1. Purpose

This standard describes the requirements pertaining to precast concrete structures.

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3. General

1. The manufacturer shall provide all materials, equipment and labor to produce precast concrete structures that are further detailed on RS-G3 and RS-G4.
2. All concrete shall be supplied and placed according to the applicable sections of American Concrete Institute (ACI), American Society for Testing and Materials (ASTM) and the Clark County Standard Specifications (CCSS), latest editions.
3. All structures shall be designed to withstand lifting loads without exceeding the first crack rating of the structure.
4. All structures shall be marked immediately after withdrawal from the pouring forms with the month and day of manufacture. The mark shall be placed inside the cable slot for pads and inside each section for other structures
5. Structures with cracks above .060” shall be discarded. All cracks from .016” to .060” must be repaired per Sika Corporation, SIKADUR 55 SLV or any other method approved by NVE before installation in the NVE system.

4. Materials

1. **PORTLAND CEMENT:** Shall be ASTM C150 Type V. LOW ALKALI only.
2. **AGGREGATES:** Shall meet the requirements of ASTM C33.
   - A. Coarse and fine aggregate shall be treated and tested as separate ingredients.
   - B. The coarse aggregate shall be Size No. 67 (3/4” maximum).
   - C. Deleterious substances of coarse aggregate shall be limited to the values of Class 4M.

D. All aggregate supplied shall be NON-REACTIVE. The aggregate shall be tested annually for potential alkali – silica reactivity per ASTM 1260:

i. Mortar bar expansion less than 0.10%: aggregate is acceptable for NVE

ii. Mortar bar expansion more than 0.20%: aggregate is not acceptable for NVE.

iii. Mortar bar expansion between 0.10 and 0.20%: additional tests are required at the supplier's option:

a. Comparator readings shall be continued until 28 days after casting.

b. Petrographic examination of the mortar bar test sample per ASTM C-856 (preferred) or petrographic examination of the aggregate samples per ASTM C-295.

E. A copy of the test reports shall be sent to:

NV Energy
Supervisor T & D Standards Department
P.O.Box 98910, M/S19
Las Vegas, Nevada 89151-0001
Phone: (702)402-6541
Fax: (702)402-6575

F. Approval of an aggregate source and supplier is effective for a period of one (1) year and contingent upon continued compliance with NVE T & D Standards. If at any time, the aggregate does not meet NVE T & D Standards, the aggregate will be rejected and the supplier may have to re-qualify the source of the non-conforming aggregates.

G. Precast Companies and NVE contractors may order and use only NVE specified approved suppliers for fine and course aggregates.

H. Approved Suppliers for fine and coarse aggregates:

Supplier	Source / Location	Aggregate		Date Approved	Re-test & Approval Deadline
		Fine	Course		
CSR Sand & Gravel	Buffalo Pit	X	X	3/95	11/03
Silver State Bldg. Material	Eldorado Pit	X	X	3/95	11/03
Nevada Ready Mix	Lone Mountain Pit	X	X	3/95	11/03
Leavitt Ready Mix	Glendale Ranch Pit	X	X	3/95	11/03
Hanson Granite	Eldorado Pit	X	X	8/95	11/03
American Sand & Gravel	NLV Blvd & Speedway	X	X	6/96	11/03
Matthew Roylance Co.	Alamo Pit	X	X	2/02	11/03
ISN Aggregates LLC	187 Quarry	X	X	11/03	10/04
Blue Point Materials	Logandale Pit	X	X	7/06	6/07

3. **WATER:** Fresh, clean potable (without any reactive mineral) to be used in the mixing process.

4. **APPROVED ADMIXTURES:**

A. Mineral Admixtures:

i. Fly ash: ASTM C618, Type F material may be used at a rate 18% to 20% by weight of total required cementitious material.

ii. Microsilica: ASTM C1240, material may be used at a rate 18% to 20% by weight of total required cementitious material.

B. Chemical Admixtures:

NOTE: Admixture containing more than 0.15% per weight of chloride is not permitted. All admixture shall be from a single source unless otherwise approved by NVE.

i. **Air Entrainment:** ASTM C260 may be used by the concrete precaster. Airentrainment is not required except with special notice

ii. **Water Reducer:** ASTM C494 Type-A shall be used (when required) by the concrete precaster. Product shall be from Sika Corporation, Plastocrete series of materials or other materials approved by NVE.

iii. **Water Reducing Retardant:** ASTM C494 Type-D shall be used (when required) by the concrete precaster. Product shall be from Sika Corp., Plastocrete or Plastocrete series of materials. Pozzolith N Type 82 or other materials approved by NVE

iv. **High-Range Water Reducer:** ASTM C494 Type F, shall be used(when required) by the concrete precaster. Product shall be from Sika Corp., Sikament series of materials or other materials approved by NVE

v. **Superfluidifying High Range Water Reducer:** ASTM C494 Type and ASTM C494 Type F and ASTM C1117, shall be used (when required) by the concrete precaster. Product shall be from Sika Corporation, ViscoCrete series of materials approved by NVE.

vi. **Set Accelerator:** ASTM C494 Type C or E, shall be used (when required) by the concrete precaster. Product shall be from Sika Corporation, Plastocrete 161FL, Sika Set NC or other materials approved by NVE.

vii. **Strength Accelerator:** ASTM C494 Type C or E, shall be used (when required) by the concrete precaster. Product shall be Sika Corporation, Sika Rapid-1, Sikament 200 or other materials approved by NVE.

viii. **Corrosion Inhibitor:** shall be used by concrete precaster. Product shall be Sika Corporation, Ferroguard series of material or other materials approved by NVE.

NOTE: Corrosion inhibitor must have dual protection system (both anodic and cathodic reaction suppression mechanisms) and must have satisfactory history of use in concrete (nondeleterious) of minimum 5 years.

5. Reinforcing steel bars shall be ASTM Grade 60, formed per ASTM A615.
6. No concrete structures shall be installed in NVE system before the minimum of 3,600 psi compressive strength is attained.

5. Weather Conditions

1. **Rain, Sleet or Snow:** Concrete shall only be poured in a protected environment – one that prevents water dilution of the concrete, e.g.: under the canopy or inside a shed or building.
2. **Cold Weather:** If the mean daily temperature falls below 40 degrees F, the minimum temperature of the concrete as placed shall be 50 degrees F.

   NOTE: The use of calcium chloride accelerators shall be strictly forbidden.
3. **Hot Weather:** All placements during hot weather shall be per ACI 305.

   A. The maximum temperature of concrete containing 20% fly ash during placement shall be 85 degrees F. Concrete with temperatures over a 85 degrees F. shall contain a water retarder such as Sika Plastiment, Sika Plastocrete 161 MR or other materials approved by NVE. Concrete with temperatures over 100 degrees F. shall not be poured.

   B. Any cooling (ice) required to control the concrete temperature during hot weather placement shall be at the suppliers expense. The water to cement ratio shall be adjusted to consider the addition of any ice.

   C. Concrete poured during hot weather shall not have the loss of slump, flash set or cold joints.

D. All reinforcing steel, forms, coarse aggregate and fine aggregate exposed to the direct rays of the sun shall be cooled by sprinkling during hot weather concrete placement.

6. Reinforcement

1. Reinforcement shall be placed per ACI 318 and ACI 315.
2. All reinforcing steel shall have a minimum concrete cover of 3", except structures thinner than 6" where all steel must be centered.
3. Splicing of reinforcing steel shall be according to ACI requirements.
4. Welding of reinforcing steel is strictly prohibited.
5. Reinforcing bars shall be supported and wired together to prevent displacement. All tie wires and chairs shall be of non-rusting type.

7. Concrete

1. The concrete shall develop a compressive strength of 3,000 psi (-10%) at 7 days and 4,000 psi (-10%) at 28 days.
2. The concrete shall contain:
   - A. Minimum 665# and maximum of 755# of cement (per cubic yard of concrete) shall be used.
   - B. Minimum of 80% and maximum 82% of cementitious material shall be Type V, Portland cement.
   - C. Minimum 18% and maximum of 20% of all cementitious material will be Type F, fly ash.
   - D. Maximum water/cement ratio shall be of 0.45 by weight.
3. Concrete Workability
   - A. All wet cast concrete shall have a minimum 2" slump unless approved as an exception by the engineer.
   - B. Concrete not containing high range water reducer or superfluidifying agent shall have maximum 4" slump and shall not exceed the maximum slump as indicated in submitted concrete mix design to NVE.
   - C. Concrete containing high range water reducer may be placed up to 8" slump but shall not exceed the maximum slump as indicated in submitted concrete mix design to NVE.
   - D. Concrete containing Superfluidifying admixture (Sika ViscoCrete) shall be judged by the slump cone "flow test". The minimum flow shall be an average of 25" diameter. The maximum flow shall be an average 32" diameter. In no case will there be evidence of paste/aggregate separation during the "flow test" of the concrete.

D. All precast structures to be on/in ground shall contain steel corrosion inhibitor (Sika Ferroguard 901, at a dosage of 2 gallons per cubic yard of concrete mix) or other materials approved by NVE.

E. A copy of the proposed mix design shall be provided to NVE prior to providing products to NVE using the proposed design mix.

8. Placing Concrete

1. Before concrete placement, the formwork shall be completed, excess water removed and the reinforcing steel shall be secured.
2. Concrete placement shall be such that the concrete that is being integrated with fresh concrete is still plastic. No placement shall be started if the previously placed section is no longer plastic.
3. Concrete shall not be subjected to any placement procedure that causes segregation of materials.

4. Concrete shall be consolidated by vibration for 5 to 15 seconds to eliminate air or stone pockets. Mechanical vibrators shall have a minimum frequency of 7,000 revolutions per minute. A vibrator shall not be used to transport concrete within the forms
5. Upon request, the supplier shall provide a batch ticket for all concrete placed. This ticket shall be prepared per ASTM C94 and shall contain the proportions of materials, additives and water added during mixes, etc. When superfluidying admixture is used in the concrete production, vibration may be eliminated but evidence of satisfactory concrete performance will have to be shown. When vibration is suspended in the production of the concrete, it will not be used in the fabrication of the compression test cylinders.

9. Testing

1. A slump test shall be made according to ASTM C143 or a "flow test" shall be performed for each day of concrete production as a minimum. The appropriate test of concrete workability shall be performed on all concrete samples used for fabricating strength test samples.
2. Strength test cylinders shall be prepared per ASTM C31. At least three (3) tests shall be performed for every 50 cubic yards of poured concrete. Cylinders shall be stored and cured the same way as the structure.
3. Strength of concrete will be considered acceptable, if the average of any of three consecutive tests (of the cylinders) reach or exceed the required strength of 3,000 psi (-10%) at 7 days and 4,000psi (-10%) at 28 days. Concrete structures with developed strength less than 4,000 psi (-10%) of the required 28 – day strength will be rejected.
4. If test results fail to meet design requirements, test cores by ASTM C42 may be taken. Costs of coring and testing of the cores will be the responsibility of the manufacturer.
5. If the core specimens fail to meet the minimum 4,000 psi (-10%) of compression strength, the concrete will be considered defective and will be rejected by NVE.
6. If the concrete doesn't attain minimum 3,000 psi (-10%) of required compressive strength within 7 days and structured built from this concrete must be kept in the manufacturer's stock, awaiting NVE decision.
7. If any test indicates that the concrete has reached a compressive strength of 4,000 psi no further testing is required.
8. Rejected structures may not be re-used in NVE distribution system.

10. Quality Control

1. The manufacturer shall develop and submit a QA/QC program satisfactory to NVE. This QA/QC program will be approved in writing by NVE. The manufacturer shall implement the QA/QC program only after receipt of written approval from NVE.
2. The manufacturer shall provide NVE with all QA/QC reports set forth by the manufacturers QA/QC program weekly.
3. The manufacturer shall make available to NVE all batch tickets and comprehensive strength test results. The batch ticket(s) information shall include a list of quantities and structure types manufactured.
4. As a minimum the manufacturers QA/QC program shall document and include the following Items:
   A. Verify compliance with the specifications of all materials used (cement, rebar, aggregate admixtures, etc) including the aggregate supplier.
   B. Provide batch tickets for all concrete per ASTM C94.
   C. Date, time of concrete pour and numbers of cubic yards poured.
   D. Design mix, including any admixtures.
   E. Verification of reinforcing steel placement and cover provided.

F. Results of any slump tests performed.
G. Reference to any strength test cylinders made. Strength test results at 7 and 28 days.
H. Any hot weather or cold weather measures used (e.g., ice, moistening of aggregates, etc.)
I. Verification of vibration of the concrete.
J. Method of curing and length of time of curing.
K. Concrete temperature at pouring.
L. Number of day's concrete is allowed to set before being moved off – site.
M. Placement method of identification on the concrete.
N. A sample format of all QA/QC tests and reports.

11. Shop Drawings and Certificates

1. The manufacturer shall furnish NVE with shop drawings of each structure, showing all dimensions needed for the placement of the reinforcing steel.
2. The manufacturer shall obtain and keep on the site, available to NVE, certificates of compliance for all reinforcing steel and Portland Cement used for precast fabrication.

12. Warranty

1. Each precast company shall design and manufacturer long lasting concrete structures that will be installed into the NVE Underground System. The structure shall have a minimum design life of 50 years.
2. If a material defect within the five-year period necessitates the item's replacement, the supplier shall be responsible for all labor and material costs incurred. These costs shall include but not be limited to the following; de-energize (if applicable), remove electrical apparatus/equipment, remove the defective item, re-excavate, deliver and place the new item, level, grout, backfill, restore site, replace the electrical apparatus/equipment, terminate the cables and energize. NV Energy reserves the right to designate a qualified contractor, to perform the work described above to best meet scheduling requirements.
3. Precast Company shall correct ant concrete structure defect, within 14 days of notification. When notified to repair 10 units or more, the supplier shall be granted 14 days per 10 units of repair time.

   NOTE: NVE reserves the right to require immediate repairs when, in NVE's opinion there is a danger to the public.

13. Repairing or Patching

1. Final decisions about repair or replacement of a damaged concrete structure belongs to NVE
2. All defective structures shall be repaired within the time specified in 12.A.
3. All honey combing or other defective concrete shall be removed to sound concrete (a minimum of 1" deep). Before placement of patching materials, an area at least 6" wide surrounding the area to be patched shall be dampened to prevent absorption of water from the patching material.
4. After the surface water has evaporated from the area to be patched, a bond coat of Type V Portland cement, Type F fly ash and fine mortar sand (1:1:1 ratio) shall be mixed to the consistency of thick cream and then well brushed onto the surface to be repaired.
5. When this bond coat begins to lose the water sheen, the premixed patching material shall be applied. The patching material shall be made of fine concrete aggregate (3/8" max.). Type V Portland cement and Type F fly ash in the same proportions as specified in the Section 5.2. The patched area shall be "struck off" to leave the patch slightly higher than the surrounding surface. The surface finish of the patch shall closely match the surface finish of the existing concrete.

6. Concrete shall be curried by using curing compound(s) (per ASTM), wet burlap bags, cotton absorptive mats or by sprinkling with vapor mist.
7. All repaired concrete structures shall be identified with a metal tag. The tag shall have the month, day and year of repair. The tag shall be permanently attached to the repaired concrete structures.

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