

PRESTRESSED CONCRETE TANKS



CROM SAFETY

We are dedicated to providing a comprehensive safe working environment. Our “safety first” approach requires a commitment to: professional training, certifications, evaluation of materials and equipment, and proper use of personal protective equipment (PPE). In addition to this effort, our team members pledge to put safety first and create a safe environment for themselves and others. CROM aspires to outperform safety expectations and industry standards on every project.

COMMITMENT TO

SAFETY

The well-being of our team and our clients is important. Our dedicated Health, Safety, and Environmental (HSE) Department works diligently to anticipate and recognize hazards and behaviors that could be harmful, to proactively prevent accidents from happening. Our team is trained to assess hazards, prevent injuries, and honor our culture of SAFETY FIRST. We have been recognized for our attention to safety protocols, practices, and forward thinking to bring our team members home safe.

QUALITY

Every client and project deserves our best. We diligently work to continue a 67+ year tradition of excellence by leveraging our experience and quality outcomes. Construction of prestressed concrete tanks, custom fabrications, and infrastructure restorations all have unique challenges. CROM ensures that our team will design, construct, and rehabilitate to the highest quality standards.

PERFORMANCE

CROM has a performance driven culture. Our goal is for each part of our company to operate efficiently and achieve more together. This collaborative effort shows through in every aspect of our work as we strive to exceed expectations. Specialized training, combined with innovative equipment and disciplined safety practices, allow us to build long-term performance into everything we do.



“You guys are the best contractors I’ve ever worked with and wanted to show my appreciation”

– John P.
Management/Safety on MTMUS site

WHY CROM?

CROM® is a TEAM focused on safely designing, building, and restoring essential infrastructure while being committed to professional integrity. Our culture of performance is built on a foundation of Core Values. Our team members choose to foster an environment of respect, consideration, and compassion to make good things happen for our CLIENTS and OUR TEAM.

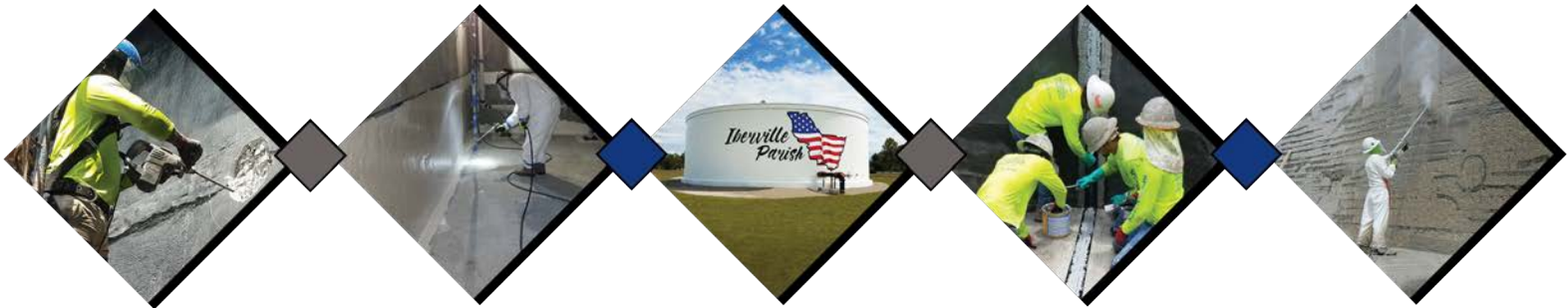
HOW CAN WE ADD VALUE?

CONSTRUCTION OF PRESTRESSED CONCRETE TANKS

CONCRETE REMOVAL & SURFACE PREPARATION
CONTINUING SERVICE AGREEMENTS
DURABILITY INSPECTIONS & ASSESSMENTS
HIGH PERFORMANCE COATINGS
ENGINEERING & DESIGN
INFRASTRUCTURE UPGRADES
SHOTCRETE
SPECIALTY FABRICATIONS
STRUCTURAL REPAIR

TANKS you know

RESTORATIONS YOU NEED



PRESTRESSED CONCRETE TANKS

Since 1953, CROM has designed and built over 4,300 prestressed concrete tanks with capacities ranging from 35,000 to over 30,000,000 gallons. CROM adheres to the highest standards of professional engineering and construction including AWWA Standard D110, ACI Report 372, and ACI Code 350. As long-term active and contributing members of the design committees, CROM remains a leader in the water and wastewater industry. All CROM design drawings and calculations are signed and sealed by one of our company's full-time registered professional engineers.

In 1942, J.M. Crom Sr. first wrapped high-strength wire in a continuous spiral on the exterior of cylindrical concrete tanks. The "wrapping" method tensioned the prestressing wire before it was placed on the wall, and thus avoided prestressing friction losses. After placement, the prestressed reinforcement was encased in shotcrete to bond each individual wire to the underlying tank wall. This shotcrete covercoat also provided corrosion protection for the critical prestressed reinforcement on the prestressed concrete tank (PCT). Today, a shotcrete covercoat is the industry standard used by ALL wire- and strand-wound prestressed concrete tank builders.

HISTORY OF PRESTRESSED CONCRETE TANKS



PRESTRESSED CONCRETE TANK DESIGN

AWWA-D110 TYPE II WALL

CROM has developed tank technology with these lasting attributes:

- **GUARANTEED WATERTIGHTNESS**
- **STRUCTURAL INTEGRITY**

- **PROVEN ECONOMY**
- **REFINED APPEARANCE**

WATERTIGHTNESS

A CROM prestressed concrete tank specification contains watertightness requirements that exceed AWWA D110 standard language. This differentiates CROM from the competition.

The exceptional watertightness of a Type II Composite Wall is made possible by a continuous galvanized steel shell diaphragm. Corrugations in the steel shell create a mechanical bond to the shotcrete giving the wall its “composite” nature. The diaphragm has no horizontal joints and the vertical joints are sealed by epoxy injection after shotcrete encasement is complete. Mild steel reinforcement is incorporated as required by the design to accommodate bending, shrinkage, and temperature effects. Finally, circumferential prestressing ensures permanent ring compression in the tank core wall.

STRUCTURAL INTEGRITY

CROM designs structures under the supervision of professional engineers; trains and certifies key team members; selects and uses the best available construction materials; and adheres to rigid standards of quality construction.

ECONOMY

Economy is a natural by-product of the AWWA D110 Type II Prestressed Concrete design; by leveraging the strength of shotcrete in compression, less material is required versus conventional reinforced concrete construction.

Of greater significance is the *permanence* inherent in the construction materials used. Shotcrete is a durable, highly impermeable, high-strength building material with a long life which requires minimal maintenance. Under most operating conditions, interior surfaces of the tank do not require protective coatings. This is a significant cost benefit.

APPEARANCE

AWWA D110 Prestressed Concrete Tanks, with Type II walls, have a soft textured shotcrete finish which ensures lasting beauty with minimal care. The low profile dome roof, sleek in line and shape, completes the structure’s engineered design. Exposed exterior surfaces do not need to be coated; however, they are often painted for beautification and to complete their refined appearance.

**CONTINUOUS STEEL SHELL DIAPHRAGM
(NO HORIZONTAL JOINTS)**

**VERTICAL JOINTS ARE SEALED WATERTIGHT BY
EPOXY INJECTION AFTER THE STEEL SHELL HAS
BEEN ENCASED WITH SHOTCRETE**

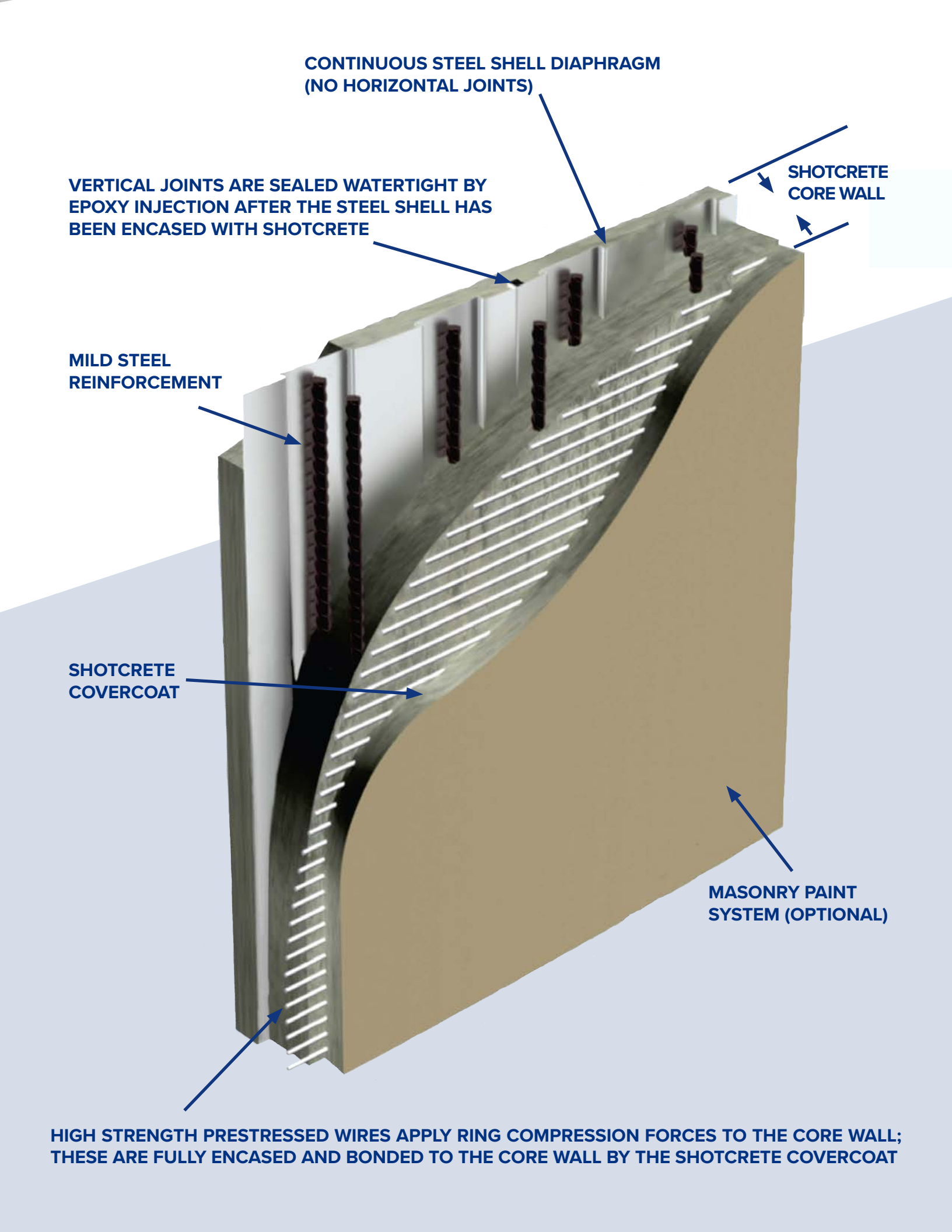
**SHOTCRETE
CORE WALL**

**MILD STEEL
REINFORCEMENT**

**SHOTCRETE
COVERCOAT**

**MASONRY PAINT
SYSTEM (OPTIONAL)**

**HIGH STRENGTH PRESTRESSED WIRES APPLY RING COMPRESSION FORCES TO THE CORE WALL;
THESE ARE FULLY ENCASED AND BONDED TO THE CORE WALL BY THE SHOTCRETE COVERCOAT**



COMPLETE TANK CONSTRUCTION

CROM provides a complete tank construction service. We prefer no division of responsibility with respect to the tank structure. Our team designs and constructs the wall footings, floor slab, circular wall, dome roof, and appurtenances as required. By eliminating the division of responsibility, our clients can proceed with confidence that the tank will be built by PCT experts that guarantee product performance.

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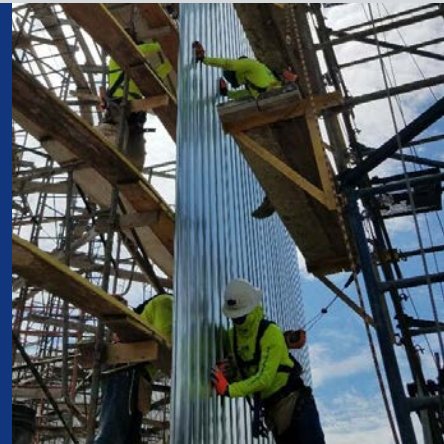


The floor of the prestressed tank is typically a heavily reinforced concrete membrane slab. Structural and ballast floor designs are also common depending on site condition requirements. This view illustrates placement of floor concrete, highly reinforced; a strong foundation.

Galvanized steel shell diaphragm is erected on a system of formwork specially designed for this purpose. The steel shell extends the full height of the tank to ensure watertightness. Vertical joints in the steel shell are sealed watertight by epoxy injection.*

*U.S. Patent No. 5,150,551

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Exterior encasement of the steel shell is accomplished with shotcrete, which is pneumatically placed concrete. The core wall of the tank is constructed using successive layers of shotcrete until the required wall thickness is achieved.

After the supporting formwork is removed from the tank interior, shotcrete is applied to encase the diaphragm and complete the interior core wall.



4



5

Vertical reinforcing bars are placed to design requirements and encased in shotcrete.

Dome roof construction is made possible with the aid of a forming system that ensures accurate dome curvature. The height of the dome rise is commonly 1/10th of the tank diameter, but lower rise domes are possible if desired.



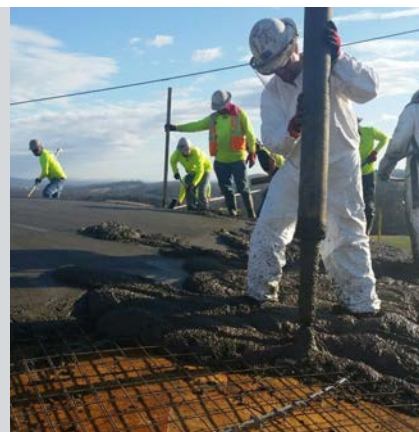
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Once the dome formwork is completed with an overlay of sheathing, reinforcement is placed.

The free-span dome roof is constructed of cast-in-place concrete. This view shows dome concrete being placed by a concrete boom pump.



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Both the core wall and the free-span dome roof are circumferentially prestressed using high-strength steel wire wrapped around the tank in a continuous helix. Wall prestressing is designed to carry the tank's hydraulic load, while dome ring prestressing resists the horizontal forces of roof live and dead loads.

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To avoid over-stressing or under-stressing of the tank, the tension in the wire is measured by the use of a direct-reading electronic digital stressometer after it is applied to the tank wall.



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In order to provide protection for the prestressing elements, a shotcrete covercoat is applied to the exterior, which permanently bonds the wire to the tank wall. Whenever two or more layers of prestressing wire are required, a thin coat of shotcrete separates and protects each layer.

The covercoat completes the concrete portion of the tank construction.

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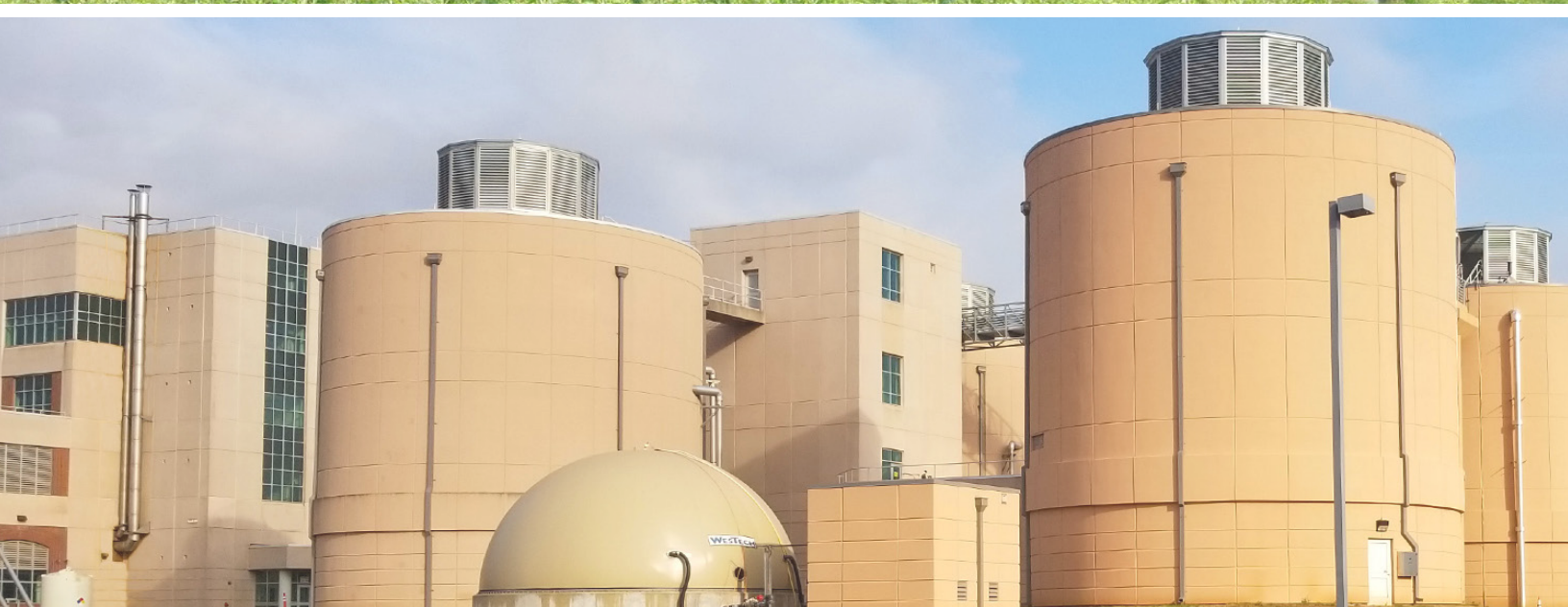
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The final stage of construction involves installation of accessories and if desired, application of exterior coatings for decorative purposes.



TYPICAL INSTALLATIONS



POTABLE WATER STORAGE TANKS

Prestressed Concrete Tanks (PCTs) are the highest quality and most durable solution in potable water containment. CROM PCTs are constructed in accordance with AWWA Standard D110, ACI Report 372, and ACI Code 350, and are custom designed and built to site specific needs.



LANDMARK TANKS



Located 25 feet from the Gulf of Mexico, on a U.S. Government port, and neighboring a Grand Casino, the “Lighthouse Tank” is a very stout CROM design. This 250,000-gallon water storage tank was designed and constructed to withstand Category 5 hurricane winds and wave action of 15 feet. The structural, pile-supported, floor is designed to prevent uplift and/or overturning during major hurricane events. The LED light atop the tank makes this tank a fully functional lighthouse. The flared base of the tank is constructed of reinforced shotcrete, as is the frame around the painted nautical flags- which spell out GULFPORT.

BLAST-PROOF WATER SUPPLY

Due to the importance of Critical Infrastructure, CROM developed blast-proof designs and construction techniques to keep water storage infrastructure functional during blast, tornadic, or seismic activity.



WATER TANKS WITH AERATORS



The installation of a natural draft tray aerator will aid in the removal of many unwanted contaminants. CROM fiberglass aerators are attractive, efficient and constructed with NSF approved materials. For additional protection of tank interiors subject to aggressive contaminants, CROM developed self-washing, flat concrete covers and embedded HDPE liners in free-span concrete domes.

FIRE PROTECTION

Dedicated fire suppression storage is frequently required for residential, urban, and commercial use, especially in locations where municipal water flow rates are inadequate. CROM water storage tanks for fire protection can assure compliance with NFPA, international, federal, state, and local fire codes.



THERMAL ENERGY STORAGE



CROM also provides turn-key services for the design and construction of insulated Thermal Energy Storage (TES) Tanks, complete with an internal, patented diffuser system. The combination of the low maintenance PCT and corrosion resistant internal diffuser system ensures decades of uninterrupted service and low life-cycle costs. Our clients across the commercial, institutional, and industrial sectors have valued the benefits of CROM TES tanks.

TURBINE INLET AIR CHILLING

The process of cooling a combustion turbine's inlet air is known as Turbine Inlet Air Chilling (TIAC). Many power generation facilities are comprised of turbines fueled by natural gas. CROMTES TIAC tanks increase efficiency for this type of power production during warm seasons. Periods of increased demand occur on hot summer days when air conditioning systems are in full use. Hot ambient air also reduces the efficiency of combustion turbines. By employing a TIAC system, power producers can eliminate the effects of hot ambient air and increase the output of their generators. Ultimately, this reduces consumers energy cost.



WASTEWATER STORAGE TANKS



Prestressed tanks in wastewater treatment plants include equalization tanks, sludge digesters, process water tanks, effluent storage tanks, clarifiers, aeration tanks, sequencing batch reactor (SBR) tanks, bilge storage tanks, and package treatment tanks.

FLOW EQUALIZATION (EQ) STORAGE

Prestressed Concrete EQ tanks are a preferred, cost effective solution to contain large volumes of wastewater for Flow Equalization or Wet Weather Storage. EQ tanks are frequently designed to accommodate peak flow conditions and provide steady inflow to the treatment plant while preventing combined sewer overflow (CSO) and sanitary sewer overflow (SSO) events.



RECLAIMED/REUSE STORAGE



Prestressed concrete tanks can be used for reclaimed or reuse wastewater. These tanks may be located at the treatment plant facility, or closer to the point of discharge, where the treated water is used for irrigation purposes. Recycling water on site or nearby, reduces energy needed to move water long distances or lift it from the aquifer. This water can also be used as make-up water for cooling towers in high-cooling environments such as data centers.

CLARIFIERS

CROM prestressed concrete tanks can be designed to accommodate various types of clarifier mechanisms. Operating on the principle of gravity settling, clarifiers have been used to treat wastewater for decades and provide efficient solutions to process and purify wastewater.



DIGESTERS



Open-top aerobic digesters and pressurized anaerobic digesters can accommodate the requirements and demands of sludge digestion and storage. Anaerobic digesters may be built with free-span prestressed concrete domes or designed to accept fixed or floating steel covers, aluminum domes, or membrane covers. Mesophilic (90 degrees Fahrenheit) and thermophilic (140 degrees Fahrenheit) processes are possible by applying insulation to the exterior of the tanks.

SEQUENCING BATCH REACTOR (SBR)

Sequencing Batch Reactor tanks and Biological Nutrient Removal (BNR) tanks are similar from a tank design standpoint. The AWWA D110 Type II walls are modified and reinforced as necessary to provide mounting points for the specialized equipment.



OXIDATION TANKS



Oxidation ditch treatment systems typically consist of single or multi-channel configuration with a ring, oval, or horseshoe-shaped basin. The structures are designed and constructed in accordance with the applicable portions of AWWA Standard D110 using a Type II core wall – shotcrete with an embedded steel diaphragm. As a result, these tanks are known for their outstanding concrete crack control, watertightness, appearance, longevity and minimal maintenance requirements.

SPENT DEICING FLUID STORAGE

A trend in transportation, especially airports, is establishing well-designed centralized deicing facilities that help process excess glycol in a more sustainable manner. The pre-treatment of spent deicing fluid is important as to not upset the WWTF where the fluid is ultimately treated to acceptable discharge quality.



5 KEYS TO OUTSTANDING PCT CONSTRUCTION

1. Continuous steel shell diaphragm encased in shotcrete
2. ***Free-span concrete dome**
3. Single wire prestressing
4. Zero division of responsibility- from design to construction
5. 5-year leak-free and structural guarantee



*FREE-SPAN CONCRETE DOME



THREE (3) - 278'- 0" ID FREE-SPAN CONCRETE DOMES

Benefits of a free-span concrete dome:

- The durability and strength of concrete compression
- No interior support columns that require inspection or maintenance
- No column point loads that increase cost and differential settlement risk

CAPACITIES AND DIMENSIONS FOR CIRCULAR TANKS*

Inside Diameter in Feet	Capacity in Millions of U.S. Gallons																				
	.1	.2	.25	.3	.4	.5	.75	1.0	1.5	2.0	2.5	3.0	4.0	5.0	7.5	10.0					
30	18'11"																				
35	13'11"	27'9"	34'9"	41'8"	55'8"	69'6"															
40	10'8"	21'3"	26'7"	31'11"	42'7"	53'2"															
45	8'5"	16'10"	21'1"	25'3"	33'8"	42'0"	63'1"														
50	6'10"	13'7"	17'1"	20'6"	27'3"	34'1"	51'2"	68'2"													
55		11'3"	14'1"	16'11"	22'6"	28'2"	42'3"	56'3"													
60		9'5"	11'10"	14'2"	18'11"	23'8"	35'5"	47'4"													
65			10'1"	12'1"	16'1"	20'2"	30'3"	40'4"	60'6"												
70				10'5"	13'11"	17'5"	26'1"	34'9"	52'2"	69'6"											
75					12'1"	15'2"	22'9"	30'4"	45'5"	60'7"											
80					10'8"	13'4"	19'11"	26'8"	39'11"	53'2"	66'6"										
85						11'9"	17'8"	23'7"	35'4"	47'2"	58'11"										
90						10'6"	15'9"	21'1"	31'7"	42'1"	52'7"	63'11"									
95							14'2"	18'10"	28'4"	37'9"	47'2"	56'7"									
100							12'9"	17'1"	25'7"	34'1"	42'7"	51'1"	68'1"								
105							11'7"	15'5"	23'2"	30'11"	38'7"	46'4"	61'10"								
110							10'7"	14'1"	21'1"	28'2"	35'2"	42'3"	56'3"								
115								12'10"	19'4"	25'9"	32'2"	38'7"	51'6"	64'5"							
120								11'10"	17'9"	23'8"	29'7"	35'6"	47'4"	59'2"							
125									16'4"	21'9"	27'3"	32'9"	43'8"	54'6"							
130		<div>Water Depth in Feet and Inches to Nearest Inch</div> <div>Quick Formula For Volume in U.S. Gallons: V = 5.875 D²H</div> <div>Where: V = Volume in U.S. Gallons</div> <div>D = Inside Diameter in Feet</div> <div>H = Liquid Depth in Feet</div> <div>CROM can build tanks to any specified dimensions. Domed tank diameters can exceed 285' and walls have been constructed in excess of 75' tall.</div>								15'2"	20'2"	25'2"	30'3"	40'4"	50'5"						
135										14'1"	18'8"	23'4"	28'1"	37'5"	46'8"	70'0"					
140										13'1"	17'5"	21'9"	26'1"	34'9"	43'5"	65'2"					
145										12'2"	16'3"	20'3"	24'3"	32'5"	40'6"	60'9"					
150										11'5"	15'2"	18'11"	22'9"	30'4"	37'10"	56'9"					
155		<div>Water Depth in Feet and Inches to Nearest Inch</div> <div>Quick Formula For Volume in U.S. Gallons: V = 5.875 D²H</div> <div>Where: V = Volume in U.S. Gallons</div> <div>D = Inside Diameter in Feet</div> <div>H = Liquid Depth in Feet</div> <div>CROM can build tanks to any specified dimensions. Domed tank diameters can exceed 285' and walls have been constructed in excess of 75' tall.</div>										17'9"	21'3"	28'4"	35'6"	53'2"					
160														16'8"	20'0"	26'7"	33'3"	49'10"	66'6"		
165															18'10"	25'0"	31'3"	46'11"	62'7"		
170															17'8"	23'7"	29'5"	44'2"	58'11"		
175																16'8"	22'3"	27'9"	41'8"	55'7"	
180											15'10"	21'1"	26'4"	39'5"	52'6"						
185												19'11"	24'10"	37'4"	49'9"						
190												18'11"	23'7"	35'4"	47'2"						
195												17'11"	22'4"	33'7"	44'10"						
200												17'1"	21'4"	31'11"	42'6"						
205														20'3"	30'4"	40'6"					
210															28'11"	38'8"					

* Larger capacities are available and typical. Omitted here for chart clarity.

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CROM[®]

PRESTRESSED
CONCRETE TANKS | COATINGS AND
RESTORATIONS

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