Ready Mixed Concrete Technology System

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EXECUTIVE SUMMARY

CarbonCure Technologies ready-mixed concrete carbonation systems sequester waste carbon dioxide into ready-mixed concrete to reduce the carbon footprint during the manufacturing of concrete and to produce performance-enhancing benefits. These systems can be easily integrated into any ready-mixed concrete facility with minimal disruption to regular production. The producer can use the CarbonCure system to inject carbon dioxide into any ready-mixed concrete truck without impacting the concrete mix batching time.
CARBONCURE TECHNOLOGIES READY MIXED CONCRETE SYSTEM

The CarbonCure Technologies (CCT) ready-mixed concrete system consists of four main components:

1. Valve enclosure
2. Human Machine Interface (HMI)
3. Programmable Logic Controller (PLC)
4. Injection device

The valve enclosure houses the valve configuration of the CCT ready-mixed concrete system. Solenoid valves are used to permit the flow of carbon dioxide (CO$_2$) into the truck. The HMI is the interface between the CCT system and the batcher, allowing the batcher to view the system during operation, navigate through existing alarms, and adjust settings in the recipe. The injection device is used to inject the CO$_2$ into the truck during batching.

The injection device varies depending on whether the customer has a central mixer operation or a dry-batch operation. In the case of a central mixer operation, a fixed CO$_2$ outlet is positioned to inject the CO$_2$ into the discharge hopper as the concrete is being dumped from the mixer into the truck. In the case of a dry-batch operation, the injection device is an extendable flexible abrasive resistant hose housed inside a fixed position steel tube positioned next to the cement pipe. The internal flexible abrasive resistant hose is extended and retracted from the ready mix truck chute using an air cylinder controlled by the CCT system and injects the CO$_2$ after the other dry components have been batched.

![Figure 1 - Injection location for Central Mixer](image-url)
INTEGRATION REQUIREMENTS

The valve enclosure is installed next to the central mixer or the loading area for the trucks. The HMI and PLC are installed in the batch house. A control cable is required between the PLC and valve enclosure to allow them to communicate with each other. Vacuum jacketed hoses/piping extend from the producer’s source of CO₂ to the valve enclosure. The producer can decide what type of CO₂ source is best suited for their production rate (i.e. dewars, mini bulk, etc.) however, mini bulk/bulk tanks are recommended given the volume of concrete produced at most sites. Bulk tank installation requires a concrete pad to support the tank and plumbing provided by the CO₂ supplier.

The CCT ready-mixed concrete system will integrate with the customer’s system in the same manner as other admixture systems. The system will either dose during the batching sequence (after the cement addition) in the case of dry-batch or will dose when the mixer is discharging into the truck in the case of a central mixer. In the central mixer case, the required dose of CO₂ will go into a queue during mixing and be injected when the mixer starts to discharge.

The injection device is an integral part of the CCT system. This is the part that is used to inject the CO₂ into the concrete and be reacted during mixing without escaping the truck. In the central mixer case, this is a fixed CO₂ outlet steel pipe that injects the CO₂ into the stream of fresh concrete as it is discharging from the mixer into the truck. In the case of dry-batch, an extendable flexible abrasive resistant hose housed inside a fixed position steel tube, used for protection, is used to inject the CO₂ directly into the drum of the mixing truck.

The recommended integration procedure for producers is as follows:

1. Contact a supplier to arrange a CO₂ supply (i.e. dewars, bulk tank, etc.).
2. If bulk tanks are selected, pour a concrete pad that meets specifications and dimensions provided by the CO₂ supplier as close to truck loading area or mixer as reasonably possible.
3. Securing routing for electrical connections between the batch house and loading area/mixer (e.g. alongside existing electrical connections). Secure routing of CO₂ lines from the CO₂ supply to the valve enclosure.
4. Ensure the producer’s system is able to send a 120VAC (or 24VDC) constant signal and be able to receive 24VDC (or 120VAC) pulse signals from the CCT system
5. Mount the valve enclosure near loading area/mixer with a power supply.
6. Mount the HMI/PLC in the batch house with a power supply. Provide an Internet connection to the HMI.
7. Mount the injection device in the discharge hopper for central batch applications or inside loading boot for dry-batch applications. CCT staff will give guidance on how best to mount the device.

**USING THE CARBONCURE READY-MIXED CONCRETE SYSTEM**

The typical sequence of events to treat a load of concrete with CO₂ is as follows:

1. A ticket for CarbonCure ready-mixed concrete is sent to the batcher.
2. The truck driver aligns his truck under the batch hood and the producer’s system determines how much CO₂ that specific truck requires based on dosages recommended by CCT staff.
3. The dose is added directly to the truck after the cement discharge (dry-batch) or is queued and injected once the mixer starts to discharge (central mixer). This shouldn't require any more time than normal.
4. The truck leaves from under the batch hood and continues as normal.

**SUMMARY**

The CarbonCure Technologies ready-mixed concrete system requires minimal work on the producer’s end to integrate into their system and allow the producer to inject carbon dioxide into any ready-mixed concrete truck. The integration process can be done quickly with minimal disruption to regular production. Carbon dioxide injections take place under the loading area and do not impact regular concrete mix batching times. With the use of CarbonCure Technologies ready-mixed concrete system, producers can create a concrete product that preforms better and reduces the negative impact concrete has on the environment.