

Phoenix Heat Is No Match for GCP Admixtures

Admixtures enable highly workable, high strength concrete

Project	PHX Sky Train® Stage 2 expansion
Client	Phoenix Sky Harbor International Airport
Ready-mix producer	CalPortland Company
Concrete contractor	J. Banicki Construction
GCP solutions	ECLIPSE®, ADVA® 198, ADVA® 195, DARACEM® 55,
GCP solutions cont.	DARASET® 400, WRDA® 64, and AIRLON® 3000 concrete admixtures
Concrete mix and specifications	6,000 psi at 28 days and 8,000 psi at 90 days
Volume	8,000+ yd3 of concrete



The Project

6,000

psi at 28 days

8,000

psi at 90 days

8,000+

yd³ of concrete

The City of Phoenix Aviation Department embarked on plans to extend the 3.2-mile Phoenix Airport PHX Sky Train® to the Rental Car Center in order to enhance customer service, improve accessibility, and ease traffic on Sky Harbor Boulevard. By reducing the daily vehicle count by an estimated 20,000 vehicles per day, the Institute for Sustainable Infrastructure awarded Phoenix Sky Harbor International Airport an Envision Gold Award for sustainability.

J. Banicki Construction, part of the Sterling Construction Company, played a key role in the Sky Harbor's PHX Sky Train's Stage 2 expansion, which included extending the airport's people mover to transport passengers from Terminal 3 to the off-site Rental Care Center. J. Banicki selected CalPortland Company to produce the mass concrete for the concrete structures, which included cast-in-place box girder bridge rail and deck beam supports. The job encompassed producing:

- High-strength concrete for a 90' long beam to support incoming trains
- Lightweight concrete for the stairs and slabs
- Concrete that was free of pock marks and cracking for the project's large exposed beams

"The most technically challenging element of the project was the Load Transfer Beam G-1, which required 6,000 psi concrete with fly ash and plasticizer chilled with 160 pounds of ice per cubic yard to reduce the internal heat generated by the curing process,"

J. Banicki Construction Manager Barry Smylie.

The Challenge

The project required highly workable concrete that would flow easily around the dense rebar needed for the beams. In addition, to achieve the rigid capacity needed for the long span of the beams, high strength concrete needed to bond to large amount of rebar. This generates a lot of heat, which can lead to thermal cracking, so it was essential to keep the concrete cool. “The most technically challenging element of the project was the Load Transfer Beam G-1, which required 6,000 psi concrete with fly ash and plasticizer chilled with 160 pounds of ice per cubic yard to reduce the internal heat generated by the curing process,” said J. Banicki Construction Manager Barry Smylie. “This isn’t easy to do in the middle of the summer heat of Phoenix where ambient temperatures can exceed 110° F.”

The concrete needed to be placed in lifts and to stay “live” in a plastic state until the crew could put the lift over the top.

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The Solution

J. Banicki Construction has served as contractor to the Phoenix Sky Harbor International Airport for more than 16 years, and CalPortland has produced the majority of the ready-mix concrete for the work. For the Stage 2 extension, J. Banicki relied on CalPortland to provide concrete that would achieve superior structural integrity. “CalPortland was instrumental to the project,” said Smylie. “They were the driving force behind developing a mix design to make the project a success.”

For the placement of the G1, G2, and G3 beams, CalPortland used the highest level of fly ash possible (25-30%) to improve workability and to reduce the heat of hydration in the mix. To achieve the lowest core temperatures for the mass structure, they replaced all of the batch water with ice. For this complex mix design, they selected concrete admixtures including:

- ADVA® 198 and ADVA® 195 high-range water reducers to provide maximum workability with high fly ash & low water cement ratio needed for high strength
- ECLIPSE® admixture to reduce concrete shrinkage
- DARACEM® 55 midrange water reducer to promote bleeding in the flatwork to counteract the high evaporation rate in the region
- DARASET® 400 admixture to accelerate cement hydration
- WRDA 64® admixture to increase set times
- AIRLON® 3000 admixture to achieve a tight air content range for lightweight concrete

"GCP's high-range water reducers allowed us to provide concrete with less probability of shrinkage cracking in this hot, dry climate," said CalPortland Company Director of Quality Control in Arizona Lauro Rivas, P.E. "The water reducers also provided for higher flowing concrete, which made for easier placement despite the high amount of rebar in the structure."

"When the temperatures reach 102 degrees at 5AM, you need a chemical additive that will stall the set times, so the water reducing agents from GCP were important," said Smylie.

The GCP team helped ensure the project went smoothly. "We had great support from our local GCP reps," said Rivas. "They even helped us with a high-definition camera system so the operators had a clear view of the dosages."

CalPortland provided a dedicated QC team onsite to maintain strict slump and temperature requirements. "None of this works if you don't have the best concrete producer supplying the material," said Smylie. "Lauro, Allan, and Ben from CalPortland made the difference on a tough job. Job orders routinely averaged 200 cubic yards of concrete at night at 10-minute intervals. Cal Portland made sure every ounce of concrete was consistent and per the specifications. It's quite an operation! Over the last nine years, Cal Portland has supplied Banicki Construction over 250,000 cubic yards of concrete at Sky Harbor and continues to do so, all with equally good outcomes."

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CalPortland Company Director of Quality Control in Arizona Lauro Rivas, P.E.

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