Concrete Mix Evaluator
CME

Requires Microsoft Excel or Office 365
with Solver Add-in installed

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Concrete Mix Evaluator (CME)

Overview

CME is an application written in Microsoft Excel Office 365.

Concrete mix design is no longer just a recipe of proportions of cement, sand, stone, and water. Today, the concrete supplier is held responsible for the performance of the in-place concrete. Curling, cracking, dusting, color variation, moisture transmission, and strength are all concerns for the quality of the in-place concrete. Much of what happens is beyond the responsibility or control of the concrete producer. Concrete of good quality can become undesirable in the hands of an inexperienced finisher. Still, poor concrete of inappropriate proportions will doom the final product regardless of the experience of the concrete finisher.

Changes in the American Concrete Institute, specifically ACI 302.1R, now discuss ranges of cementitious material contents, mortar fractions, coarseness/workability indexes, and the total gradation of aggregates as methods of evaluating concrete for potential in-place performance. The Concrete Mix Evaluator (CME) is a tool to help the concrete mix professional move from raw material selection to the final job submittal letter.

CME is an easy-to-use application that utilizes Microsoft Excel and VBA programming. This combination makes it possible to store up to 1500 concrete mixtures with material cost and provide Auto Blending features such as:
- Blend up to five (5) aggregates to fit within upper and lower gradation limits!
- Blend aggregates to a specified Workability / Coarseness Index
- Yield a concrete mix to specified aggregate volume percentages.
- Specify up to four cementitious percentages along with a W/C ratio and solve using water demand or cementitious content.
- Blend using the volume of a primary aggregate.
- Sand to yield functions.

CME contains three graphs:
1. Total gradation of the concrete mix as percent retained and passing
2. ACI 302 Coarseness Factor Chart
3. Power of 45 curve

CME also calculates the concrete density and the following concrete ratios: Water/Cementitious - Mortar and Paste fraction - Air Volume within the cement paste - Sand / Aggregate ratio by volume - w-Adjust factor - Volume of water to Volume of Cementitious - Omega-Index (OIF), and Modified Omega-Index (MOIF).

CME also calculates proportions for laboratory trial batches and exports results to a stand-alone Microsoft Excel Workbook Concrete Mix Evaluator (CME)

<u>Using Excel 2007</u>
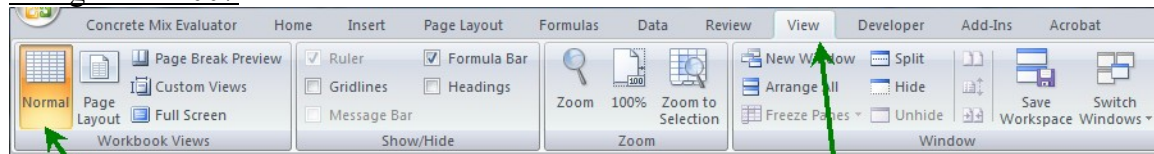
CME is designed to be used under the "Normal" view mode in Excel 2007. Click on the <u>View Tab</u> in Excel 2007 to change the view from page layout to normal view.

Design Methodology

The CME program allows the concrete design professional to approach the proportioning of concrete from many approaches. After you use the program and get comfortable with its operation, you will develop your own flow of operation.

My suggested workflow is as follows:
1. Enter all current material information.
2. Fill out the "Mix Profile"
3. Input your cement Fly Ash, or Slag Cement weights.
4. Input admixture
5. Input your design air content.
6. Input your design water.
7. Now complete the mix design by proportioning the aggregate volume. This is where the capabilities of the CME come into play. You have many options for completing this part of the process.

Method I... Use the "Yield Agg" buttons.

Method II... Use one of the several Auto Blend functions.

Methodology Summary:
Complete the mix design by proportioning the aggregates after the other constituents.

Wal-Smart Inc.	
Floor 002	
Wal-Smart	
FlatWork	Weight
Cementitious Materials	Lbs
Portland Cement Type I	513
F Ash	128
Total Cementitious	642
ACI 1"	
ACI Sand	
ACI 3/8"	
Design Air Content	1.6
Water: 36.0 Gal	300
Totals: + admix water Vol & Wt	942

Menu Bar

The custom menu bar is the first place to start familiarizing yourself with Concrete Mix Evaluator (CME).

Mixture Profile:

Mix Profile is where you define the characteristics of the concrete mixture you are about to proportion. It is where you enter information about the project and job location. CME can store concrete mixtures in a database. Mix Profile is where you distinguish between saved mixture designs. Each concrete mix gets saved in an external Excel file (CME.DATA) that works in conjunction with the CME program. The fields **Project Name, Mix Code ID, and Mix Category** make up the total concrete ID. If you want to save two or more concrete mix designs, you must change something within one of these three Mix Profile fields. If you do not, and try to **Post** the mix to the database, a message will appear to indicate that a duplicate mix is already present in the CME database. The information on the Mix Profile form follows the particular mix design throughout the rest of the program and may appear in the design sheet and submittal letters. An expiration of the Omega-Index and Modified Omega-Index will be covered elsewhere in the manual.

Mix Design

| File | Mix Profile | Mix Design | Materials | Auto Blending | Lab Batch | Graphs | Submittal | ACI 302.1R-04 | About... |
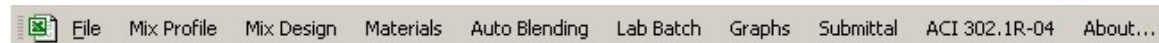
Return to Design Page
Post Mix to Data Base
Retrieve Mix from Data Base
Manage Data Base
Enter Admixtures
Gradation Analysis
Gradation Analysis II
Metric Conversion
Clear Design
Mix Constants
Batch Print

The menu bar is how you navigate around the CME program. If you are in some other part of the program and wish to return to the main Design Sheet, click on *Return to Mix Design.* If you are already on the Design Sheet, the menu item is grayed out, as shown to the left. Under the Mix Design, the menu item is where you save, retrieve, and manage the database, containing concrete mix designs.

- ### Mix Design > Post Mix to Data Base

The CME.xls is the program that you use to design your concrete mixtures; it contains a list of materials for proportioning. Think of it as the interface between you and your concrete mixes. When you elect to save a concrete mixture with a underlined mix profile, you click on **Post Mix to Database**. This record of the concrete mixture gets saved to the file **CME.DATA2**. You, as the user, do not see this file, but it will be in the same folder as your CME.xls. Normally, the CME program is installed under PROGRAMS; see the section on installing CME; you also have the option of installing it under the "Documents" folder.

Remember a unique mix profile contains the following items:
Project Name – Mix Code ID – Mix Category, and not the items in the mix design

<u>**BACKUP**</u> your Data:
To create a backup of all the concrete mixtures you have saved, make a copy of the CME.DATA file and save it in a secure location. That means not on the same computer that you are using or on a CD.

Mix Design > Retrieve Mix from Database

When you click on Retrieve Mix from Database, the Manage Database Listing dialog box will appear. This dialog box lists all the concrete mixtures listed in the CME.DATA file. The standard CME program will accommodate 1000 entries. Each of the column headers can sort the mix entries. You can sort by Date, Category, Project, Mix ID, Client, and Job location. These six items originate from what was entered into the Mix Profile form. The success of your database depends on how you preplan your mixture profile data. If the mix designer wishes to create a mixture category for "FLAT WORK" and then some number of concrete mixtures with different Mix IDs, all the "FLAT WORK" mixes would be grouped together. Consequently, if the concrete mix designer is creating

concrete proportions for a particular PROJECT, the PROJECT Category would list all the mixes (Flatwork, Wall, Footer, etc.) for that project.

The success of the concrete database is in the planning of the MIX PROFILE. Remember, the combination of the Category, Project, and Mix ID differentiates the overall Mix Identification and not the mixture constituents. Make your Category, Project, and Mix ID as short as possible, keeping space to a minimum.

Mix Design > Duplicate records.

Mix Design > Enter Admixtures

The list of available admixtures is located under *Materials* on the main menu. You may select an admixture and assign dosage rates through the main menu selection or by using the control button "Enter Admix," located in the upper right corner of the Coarseness Chart on the design sheet. Selecting one brings up the **Enter Admixture** dialog box.

Enter Admixture for concrete mix design

Wal-Smart Inc.
Floor 001
Wal-Smart

		oz / cwt	oz/ Yard	Check for oz/ cwt	Check for calculate dosage on Total Cementitious	Oz/yard	Cost / cubic Yard	Admixture Volume (Future)
AEA	▼	0	3	☐	☑ Total Cementitious	3.00	$0.09	
HRWR	▼	3	0	☑	☑ Total Cementitious	18.00	$1.69	
Mid Range W/R	▼	3		☑	☐ Total Cementitious	15.00	$0.94	
	▼			☐	☐ Total Cementitious	0.00	$0.00	
	▼			☐	☐ Total Cementitious	0.00	$0.00	
	▼			☐	☐ Total Cementitious	0.00	$0.00	
						Total Cost	$2.72	

Primary Cement only 500 lbs
Total Cementitious 600 lbs

When entering the admixtures, use the drop-down arrows and arrange them from top to bottom. You have a choice of dosing the quantity of liquid admixture by the ounce per cubic yard of concrete (oz/yd), or by ounces per 100 weight of cementitious material (oz/cwt). Also, when dosing admixture by the 100 weight of cement, you may decide to dose on total cementitious or only on the **Primary Cement**, which is the first (top) cement listed on the design sheet.

Example:
- AEA (an air entraining agent) is being dosed at 3oz per cubic yard; the *Total Cementitious* is checked but has no effect as it is overwritten by the oz/yd decision.
- HRWR (High Range Water Reducer) is dosed at 3 oz/cwt and based on total cementitious content. Total cementitious is listed at the top, like 600 lbs. so the dosage would be calculated as: (600/100 * 3 = 18 ounces of admixture)
- Mid-Range W/R is dosed at 3 oz per cubic yard, but *the Total Cementitious Box* is NOT checked. The admixture dose is calculated on the first (PRIMARY) cement only, and is calculated thusly: (500/100 * 3 = 15 ounces of admixture)

Admixture	Oz/yard	oz / cwt
AEA	3.00	0.60
HRWR	18.00	3.00
Mid Range W/R	15.00	3.00
Admixture Cost/ Volume	$2.72	Enter Admix

Always refer back and review the Mix Design Sheet to confirm how you are dosing your admixtures.

Materials > Admixtures

		Admixture Data Sheet				Enter Admix
Material	Cost / Gallon	Vendor / Source	Specifications	S.G.	Adjust for water in admixture	water content - Lbs per gallon
Water Reducer	$5.00	AdMix Co. #1	ASTM C494	1.020	☑ Water adj.	7.000
HRWR	$12.00	AdMix Co. #2	ASTM C494	1.030	☐ Water adj.	

Admixture cost is per gallon (128 ounces). If you check the "Water adj" box, CME will adjust the mix water and w/c ratio for the water content (in pounds/gallon) contained in the admixture. Ask your admixture supplier to supply the water content of the product as "pounds of water per gallon."

Design Air Content	1.8	
Water: 36.0 Gal	300	
No Water Adj	▼	
Total:	3936	
Plastic Density - Cu.Ft.	145.79	
Water/Cementitious Ratio	0.500	

Design Air Content	1.8	
Water: 36.0 Gal	300	
Water in Admix	▼	
Totals: + admix water Vol & Wt	3938	
Plastic Density - Cu.Ft.	145.69	
Water + AdmixWater / CM Ratio	0.503	

Mix Design > Clear Mix Design

.This menu choice erases or clears up all entries on the Design Sheet, CME.xls. It does not change any saved mix designs in the CME.Data2 file.

Mix Design > Set up Mix Constants

CME allows you to change some of the basic constants. For example, when you use the auto blend or yield functions, you can change the target volume from the standard 27.0 cubic feet to, say, 27.2. Some companies intentionally design their concrete to over-yield.

Concrete Evaluator Mix Constants		
	Preset Values:	Continue
Target Volume (Cubic Ft):	27	27.0
		Exit
Density of Water (Lbs/Cubic Ft):	62.4	62.4
		Use Caution when changing Mix preset values!
Weight of a Gallon of Water (lbs):	8.33	8.33
No. of pounds in a Ton:	2000	2000
		Re-Set Values
Cost of a Gallon of Water ($):	0	0.00

Water Cost ($)

Also, if you want to include the cost of water, this is where you would make that decision.

If you feel that your mix is not calculating properly, reset the original values by clicking on the Re-Set Values button. The user should be EXTREMELY cautious when changing these numbers.

Metric Conversion

This feature of CME will convert a concrete mix design in lbs./ft^3 to kg/m^3. It is a one-way conversion. The CME does not take a kg/m^3 mix design and convert to lbs./ft^3.

Materials

First things first, all proportioning of concrete mixtures start with materials. Under this menu item, you define the materials you are using to design your concrete. This section is rather straightforward, but here are a few comments.

This *active* material data is stored as part of the CME.xls file Workbook. It's called *active* because it's what you use when putting together your concrete mix design, and when you use the material drop-downs on the Design Sheet, you are accessing this material data. When you ***post a mix to the database, all the material information for that mix is*** saved to the CME.DATA file. When you select ***Retrieve Mix from the Database***, the material information gets pulled out of the CME.DATA file and posted to the bottom of each individual material sheet (see figure). The material information at the bottom of the material sheet, in the darker yellow, changes whenever you retrieve a new mix from the database.

Materials >Aggregate Material Data

If you consider the aggregate to be SAND, you must check the BOX. Otherwise, some of the calculations, such as the Sand / Aggregate ratio, will be incorrect.

Cementitious Data

Material	S.G.	Cost / Ton	Vendor / Source	Specification
Portland Cement Type I	3.15	$80.00	Portland	ASTM C 150
GGBFS	2.90	$60.00	Alabama	ASTM 989
F Ash	2.36	$25.00	South Electric	ASTM 618
C Ash	2.65	$31.00	Clark Electric	ASTM 618

Active Data:

Material Data retrieved from saved mix design in the data base

20 last cement				
Portland Cement Type I	3	80	Portland	ASTM C 150
F Ash	2	25	South Electric	ASTM 618

Materials >Aggregate Sieve Data

									Intermediate		Fines					
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
				Inch							Percent Passing					
Sieve Set up	3.0"	2.5"	2.0"	1.5"	1.0"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200	FM
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	FM
ACI 1"	100.00	100.00	100.00	100.00	98.00	80.00	28.00	8.00	2.00	1.30	0.90	0.00	0.00	0.00	0.00	7.08
ACI Sand	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.10	87.40	71.10	47.00	12.80	1.20	0.00	2.81
ACI 3/8"	100.00	100.00	100.00	100.00	100.00	100.00	100.00	88.00	16.00	3.00	13.00	0.00	0.00	0.00	0.00	5.80
Coarse Agg Exp	100.00	100.00	100.00	100.00	95.00	90.00	60.00	30.00	7.00	4.00	3.00	2.00	1.00	0.00	0.00	6.63
Fine Agg Exp	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.00	92.00	75.00	40.00	25.00	10.00	1.50	2.60
Intermediate Agg Exp.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	85.00	60.00	15.00	10.00	8.00	7.00	6.00	0.00	5.09

Sieve data is entered by Percent Passing. If you are entering a #57 stone and you have no stone retained on the 2-inch sieve, you must enter 100, under the 2.0 inch, because all the material has passed that sieve. The common mistake is to enter zero (0), which means that none of the materials can pass that sieve. The standard sieves are already entered into the program. If you want to modify the sieve NAMES, you can do that by clicking on *Sieve set up*, green arrow. Please note that sieves in columns #6 and #7 are considered intermediate sieve sizes. Calculations involving sieve sizes, such as Paste Fraction, Mortar Fraction, Workability, Coarseness, w-adjust, and FM, are all calculated using standard sieve sizes. **Warning:** If you change your sieve size name, be aware of how the calculations mentioned above get interpreted.

Materials > Fiber / Color

Dry powder color and fiber information are entered here. If you want to account for the VOLUME of the Fiber or color, check the volume of Mass calculation box.
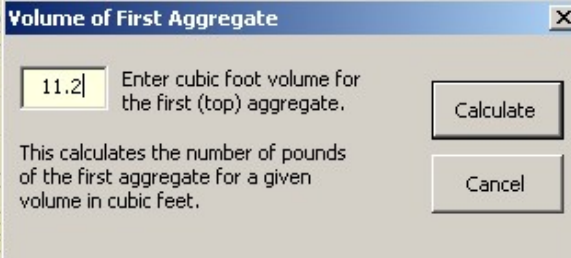
Auto Blending

This menu item is a gateway to the real power of the Concrete Mix Evaluator (CME). The ability to blend aggregates to solve for a predetermined gradation, workability–coarseness factor, sand-to-aggregate ratio, or water cementitious ratios as a function of total water demand or cement factor opens up a new approach to designing your concrete mix proportions. CME uses the Excel Solver Functions as an optimization tool. To learn more about SOLVER, visit www.solver.com.

Auto Blending > Volume of First Aggregate

In some cases, when proportioning a concrete mixture, it is useful to set the volume of one of the aggregates to a known value, as in the case of some State DOTs that require a set volume of stone. For example, if working with only two aggregates (always list the primary stone as the top or first aggregate in the design sheet), let the required volume of stone in a mix be set to 11.2 cubic feet. Click on <u>Auto Blending > Volume of First</u>

aggregate, enter 11.2 in the dialog box, and click *Calculate*. The CME program will calculate the number of pounds of stone to equal 11.2 cubic feet. The next step would be to yield the mix to 27 cubic feet. Click on the ***Yield Agg2*** button to obtain the sand to yield the mix.

Auto Blending > Workability - Harshness Chart

If you are unfamiliar with the use of the Workability or Harshness (Coarseness) factor method for designing concrete, refer to ACI 302.1R.

The CME program allows you to input your target values for the "Workability / Harshness," and the program will auto-blend the aggregates to within 1% or 5% of the target values. Note that the success of the auto blend is limited by your aggregate sizes. You cannot increase the harshness if you do not have any upper-size stones.

HINT: If you have an existing mix and want to increase the overall harshness (coarseness), using this feature is a good way to adjust your design.
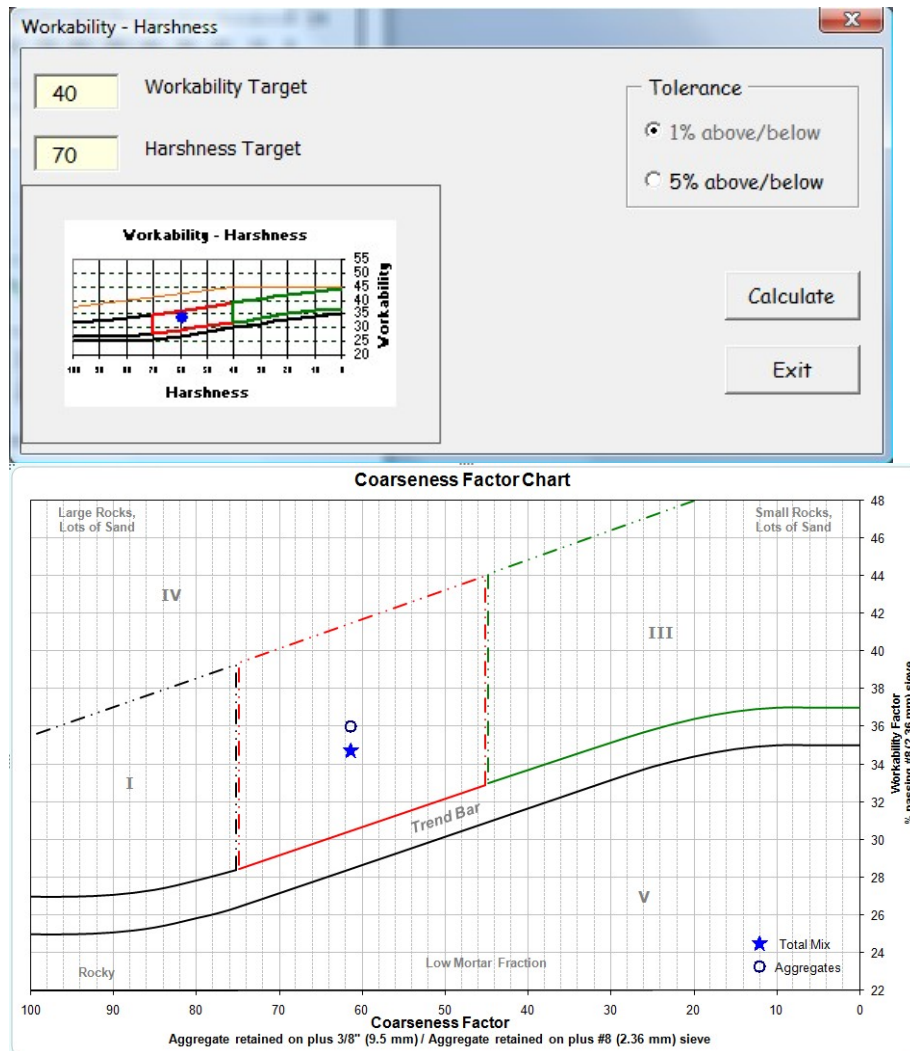
Auto Blending > Gradation

When you use Auto-Blend, the CME will blend up to five aggregates listed in the main design sheet; this is a very powerful tool. Some concrete pump companies have suggested grading curves to improve the performance of the concrete going through the pump. As shown below, you can create your grading curve. The CME requires that you list the aggregates from top to bottom. For example, if you have three aggregates, list them as shown, with no blank rows.
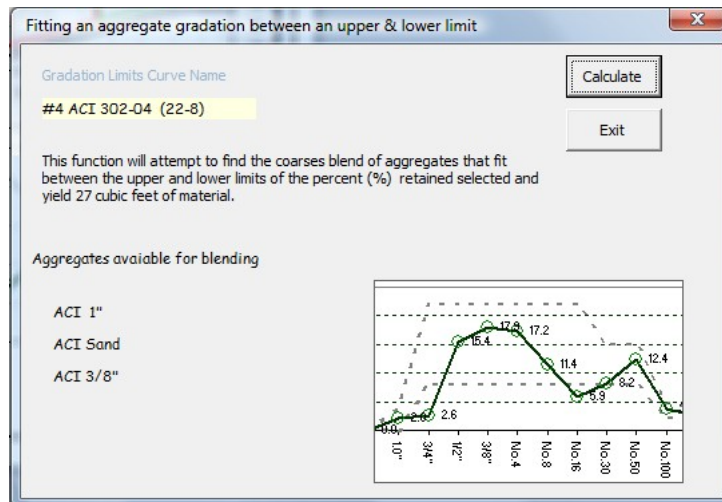
Auto Blending > Aggregate Blending Limits

You can create up to four custom blending limits; this can be for concrete flat work, pump mix, lightweight, etc.

	3.0"	2.5"	2.0"	1.5"	1.0"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200	Pan
JH-Holand	0	0	0	0	4	22	22	22	22	22	22	15	15	5	4	3
	0	0	5	0	0	8	8	8	8	8	8	8	8	2	2	0
# 2 SCC.1 Concrete	0	0	0	0	0	2	13	18	28	20	14	13	13	7	6	4
	0	0	0	0	0	0	0	10	24	12	6	5	5	3	3	0
Test Curve	0	0	0	18	18	18	20	20	20	18	18	16	16	14	14	14
	6	0	0	0	0	0	4	4	4	4	4	2	2	2	1	0
#4 ACI 302-04 (22-8)	0	0	0	3	4	22	22	22	22	22	22	16	16	5	5	4
	0	0	0	0	0	8	8	8	8	8	8	8	8	2	1	0
Your curve here	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No limits set

On a day that you are getting compliments for your concrete and how it is finishing, record the total gradation and save it for a future design; it makes a great place to start.

It can be difficult to meet many required grading specifications; do not be surprised to see this message.

No Solution was found, check aggregate selection.
A combination of the chosen aggregates may not give a solution.
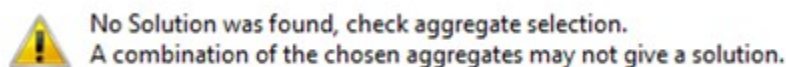
Auto Blending > Density & Sand to Aggregate Ratio

This auto-blending feature allows you to blend aggregates to a specific SAND / TOTAL AGGREGATE ratio. This ratio is calculated from the volume of the sand divided by the total aggregate volume. For a concrete slab on the ground, it is typical to have a Sand / Agg ratio of around 0.42. The difference between using the "Sand/Aggregate Ratio" and the "Harshness (Coarseness) factor" is that the Harshness calculation uses the total combined gradation (sieve analysis) to adjust the mix.

If you're designing low-density concrete using lightweight aggregate, you can set your upper and lower target limits for the plastic unit weight. For example, if your design density is 118 lbs./ft^3 set your limits to 119 to 117; see below:

Note: If you are designing normal-weight concrete, keep the upper and lower limits set very far apart, for example, upper design weight. 300 lbs. / ft^3

Lower Design Wt. 10 lbs. / ft ^{3}

Auto Blending > Water / Cementitious

The CME program does not determine how much cementitious product is required to develop a strength target. You, as the concrete mix designer, are required to understand the relationship between the water demand of concrete materials and the amount of cementitious product required to produce the desired strength performance.

If you are given a specified **W**ater / **C**ementitious ratio (W/Cm), this auto-blending feature may be helpful. Input the specified W/Cm in the dialog box; note that a decimal is required, in this example: 0.468.

"*Known quantity*": You can input a known quantity of cementitious products or a known quantity of water (with optional admixture) to achieve the design slump.

Next, enter the cementitious combination. In this example, 80% Type I and 20% F Ash are used. Note that the percentages are entered as decimals.

Auto Blending > Blend Aggregates by % Volume

Many times, you will want to complete the mix with a pre-selected percentage breakdown of the aggregate combinations. This auto-blend function allows you to select the percentage volume of each aggregate. One example of using this function is when creating concrete performance curves of varying cementitious contents while maintaining a constant aggregate blend.

Blend Aggregates by % Volume

Enter each pecent volume of aggregate

ACI 1"   .44   Example: enter 30% as .30

ACI Sand   .42

ACI 3/8"   0.14   [Calculate]

[Exit]

In the example above, the ACI 1" aggregate is blended to 44% of the aggregate volume, sand is 42%, and the ACI 3/8" mid-size stone is 14%. See below.

Use the auto blend functions to *blend and yield* the concrete volume.

FlatWork		Weight	Abs. Vol.	% Vol.
Cementitious Materials		Lbs	Cu.Ft.	
Portland Cement Type I	▼	513	2.61	80.0
F Ash	▼	128	0.87	20.0
	▼			
	▼			
Total Cementitious		642	3.48	
ACI 1"	▼	1321	8.05	44.0%
ACI Sand	▼	1246	7.68	42.0%
ACI 3/8"	▼	425	2.56	14.0%
	▼		% Aggregate	
	▼		Volume	

Materials > Aggregate Sieve Data-->Sieve Set up.

Comment on entering sieve data:

Sieve Set up	3.0"	2.5"	2.0"	1.5"	1.0"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200	FM
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	FM
ACI 1"	100.00	100.00	100.00	100.00	98.00	80.00	28.00	8.00	2.00	1.30	0.90	0.00	0.00	0.00	0.00	7.08
ACI Sand	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.10	87.40	71.10	47.00	12.80	1.20	0.00	2.81
ACI 3/8"	100.00	100.00	100.00	100.00	100.00	100.00	100.00	88.00	16.00	14.00	13.00	8.00	0.00	0.00	0.00	5.61
Lightweight Agg																0.00
5																0.00

Sieve data is entered in percent passing. If you're entering a coarse aggregate with a maximum size of 1 $^{1/2"}$, the sieves above that are considered 100% passing. A complete nest of sieve data in percent passing is required. If you are missing a particular sieve size, use your judgment for that value. You cannot enter a zero nor have a blank in the series.

The FM calculation only uses the sieve sizes shown in the gray background above, but blank cells cannot be in the series.

Sieve Setup:

Custom sieves or metric sieve labels can be used. Please note that if you change the sieve designations be aware that the workability and coarseness numbers are calculated by their position in the sieve series.

Select Sieve Selection

Inch	Coarse Aggregate								Intermediate		Fines				
Inch	3.0"	2.5"	2.0"	1.5"	1.0"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
Metric-1	75mm	63mm	50mm	37.5mm	25.0mm	19mm	12.5mm	9.5mm	4.75mm	2.36mm	1.18mm	600µm	300µm	150µm	75µm
Custom	#15	#14	#13	#12	#11	#10	#9	#8	#7	#6	#5	#4	#3	#2	#1

ASTM E11 Nominal dimensions Standard Mesh opening

	Coarse Aggregate								Intermediate		Fines				
Inch	75.00	63.00	50.00	37.50	25.00	19.00	12.50	9.50	4.75	2.36	1.18	0.60	0.30	0.15	0.08
Metric-1	75.00	63.00	50.00	37.50	25.00	19.00	12.50	9.50	4.75	2.36	1.18	0.60	0.30	0.15	0.08
Custom															

Definition of Workability and Harshness index

Workability index Volume

3.0"	2.5"	2.0"	1.5"	1.0"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
										Total Fines Volume (includes pan)				
Total Aggregate Volume														

Harshness index Volume

3.0"	2.5"	2.0"	1.5"	1.0"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
Coarse Aggregate Volume														
Coarse + Intermediate Aggregate Volume														

Lab Batch

CME and creating lab batch sheets.

Input the lab batch size and the total moisture on the aggregates. The moisture corrected lab batch proportions are listed in green.

When the plastic density of the lab concrete is entered, the CME calculates the Lab Yield, Relative Yield, Calculated Air, Total trim water in pounds per cubic yard, and lab w/cm ratio.

Lab Batch Water Adjustments

When producing lab concrete, it is often necessary to adjust the slump by adding water. Guidance is given at the top of the lab batch sheet for the influence of adding or withholding water to the lab batch. For example, if the lab batch is 1.0 cubic feet, a 1-pound addition of water is equal to 3.24 gallons of water per yard. If the lab batch is 1.5 cubic feet, a 1.0-pound water addition is the same as adding 2.16 gallons of water per yard. The *rule of thumb* of one gallon of water per yard will move the slump by 1 inch, which is calculated for the lab batch size. In this example of 1.5 cubic feet, 0.463 pounds (or 210.3mL) is equivalent to 1 gallon per yard. In order to minimize the influence of lab batching measurements, always make the largest practical lab batch.

1 pound of water =	2.16 gal/yd		Lab Date...	10/10/2005
210.3 mL~	1 gal / cubic Yd		Lab Series...	A
0.463 Lb~	1 gal / cubic Yd		Lab Mix #...	Mix 1b
			Lab Batch Size (Ft³)...	1.5

CME will calculate the "Relative Yield" for the water adjustment and new water-cementitious ratio. By clicking on the "*Recalc Yield for Water Addition*" button, the aggregate weights will be adjusted for the new volume of water by adjusting the aggregate's SSD weights, keeping the original volume percentages of the aggregates.

| 1 pound of water =	2.16 gal/yd		Lab Date...	9/25/2010
210.3 mL~	1 gal / cubic Yd		Lab Series...	A
0.463 Lb~	1 gal / cubic Yd		Lab Mix #...	Mix 1b
			Lab Batch Size (Ft³)...	1.5

Joe Engineer				Design Strength (f'c)	3500 psi					Enter Admix
Wal-So-Smart				Target Strength (f'cr)	4000 psi	Admixture:	oz / cwt	Oz/yard	Batch (ml)	
GreatMix-01				Design Slump Rang	4-6" in"	Water Reducer	5.00	32.05	52.66	
Truck				Design Air Range	5	-				

Cementitious Materials	Source	Lbs			Batch wts	Lab Batch				
Portland Cement Type I	Portland	513			513	28.50	-			
F Ash	SEFA Winyah	128			128	7.11	-			

							Plastic Properties	Batch Start Time:	11:00 AM	
							Testing Stage:	(I)	(II)	(III)
Aggregates:		641	Total Moist	Abs.	641	35.61	Sample Time:	11:15 AM	11:30 AM	11:45 AM
ACI 1"	Farm Hills Quarry	1321	1.00%	1.00%	1321	73.39	Lab Water(+/-)Lb	1.00		
ACI Sand	Butler Rock Quarry	1231	0.45%	0.50%	1230	68.34	Slump:	5.00		
ACI 3/8"	Bed Rock Quarry	425	0.50%	0.45%	425	23.62	Plastic Air (%)	1.5		
							Plastic Density:	146.00		
							Concrete Temp:	75		
							Ambient Temp:	70		
Design Water + Water in admixtures		302	Adj water	-0.4	300	16.69	I Time of Set (Hrs)			
Water in Admixture, lb/yd					1.753	0.10	F Time of Set (hrs)			
Total Weight + Weight of admixture water		3919			3919	217.74	Lab Yield	1.498		
Design Volume includes admixture water volume		27.00					Relative Yield	0.9988		
Design Density		145.16					Yield (cu ft/yard)	26.97		
Design Air (%)		1.50					Calculated Air (%)	0.93		
(Design Water + Admix Water)/Cement		0.471					Total Trim Water lbs/ yd³	18.0		
							Actual W/C ratio	0.499		

Recalc Yield for Water Addition   Clear Adjustment for Water Addition

Adjusted Batch Wts			Stage I Adjusted for
Only aggregates and water are adjusted for Relative Yield		SSD Design Wts	New Water RY= 0.999
Aggregates:			
ACI 1"		1321	1300
ACI Sand		1231	1211
ACI 3/8"		425	418
-		-	-
-		-	-
Adjusted Water:			
Design Water		302	320
Water / Cementitious Ratio		0.471	0.499