

## Part 536 – Structural Engineering

### UT536.2 Design Criteria for Reinforced Concrete

- C. The design of reinforced concrete structures in Utah shall conform to the attached table *Design Guidance for Reinforced Concrete* based on type of structure and environmental exposure conditions.
- D. The use of Fiber-Reinforced Concrete
  - (1) Any concrete structure designed to store, or that has the potential to store animal waste must have the appropriate steel reinforcement as outlined in ACI 350, or TR-67. This applies to floor slabs even if it is determined that structural loading is minimal or not applicable. The purpose of steel reinforcement is to allow the engineer to design joints to control movement and cracking with the intent of providing a water-tight structure. Manure bunkers and storage tanks (both dry and liquid) fall in this category.
  - (2) The use of fibers in concrete shall not be used to replace required temperature and shrinkage steel.

## Design Guidance for Reinforced Concrete

Draft NEH 636 Ch 30 Terminology	Ag Waste Storage Structures	Environmental Structures	Non-environmental/Other	
NEM Terminology		Service Hydraulic Structures	Other Structures	Other Structures Controlled Environments
Definition	Uncontrolled environments, exposed to liquid waste, waste slurries, or corrosive materials, or structures required to be water tight	Severe Exposure, Uncontrolled environments exposed to flowing water, impounding water, or non-hazardous liquids	Uncontrolled environments exposed to flowing water, impounding water, or non-hazardous liquids	Not exposed to flowing liquids, not impounding liquids, do not serve as secondary containment of hazardous wastes
Applicable Code	ACI 350, Practice Standard 313	ACI 350 as supplemented by TR-67	ACI 350 or ACI 318+TR-67	ACI 318
Additional Criteria	$f_y=60$ ksi, Grade 60 Steel $f'_c=4500$ psi	$f_y=60$ ksi, Grade 60 Steel	$f_y=60$ ksi, Grade 60 Steel	
	$f_s=36$ ksi (unfactored loads)	$f_s=20$ ksi (unfactored loads)	$f_s=36$ ksi (unfactored loads)	
	Load factors ACI 350. Environmental durability factor.	Effective Load factor (environmental durability factor and Load factors, 2.7)	Load factors ACI 318, or ACI 350. If ACI 350 is used the environmental durability factor = 1.0	
	$\rho_{max} = .3 \rho_{bal}^1$	$\rho_{max} = .546 \rho_{bal}^*$	$\rho_{max} = .3 \rho_{bal}^*$	$\rho_{max} = .5 \rho_{bal}^1$
	Strength Design ACI 318 + TR-67	Redistribution of moments in continuous members not allowed	Strength Design ACI 318 + TR-67	
	Working stress design according to ACI 350 Appendix I, with $f_c=.45f'_c$ , with distribution of flexural reinf according to ACI 350.10.6	Two grids of steel required in both faces and in both directions. Exceptions: concrete linings of trapezoidal channels or with SCE's approval on walls with max thickness of 8", Job Class V or less, steel placed in center of wall	Working stress design according to ACI 350 Appendix I, with $f_c=.45f'_c$ , with distribution of flexural reinf according to ACI 350.10.6	
Types of structures that apply	Waste storage tanks and bunkers storing liquids and semi solids that must be water tight and subject to freezing and thawing	Stream diversions and water control structures in constant exposure to water subject to freezing and thawing	Irrigation structures and components used to transport water that are drained in the winter. Components of waste handling systems used to transport liquids to storage facilities cast in place and pre-cast	Pre-cast access boxes, valve boxes, vaults and manholes

\*As listed in NEM 536.20

<sup>1</sup> As listed in Draft NEH Part 636 Chapter 30

Structures for the storage of hazardous chemicals shall be design according to EPA requirements

#### UT536.77 State Standard Detail Drawings

- F. NRCS Utah does not maintain standard detail drawings.

#### UT536.78 Standard Detail Drawings Prepared by Non-NRCS Engineers

- F. NRCS Utah does not maintain standard detail drawings.