAINERS IN BLOCKS 5 HIGH BPA MANUAL REQUIRES A MIN 8" RCC FOR STACKING EMPTY CONTAINERS IN BLOCKS 3 HIGH			

and static loads as well as significant end-user cost due to downtime, are an ideal application for roller-compacted concrete.

APM employed the services of Han Padron Associates (HPA—A Division of Halcrow), one of the country’s largest full service consulting engineering firms dedicated to marine projects, to facilitate designing the terminal. In turn, HPA employed a local engineering firm, Gulf States Engineering (GSE), as the primary engineering service firm for the project. The design team was initially hesitant to specify RCC as a paving alternate as most of their existing facilities were a combination of hot mix asphalt (HMA) and conventional concrete. The process of convincing the client that RCC was a viable paving option began at the local engineering level and ultimately extended to an in-office visit with the APM Terminal North America Engineering Group in Charlotte, NC. PCA promotion efforts focused on two key issues: 1) RCC’s positive attributes, including the speed of construction, durability, and low maintenance cost, and 2) the excellent track record of RCC at other major terminals, including recent projects at Bayport in Houston, TX and NIT in Norfolk, VA.

HPA employed the services of Nigel Nixon & Partners, Inc. (NNP), a recognized leader in heavy pavement design, to facilitate preparing the pavement design and plans. NNP was able to review the expected loadings for the terminal and provide an alternate paving option to conventional HMA utilizing RCC (Table 1). NNP was instrumental in alleviating APMT’s concerns, as NNP has significant experience in the design and installation of RCC. Nigel explained, “While RCC is not the most architectural aesthetic finish, its serviceability and durability provides a very cost effective heavy-duty pavement and is particularly suited to open storage, industrial, and cargo handling facilities.”

RB Baker Construction Inc., based in Savannah, GA, was the successful bidder on the project. Jay McMahan, vice president and group manager, provided two main reasons why the RCC paving option was selected: 1) RCC provided the client significant cost savings on the medium and heavy-duty pavement sections and 2) RCC shortened the time of construction, thereby expediting the project schedule, which was of vital importance to everyone on the project team.

A.G. Peltz Group, LLC, the largest RCC paving contractor in the United States, was subcontracted by RB Baker as the primary paving contractor on the site. The RCC specification for this facility required a 790 psi flexural strength after 28-days and a correlation was established



Figure 2—RCC Test Section

prior to starting the job to determine the acceptable compressive strength of the field cast cylinders that would assure the minimum flexural strength was achieved. This correlation was established in a test section placed at A.G. Peltz office location in Birmingham, AL prior to starting this job. A second on-site test section was primarily performed to show APM Terminals and MCT personnel that the pavement can be constructed using widely spaced longitudinal and transverse joints. Additionally, the test section allowed project personnel to view the pavement firsthand and voice any concerns prior to completing significant paving quantities.

AG Peltz began paving in May of 2008 and used a variety of equipment on the site, including both Titan-ABG and Voegel high-density pavers. Paving width was 30 feet and production rates routinely exceeded 2000 cubic yards per day. The paving plan for the project required both single-lift (8 inches) and dual-lift construction (15 ½ inches), all placed on 6 inches of cement stabilized sand. Material transfer devices have routinely been used to help ensure that the second lifts are placed within 60 minutes of the first lift in order to ensure the creation of a monolithic slab. The RCC was saw cut in transverse direction (30 foot intervals) and longitudinally along the cold joint.

CEMEX provided the cement for the project, while Vulcan Materials Company provided both coarse and fine aggregates. A.G. Peltz mixed all materials on-site utilizing an ARAN Modumix II continuous mixing plant with a capacity of 1000 tons per hour. A second ARAN ASR280B



Figure 3—Compaction using vibratory roller and background showing containers stacked on RCC pavement completed earlier



Figure 4—ARAN Modumix II Continuous Mixing Plant

pugmill with a capacity of 400 tons per hour was the backup plant to ensure that the paving operation remained continuous. A variety of rollers were used on-site, including pneumatic rubber coated and tandem rollers.

A.G. Peltz completed the 400,000 square yards project in February of 2009. Phase I paving was completed in August of 2008 and the first vessel arrived to Mobile Container Terminal on October 2, 2008, only five months after the start of paving.

Initial feedback from both project and outside personnel who have viewed the RCC has been overwhelmingly positive. Project test parameters have routinely been exceeded, with flexural strengths averaging more than 800 psi and compressive strengths averaging 5800 psi at 28 days.

Other parties were highly impressed by the surface quality of the pavement, many noting that it was difficult to tell the RCC apart from conventional concrete. Will Gray, managing partner with A.G. Peltz, spoke about the mix quality, “One of the challenges with RCC paving is to obtain quality surface textures while meeting structural requirements. This mixture provided a unique combination of outstanding structural characteristics, excellent constructability, and pleasing aesthetic attributes.”

Bob Ardary, lead engineer with GSE on the project, stated, “A.G. Peltz has provided a quality product. Normally slip form pavers are limited to 2% slopes to prevent standing water. This project was limited to a 1% slope. A.G. Peltz was able to provide the 1% slope with their pavers with minimal standing water.” Other engineers visiting the site



Figure 5—RCC transverse and longitudinal saw-cut joints at Choctaw Point, Mobile, AL



Figure 6—Close up showing surface texture of RCC pavement

were impressed and stated this was the best RCC project they have examined. The quality was due to the care with which A.G. Peltz selected the RCC mix material and the workmanship of their employees.

RCC's combination of strength, durability, speed of construction, and economy continues to meet the growing need for value added pavements in the industrial sector. For additional information on roller-compacted concrete—including case studies, suggested specifications, and technical support—please visit the PCA web site at www.cement.org/pavements.

Credits

Owner: Mobile Container Terminal, LLC
www.mobilecontainerterminal.com

RCC Sub-Contractor: AG Peltz Group, LLC
www.agpeltz.com

Pavement Designer: Nigel Nixon & Partners Inc.
www.nigelnixon.com

Engineer: Gulf States Engineering
www.gseeng.com



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