



ACI Fellow **Frank Kozeliski, P.E., F.A.C.I.**, is a consultant and materials engineer. He is an expert in ready mix concrete, troubleshooting and promoting concrete as the owner of Gallup Sand & Gravel before selling the company in 2007. He holds a B.S. and M.S. in civil engineering, and is a registered professional engineer in Alabama, Texas, and New Mexico. Mr. Kozeliski has been active in ACI's New Mexico Chapter since its inception. He served as Chair of ACI 211, Proportioning Concrete, and is a member of ACI 229 (Flowable Fill), ACI 305 (Hot Weather Concreting), ACI 308 (Curing), ACI 330 (Concrete Parking Lots), and E801 (Student Activities). He also is a member of several other professional organizations.



## All Mixed Up Unraveling the Concrete Mix Design Report (Submittal)

By  
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### Information in the mix design submittal

1. Information about the concrete mix design
2. 3000 psi mix with recent test reports
3. ACI 214 summary -supporting test data
4. 4000 psi exterior mix with entrained air
5. Computer look at the Mix Design
6. ACI 214 summary on the 4000 psi
7. Screen analysis of fine & coarse aggregate



### Information in the mix design submittal

8. Test report on the aggregate
9. Cement and Fly Ash certificates
10. Certification of concrete plant, mixers scales and admixtures
11. Information on the admixtures and Super
12. Initial curing standards for New Mexico
13. MSDS sheets on concrete & Super



## The Mix Design Submittal

What should it include?

- Client's Name
- Project Name
- Location
- Bid date



## The Mix Design Submittal

- The mix in accordance with ASTM C94 Option A
- ACI 318 Chapter 5
- ACI 301
- ACI 211.5R-01 Guide for Submittal of Concrete

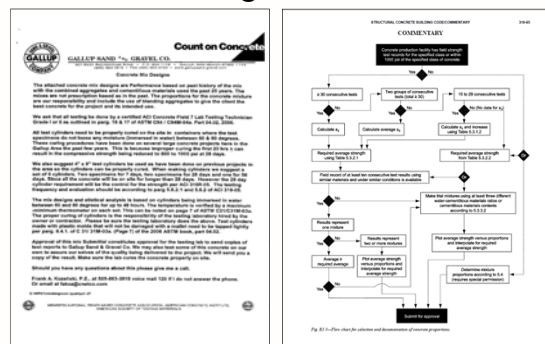


## The Mix Design Submittal

- Indicate the mixes are performance-based and designed for a 4-inch slump.
- If over a 4-inch slump is requested, Super Plasticizer is required to comply.
- This sets the game plan for the mix and establishes a plan for the contractor.



## Mix Design Procedure



## About the Concrete Mix Design

- The attached concrete mix designs are performance-based on past history of the mix with the combined aggregates and cementitious materials used in past years.
- The mixes are not prescription-based as in the past.
- The proportions for the concrete mixture are the responsibility of the producer. Includes the use of blended aggregate to give the client the best concrete for the intended use.



## Mix Design Submittal (Guidelines)

Ask that all testing be done by Certified ACI Concrete Field Testing Technician Grade I, as outlined in Para. 16 & 17 of ASTM C94 / C94M-04 Part 04-02



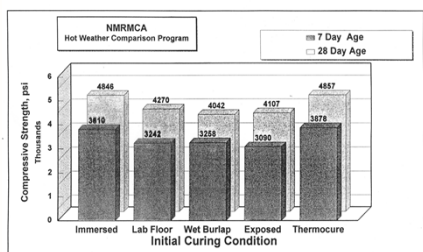
## Proper Curing of the Test Specimens

- ALL test cylinders must be properly cured on site in containers where the test specimens lose no moisture (immersed in water between 60 & 80 degrees).
- Improper curing for the first 20 hours can result in 28-day reduction from 800 psi to 1000 psi.





## Comparison of Immersed vs. Exposed Cylinder Curing



- Curing boxes and curing standards/procedures help eliminate compressive strength problems.
- The box was placed by the producer. Where the box was used, the cement efficiency was over 10 psi per pound of cementitious material with a coefficient of variation of less 8%, showing good quality control.
- On another project, the laboratory did not use the curing box and the efficiency was down to less than 8 and coefficient of variation of about 16%. Many of the test cylinders did not make the 28-day strength, resulting in very poor quality control.

Count on Concrete		Count on Concrete	
<p>PL = 3000 psi min. 50 MPa</p> <p>BATCH WEIGHTS AT THE 900 CONDITIONS WITH THE ABSOLUTE VOLUMES</p> <p>CEMENT, TYPE II, L.A.</p> <p>POZZOLAN (CLASS F)</p> <p>CEMENTITIOUS MATERIAL</p> <p>COARSE AGG. 1" max @ 1.16%</p> <p>COARSE AGG. 1/2" max @ 1.51%</p> <p>COARSE AGG. 3/8" max @ 2.07%</p> <p>FINE AGG. WASHED SSD @ 1.58%</p> <p>WATER 31.8 gallons</p> <p>ENTRAINED AIR 3.0 ± 1.5%</p> <p>POZZOLITH 997 @ 5.55 oz/cwt 33 oz</p> <p>POZZOLITH 300R @ 5.55 oz/cwt 33 oz</p> <p>TOTAL BATCH WEIGHT</p> <p>water cementitious ratio is 0.50 ± 0.02</p> <p>The above batch weights provide a yield of 27.08 cu ft per cubic yard. This is based on the gross unit weight of 140 lb per cubic yard.</p> <p>All test results must be done in accordance with ASTM C-119 to meet the strength requirements. All testing of test specimens must be done in accordance with ASTM C-119 to meet the strength requirements.</p> <p>NOTE: The above mix was designed and proportioned using the combined aggregate gradation, and maximum surface area aggregate. Conditions for maximum volume of the fine and coarse aggregate will be made at the batch plant prior to the batching and mixing operation to provide a 27.08 cu ft minimum, as required by the specifications. The above mix is subject to change in the proportions based on changes in the materials.</p> <p>Should a higher strength be required, the mix can be done with an admixture called High Range Water Reducer. It is added at the rate of 1.5% to 2.0% of the cement. This increases the strength but does not change the water cementitious ratio. The concrete strength test is done in accordance with ASTM C-119 to meet the strength requirements. The above mix is subject to change in the proportions based on changes in the materials.</p> <p>12448 or 140.5 lb is a more efficient concrete may be used in the writer to increase the mix. After month can be added with no change in the mix.</p>		<p>PL = 3000 psi min. 50 MPa</p> <p>BATCH WEIGHTS AT THE 900 CONDITIONS WITH THE ABSOLUTE VOLUMES</p> <p>CEMENT, TYPE II, L.A.</p> <p>POZZOLAN (CLASS F)</p> <p>CEMENTITIOUS MATERIAL</p> <p>COARSE AGG. 1" max @ 1.16%</p> <p>COARSE AGG. 1/2" max @ 1.51%</p> <p>COARSE AGG. 3/8" max @ 2.07%</p> <p>FINE AGG. WASHED SSD @ 1.58%</p> <p>WATER 31.8 gallons</p> <p>ENTRAINED AIR 3.0 ± 1.5%</p> <p>POZZOLITH 997 @ 5.55 oz/cwt 33 oz</p> <p>POZZOLITH 300R @ 5.55 oz/cwt 33 oz</p> <p>TOTAL BATCH WEIGHT</p> <p>water cementitious ratio is 0.50 ± 0.02</p> <p>The above batch weights provide a yield of 27.08 cu ft per cubic yard. This is based on the gross unit weight of 140 lb per cubic yard.</p> <p>All test results must be done in accordance with ASTM C-119 to meet the strength requirements. All testing of test specimens must be done in accordance with ASTM C-119 to meet the strength requirements.</p> <p>NOTE: The above mix was designed and proportioned using the combined aggregate gradation, and maximum surface area aggregate. Conditions for maximum volume of the fine and coarse aggregate will be made at the batch plant prior to the batching and mixing operation to provide a 27.08 cu ft minimum, as required by the specifications. The above mix is subject to change in the proportions based on changes in the materials.</p> <p>Should a higher strength be required, the mix can be done with an admixture called High Range Water Reducer. It is added at the rate of 1.5% to 2.0% of the cement. This increases the strength but does not change the water cementitious ratio. The concrete strength test is done in accordance with ASTM C-119 to meet the strength requirements. The above mix is subject to change in the proportions based on changes in the materials.</p> <p>12448 or 140.5 lb is a more efficient concrete may be used in the writer to increase the mix. After month can be added with no change in the mix.</p>	

## Mix Designs with 4 Aggregates

Cement, Type II, L.A.	444 lb / (3.15 x 62.4) = 2.26 cu ft.
Pozzolan (Class F) 25% of total cem.	150 lb / (2.09 x 62.4) = 1.015 cu ft.
Cementitious Material	595 lb = 6.32 bags
Coarse Agg. 1.0" ssd @ 1.16%	895 lb / (2.65 x 62.4) = 5.41 cu ft.
Coarse Agg. 1/2" ssd @ 1.51%	687 lb / (2.63 x 62.4) = 4.19 cu ft.
Coarse Agg. 3/8" ssd @ 2.07%	507 lb / (2.61 x 62.4) = 3.11 cu ft.
Fine Agg. Washed ssd @ 1.58%	960 lb / (2.64 x 62.4) = 5.83 cu ft.
Water 31.8 gallons	265 lb / (1.0 x 62.4) = 4.25 cu ft.
(Entrained air) 3.0 ± 1.5%	6 oz = (0.03 x 27) = 0.81 cu ft.
Pozzolith 997 @ 5.55 oz/cwt 33 oz	
Pozzolith 300R @ 5.55 oz/cwt 33 oz	
<b>Total Batch Weight</b>	<b>3907 lb/cuyd or 27.08 cu ft.</b>

### Water cementitious ratio is 0.45 = 265/595.

- The mix provided a yield of 27.0 cubic feet per cubic yard. This is based on the plastic unit weight of 144.70 pound per cubic foot with 3% entrained air.
- A theoretical unit weight is 149.18 pcf to verify the entrained air.
- All field testing must be done in accordance with ASTM C-31 to meet the strength requirements.
- All casting of test specimens must be done in accordance with ASTM C-94 paragraph 14.3.



**Note:** The above mix was designed and proportioned using the combined aggregate gradations, and saturated surface dried aggregates.

Corrections for moisture content of the fine and coarse aggregates will be made at the batch plant prior to the batching and mixing operation to provide a 3" ± 1" slump as required by the specification.

We reserve the right to make changes in the proportions based on changes in the material.



Should a higher slump than 4 inches be required (like 8"), this can be done with an admixture called High Range Water Reducer. It can be added at the site.

The High Range Water Reducer increases the slump but does not change the water-cementitious ratio. The concrete resorts back to normal setting in about an hour (see admixture data sheet attached-Rheobuild 1000).

Fiber mesh at 1.5 lb/cuyd can be added to this mix with no changes.

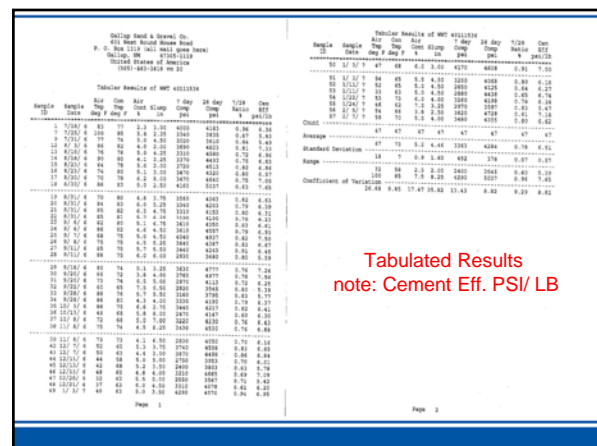
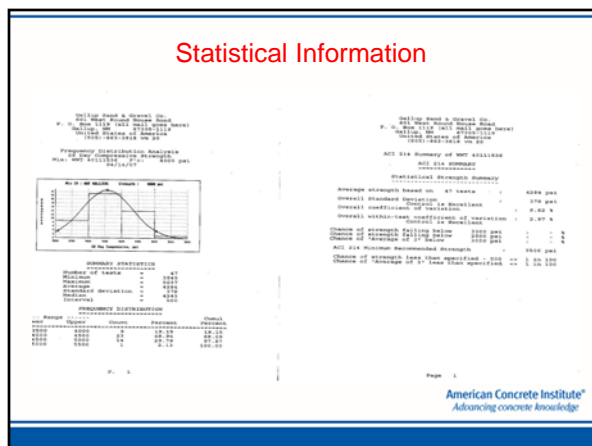
NC 534, a non-chloride admixture, may be used in the winter to increase the set time when used with warm water.



### Test Reports to Back Up the Mix



### Statistical Information



Tabulated Results  
note: Cement Eff. PSI/ LB



## Screen Analysis of Coarse Aggregate (1" Nominal Size) &amp; Passing

Screen Size	1" -0.5" agg.	3/4" -#4 agg.	3/8" x #8	Combination	ASTM C-33
	(use 53%) +	(use 41%) +	(use 6%) =	(100%)	#57 - 1" - #4
1-1/2"	100	100	100	100	100
1"	99.9	100	100	100	95-100
3/4"	73.6	100	100	86.7	----
1/2"	17.9	99.9	100	57.8	25-60
3/8"	2.9	78.1	100	38.7	----
#4	1.0	3.3	86.7	7.3	0-10
#8	0.8	1.0	44.0	3.7	0-5
#200	0.5	0.7	4.5	1.1	0-3
Avg. S.G.	2.65	2.63	2.61	2.65 S.G. @ SSD	
Avg. Abs.%	1.16%	1.51%	2.07%	1.35% Absorption	

Source of Material: Gallup Sand &amp; Gravel Co., Sand Antone Quarry, Thoreau, N.M.

Type of Material: Crushed Limestone

L.A. Wear (% loss) 24.0% (500 rev.) Fractured Faces 100%

Dry Rodded unit Weight of the coarse aggregate 93.5 pcf

Soundness Loss (Magnesium Sulfate) -- 10.0 Sodium 2.5



amec

Aggregate Test for the Submittal

SRAG

Fly Ash and Cement Certification

National Ready Mixed Concrete Association

Plant and Truck Certification

Scale Certification for the Plants

Use of Super Plasticizer and Curing Information



**BASF**  
The Chemical Company

April 10, 2007  
Richard A. Kozeliski, P.E.  
P.O. Box 1174  
Gallup, New Mexico 87301-1174  
Attention: Frank A. Kozeliski, P.E.  
Project Number: 00000000000000000000

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**Admixture Certification**

**Master Builders**

**BASF**  
The Chemical Company

**RHEOBUILD® 1000**  
High-Range Water-Reducing Admixture

**Product Data: RHEOBUILD® 1000**

**Admixture Information – Super Plasticizer**

**Master Builders**

**BASF**  
The Chemical Company

**MB-AE™ 90**  
Air-Entraining Admixture

**Product Data: MB-AE™ 90**

**Admixture Information – Entrained Air**

**Master Builders**

**BASF**  
The Chemical Company

**QUALITY SAND AND GRAVEL, S.G.**  
MATERIAL SAFETY DATA SHEET

**MSDS for the Concrete and Super if Added On Site**

**Master Builders**

Thank You!

Any Questions?

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