KU MIX 3.4 BETA 1
QUICK START GUIDE

ABOUT KU MIX

KU MIX is a concrete mix design program based in Microsoft Excel that includes aggregate optimization. Optimization is performed on the basis of aggregate volume and may, therefore, be used for concretes containing lightweight aggregates as well as normalweight aggregates.

KU MIX VERSION

Version 3.4 Beta 1
Released May 24, 2011

COMMENTS /SUGGESTIONS

Please send comments, suggestions, or report any problems to kumix@ku.edu.

USING THIS GUIDE

This guide provides instructions to help you set up KU MIX 3.4 BETA 1 and is divided into three sections:

1. Before You Begin
2. Using KU MIX 3.4 BETA 1
3. Input Material Details

TABLE OF CONTENTS

PART 1: BEFORE YOU BEGIN

1.1 Materials Required

Gather the following materials before you prepare to run KU MIX.

1. The KU MIX 3.4 BETA 1 Excel file.
2. Computer with Microsoft Excel 2000 or newer
   If you are using **Excel 2000 or 2003,** use KU Mix 3.4 Beta 1 (Excel 2003); for **Excel 2007** or **Excel 2010,** make sure to use KU Mix 3.4 Beta 1 (Excel 2007).xlsm or KU Mix 3.4 Beta 1 (Excel 2010).xlsm correspondingly.
3. You will need your Microsoft Office CD to install the Solver Add-In if prompted in Section 1.2, Step 1.

1.2 Setting Up Your Computer

Before opening KU MIX for the first time, perform the following series of operations through the Excel menu items:

1. Install Solver Add-in.

For Excel 2000 or 2003:

Go to: Tools → Add-Ins… → Select "Solver Add-In" if not already selected.

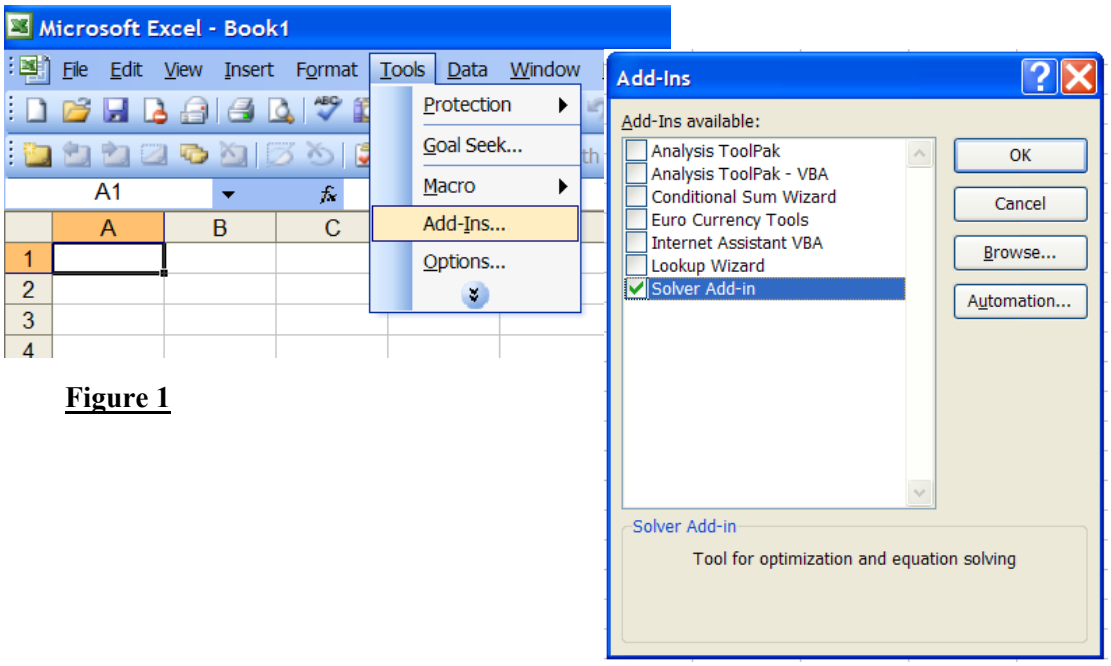


Figure 1

For Excel 2010:

a. Click the **Microsoft Office Button** , and then click **Excel Options**.
b. Click **Add-Ins**, and then in the **Manage** box, select **Excel Add-ins**.
c. Click **Go**.
d. In the **Add-Ins available** box, select the **Solver Add-in** check box, and click **OK**. **Tip:** If **Solver Add-in** is not listed in the **Add-Ins available** box, click **Browse** to locate the add-in. If you get prompted that the Solver Add-in is not currently in stalled on your computer, click **Yes** to install it.
e. After you load the Solver Add-in, the **Solver** command is available in the **Analysis** group on the **Data** tab.

For Excel 2010:

a. Click the **File** menu and choose **Options**.
b. Now in the **Excel Options** dialogue box, click **Add-Ins** from the left sidebar.
c. In the **Manage** drop-down box, select **Solver Add-in**, and then click **Go**.
d. In the **Add-Ins available** box, select the **Solver Add-in** check box, and click **OK**.
e. After you load the Solver Add-in, the **Solver** command is available in the **Analysis** group on the **Data** tab.

2. Security Setting for VBA

For Excel 2000 or 2003:

Go to: Tools → Macro → Security… → Select Medium (or lower)

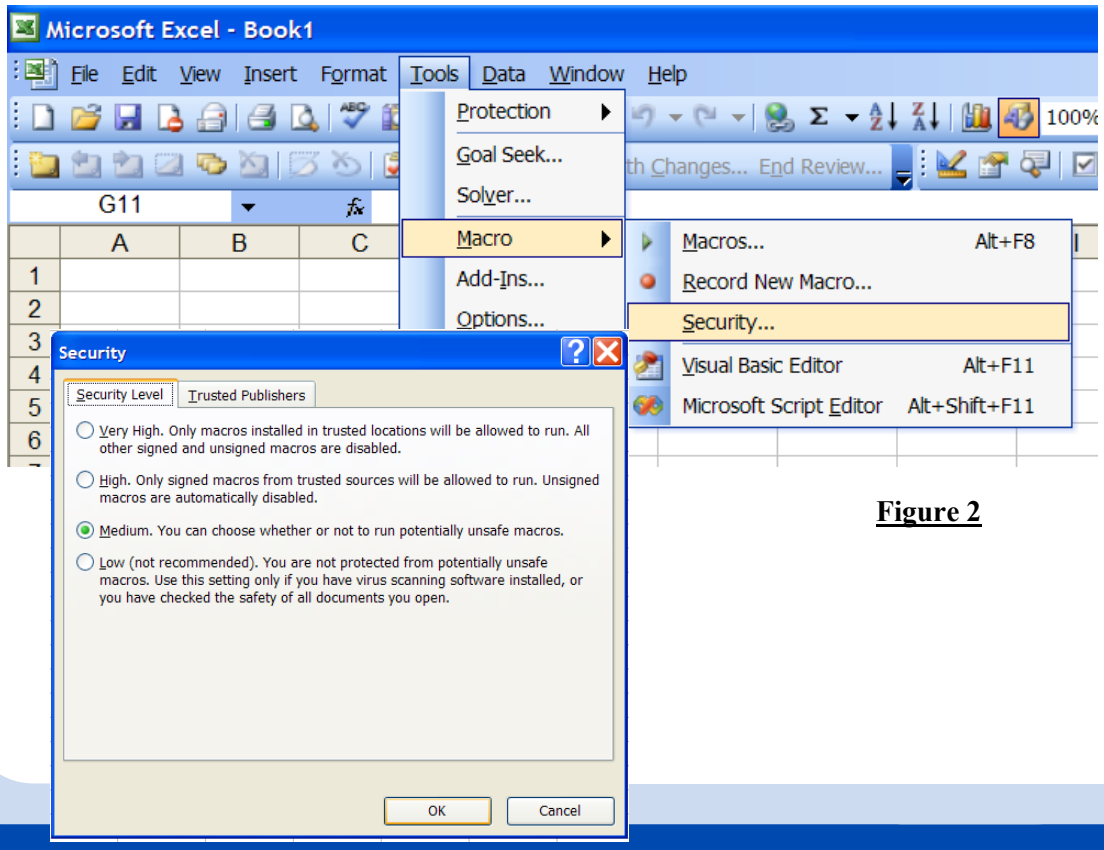


Figure 2

Then, go to: Tools → Macro → Security… → Select the Trusted Publishers Tab
Check the "Trust access to Visual Basic Project" checkbox and press Okay to finish setting up your computer.

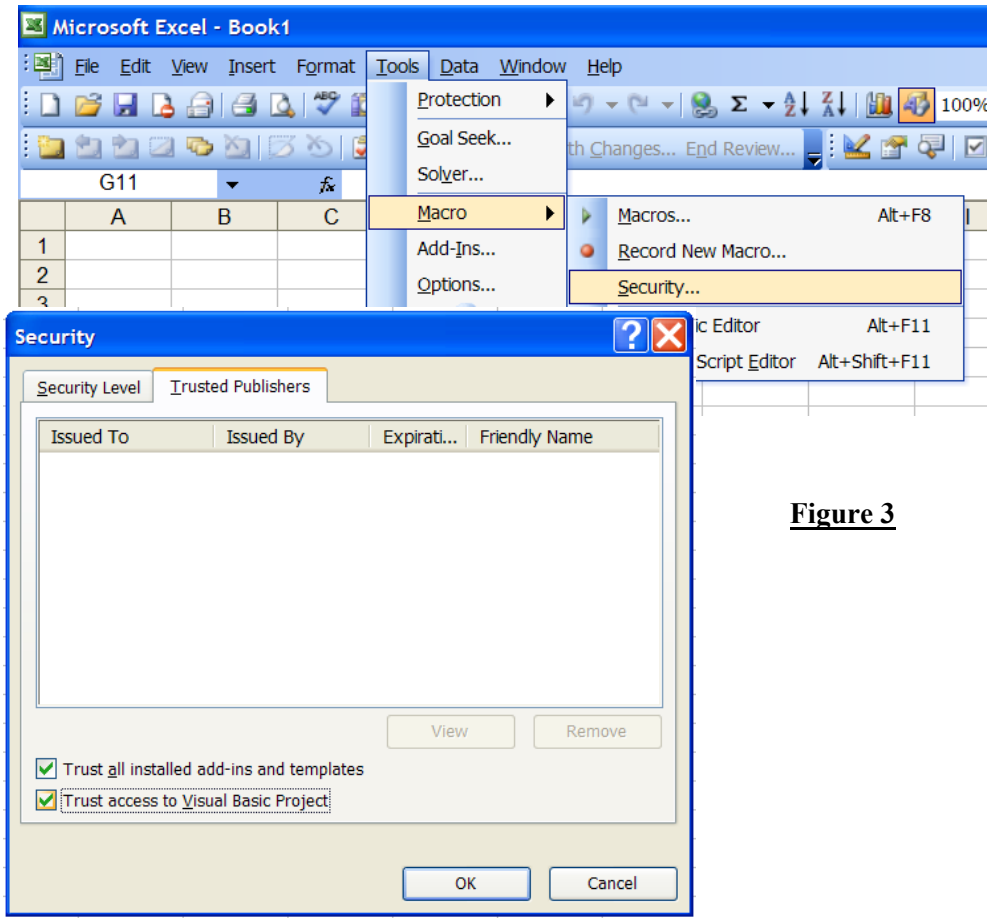


Figure 3

For Excel 2007 or 2010:

1. Click the **Microsoft Office Button** , and then click **Excel Options for** Excel 2007; click the **File** button, then click **Options** for Excel 2010.
2. Click **Trust Center,** and then click **Trust Center Settings.**
3. Select **Macro Settings,** and then select **Disable all macros with notification.**
4. Mark the **Trust access to the VBA project object model** box.
5. Click **OK** and **OK**.

Security Warning: Every time the program is opened, click **Options…** and then click **Enable this content** (this appears at the top of the screen below the **Home** tab and above the formula bar). The program will not run until this operation has been completed.

PART 2: USING KU MIX

2.1 Startup and Settings

To begin using KU MIX:

1. Open KU MIX 3.4 BETA 1 (Excel 2003) .xls in Microsoft **Excel 2000** or **2003**, open KU MIX 3.4 BETA 1 (Excel 2007).xlsm or KU MIX 3.4 BETA 1 (Excel 2010).xlsm if you are using **Excel 2007 or 2010**.

2. If prompted, choose Enable Macros (In **Excel 2007 and 2010**, select **Enable this content** under **Options** if you receive a **Security Warning**).

2.2 General Navigation

KU MIX 3.4 BETA 1 has four main sections that may be accessed using the buttons found on each page.

Home	Functions as both a final report for the concrete mix design and a navigation site.
Input Materials	Materials to be used for concrete mix design and mixture optimization may be input and stored.
Design Mix	Concrete mix design properties are identified and mix design optimization is accomplished.
View Gradation Details	View additional details regarding the aggregate gradation and optimization.

2.3 Process to Design an Optimized Mix

The optimization process consists of six steps. All steps can be accomplished easily by navigating from the **Home** page.

- Use Section A of this guide, "Quick Reference Navigation," for a general description of the optimization process and for future reference.
- Use Section B of this guide, "Detailed Instructions," for a more in-depth explanation of the optimization process.

A. Quick Reference Navigation

Input Materials	Enter the materials information which may be used in the concrete mix optimization (aggregates, cementitious materials, admixtures).
Design Mix	Select the materials and mix properties for optimization.
Optimize Mix Design	Optimize the concrete mix using the selected materials.
View Mix Design	View the completed concrete mix design (Home).
View Gradation Details	Review the optimized combined gradation details (recommended).
Save Mix Design	Save the completed mix design as a new Excel Workbook (optional).

B. Detailed Instructions

Step 1 of 5: Input Material Information

Click **Input Materials** from the Home Page

Figure 4

Step 1 of 5: Input Material Information (continued)
From this point, four basic materials may be entered: *Cementitious Materials, Aggregates, Air Entraining Agents,* and *Other Admixtures.* Materials entered during this process will be available during the mix design process described in Step 2.

A detailed description of each column header can be found on pages 15—16.

To begin, Click **Cementitious Materials** and enter the material information.

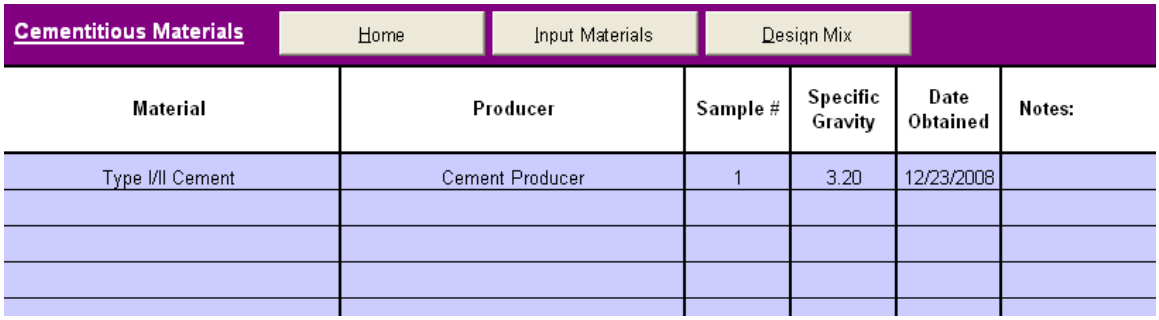


Figure 5

Click **Input Materials** to continue entering materials and their properties for **Aggregates**, **Air Entraining Agents**, and **Other Admixtures**.

Click **Design Mix** to continue after all material information has been entered.

Step 2 of 5: Design Concrete Mix
A complete concrete mix can be designed using the following four steps.

1. Begin with Part 1: "Select the Cementitious Materials, Water-Cementitious Material Ratio, and Design Air Content"

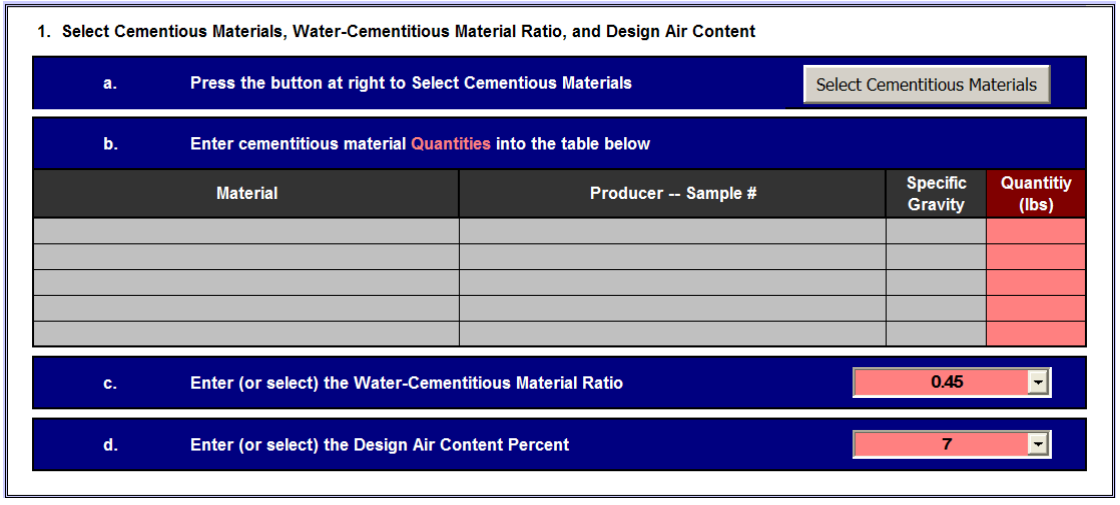


Figure 6

Step 2 of 5: Design Concrete Mix (continued)

a. Click the **Select Cementitious Materials** button to choose which of these cementitious materials will be used in the current mix design.

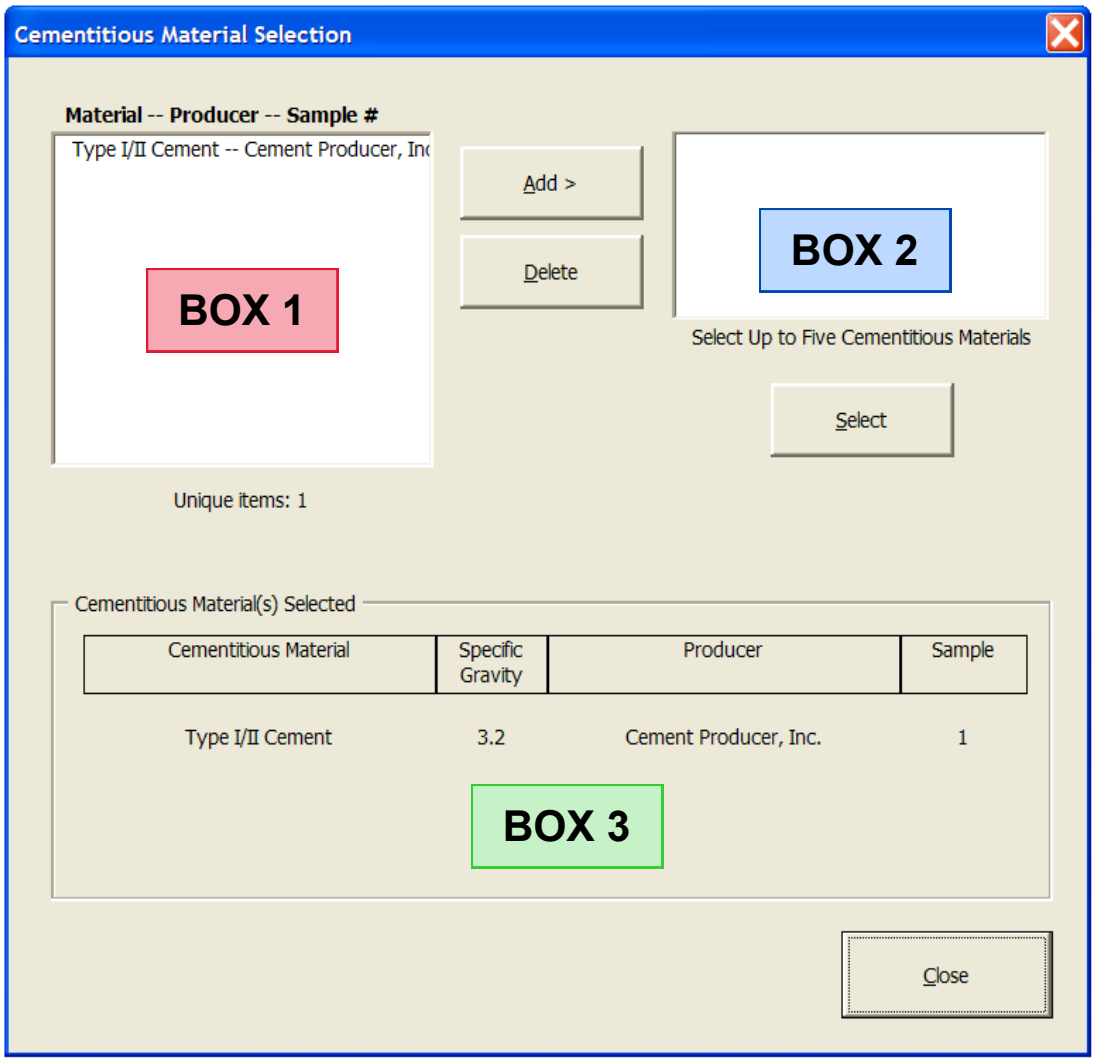


Figure 7

Selecting cementitious materials involves three steps:

i. Materials entered during *Step 1* may be added to the current mix design by selecting the desired material in **BOX 1** and clicking the **Add >** button. Materials selected from **BOX 1** will appear in **BOX 2** and can be removed by clicking the **Delete** button.

ii. After all desired materials have been added to **BOX 2**, click the **Select** button to complete the process. Materials selected for use will appear in **BOX 3**.

iii. To finish and save your selections, click **Close**.

Step 2 of 5: Design Concrete Mix (continued)

b. Enter the quantities (in lb/yd^3) for the materials selected in Step 2a (shown in Figure 6).

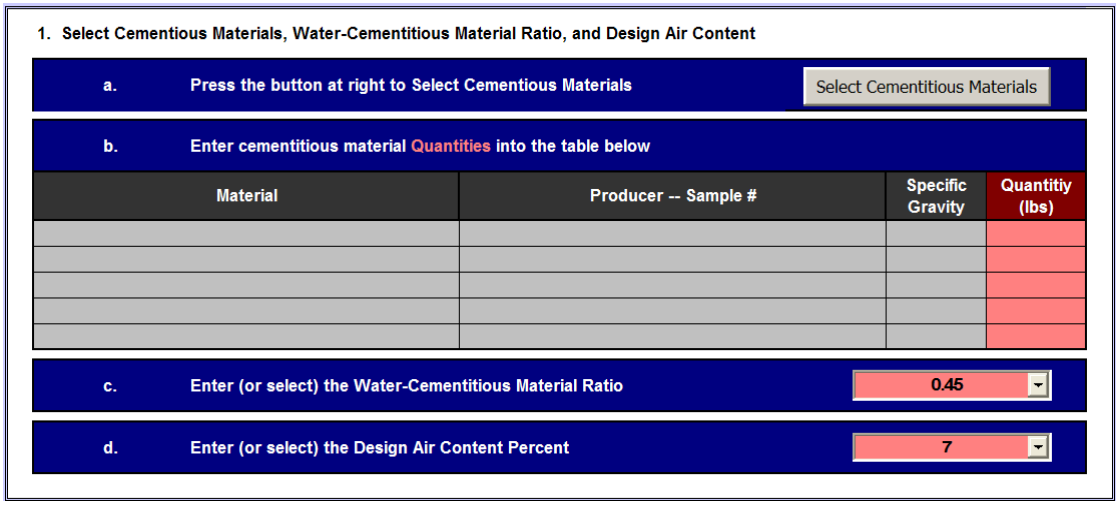


Figure 6 (repeated)

c. Enter (or select) the Water-Cementitious Material Ratio

d. Enter (or select) the Design Air Content Percent

2. Go to: "Select Aggregates and Gradation Constraints"

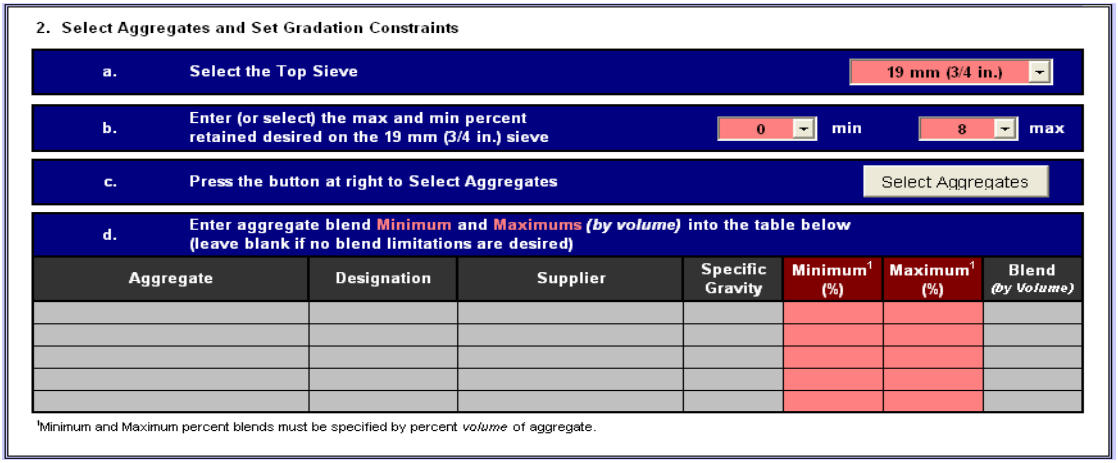


Figure 8

a. From the pull-down list, select the *Top Sieve* size that will retain aggregates from the combined gradation.

b. Enter (or select) the desired maximum and minimum percentage retained on the *Top Sieve*.

The actual percentage retained on the *Top Sieve* will automatically be adjusted to obtain an optimum combined gradation. This range represents a target that may or may not be satisfied depending on the aggregates selected and any blend limitations (Part d.).

Step 2 of 5: Design Concrete Mix (continued)

c. Click **Select Aggregates** to select aggregates for use in the current mix design. The process for selecting aggregates is identical to the process outlined on Page 7 for selecting cementitious materials. If desired, the **View Aggregates** tab shows the individual aggregate gradations. Click **View Gradation** to display the chart.

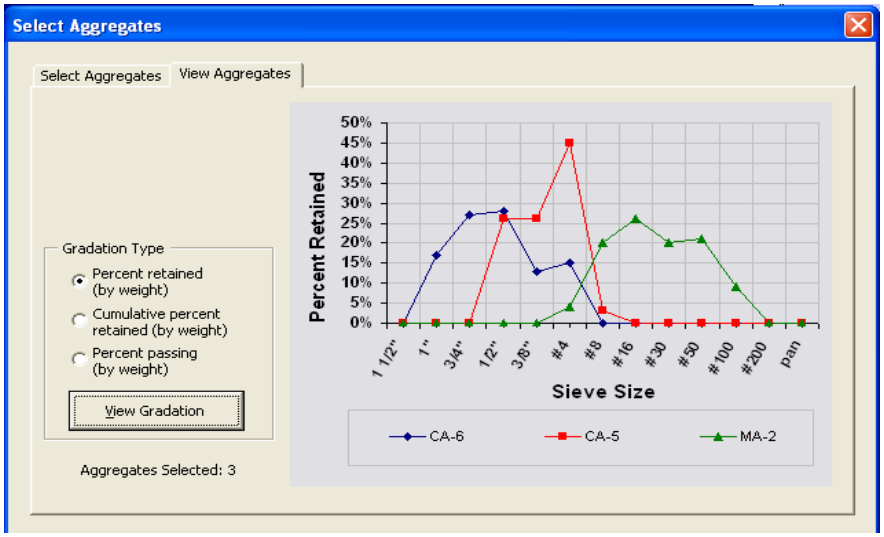


Figure 9

d. If desired, input minimum and maximum restrictions (as a percentage of total aggregate volume) on the aggregate blend. These limitations will be enforced during the optimization process and may adversely effect the combined gradation.

3. Go to: "Select Chemical Admixtures"

3. Select Chemical Admixtures

a. Press the button at right to select an Air Entraining Agent (AEA) — Select AEA

b. Enter the Air Entraining Agent Quantity (US fl oz) into the table below

Air Entraining Agent	Producer	Dosage Rate (US fl oz)* min	Dosage Rate (US fl oz)* max	Percent Solids	Specific Gravity	Quantity (US fl oz)
Air Entraining Agent	Air R Us	1	9	30.0%	1.01	0

c. Press the button at right to select additional Chemical Admixtures — Select Admixtures

d. Enter Chemical Admixture Quantities (US fl oz) into the table below

Chemical Admixtures	Producer	Dosage Rate (US fl oz)* min	Dosage Rate (US fl oz)* max	Percent Solids	Specific Gravity	Quantity (US fl oz)
Superplasticizer	Admixtures R Us	24	72	30.0%	1.20	60

*Manufacturer's recommended dosage rate per cubic yard

Figure 10

Step 2 of 5: Design Concrete Mix (continued)

a. Click **Select AEA** to select an air entraining agent for use in the current mix design. The process for selecting an air entraining agent is identical to the process outlined on Page 7 for selecting cementitious materials.
b. Enter the air entraining agent quantity (US fl oz/yd^3) into the table.
c. Click **Select Admixtures** to select additional chemical admixtures.
d. Enter the quantities (US fl oz/yd^3) for any additional chemical admixtures into the table.

4. Go To: "Complete and View Concrete Mix Design"
   a. Click **Optimize Mix Design**

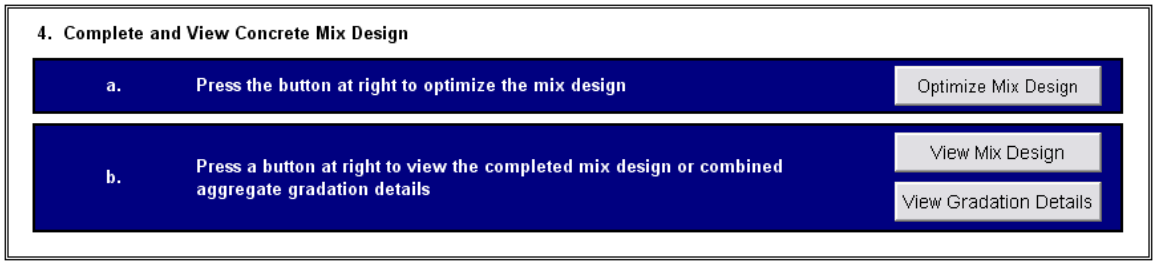


Figure 11

b. Click **View Mix Design** to see the completed mix design. An example of a completed mix design is shown on Page 14.

Step 3 of 5: Evaluate Optimized Mix Gradation Details (Optional)

Click **View Gradation Details** to view additional gradation details.

1. Select minimum and maximum combined gradation limits for comparison purposes only. This step will not change the combined gradation.

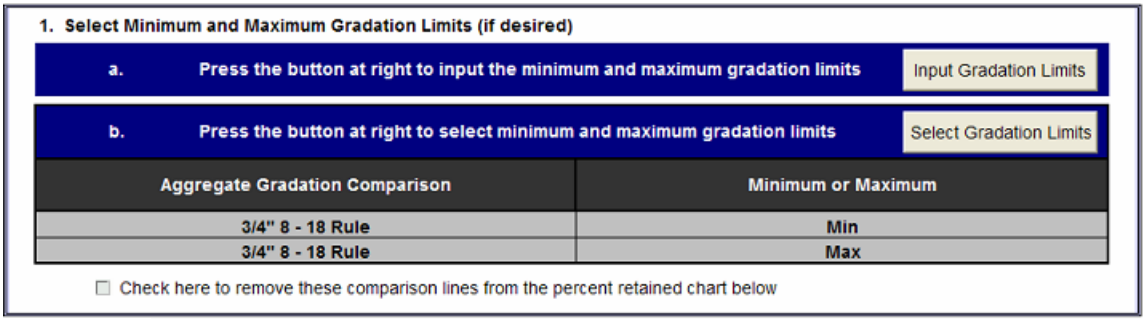
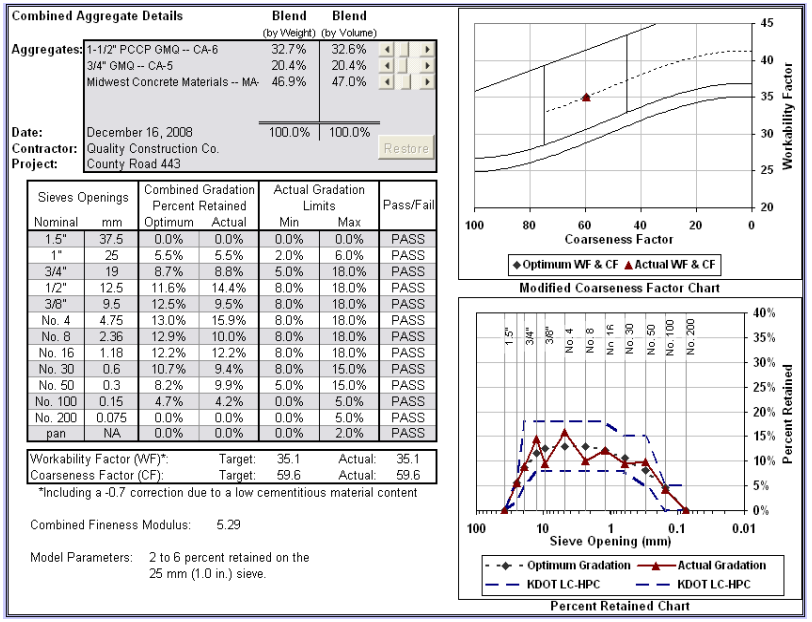


Figure 12

a. Click **Input Gradation Limits** to enter specific minimum and maximum limits for the percent retained on each sieve.
b. Click **Select Gradation Limits**. These limits are for comparison purposes only. These optional limits may be toggled on or off using the checkbox located below part b.

2. If desired, manually adjust the aggregate blend using the scroll bars to change the percentages of each aggregate in the mix design. The aggregate blend *must* total 100%.
   Note: KU Mix will automatically adjust the mixture proportions and combined aggregate details based on any changes to the aggregate blend.

   a. Click **Restore** to return to the original optimized aggregate blend.



Combined Aggregate Details

		Blend (by Weight)	Blend (by Volume)
Aggregates:	1-1/2" PCCP GMQ -- CA-6	32.7%	32.6%
	3/4" GMQ -- CA-5	20.4%	20.4%
	Midwest Concrete Materials -- MA-	46.9%	47.0%
		100.0%	100.0%
Date:	December 16, 2008		
Contractor:	Quality Construction Co.		
Project:	County Road 443		

Restore

Sieves Openings Nominal	mm	Combined Gradation Percent Retained Optimum	Actual	Actual Gradation Limits Min	Max	Pass/Fail
1.5"	37.5	0.0%	0.0%	0.0%	0.0%	PASS
1"	25	5.5%	5.5%	2.0%	6.0%	PASS
3/4"	19	8.7%	8.8%	5.0%	18.0%	PASS
1/2"	12.5	11.6%	14.4%	8.0%	18.0%	PASS
3/8"	9.5	12.5%	9.5%	8.0%	18.0%	PASS
No. 4	4.75	13.0%	15.9%	8.0%	18.0%	PASS
No. 8	2.36	12.9%	10.0%	8.0%	18.0%	PASS
No. 16	1.18	12.2%	12.2%	8.0%	18.0%	PASS
No. 30	0.6	10.7%	9.4%	8.0%	15.0%	PASS
No. 50	0.3	8.2%	9.9%	5.0%	15.0%	PASS
No. 100	0.15	4.7%	4.2%	0.0%	5.0%	PASS
No. 200	0.075	0.0%	0.0%	0.0%	5.0%	PASS
pan	NA	0.0%	0.0%	0.0%	2.0%	PASS

Workability Factor (WF)*:	Target:	35.1	Actual:	35.1
Coarseness Factor (CF):	Target:	59.6	Actual:	59.6

*Including a -0.7 correction due to a low cementitious material content

Combined Fineness Modulus: 5.29

Model Parameters: 2 to 6 percent retained on the 25 mm (1.0 in.) sieve.

Individual Aggregate Details

		Blend (by Weight)	Blend (by Volume)
Aggregates:	1-1/2" PCCP GMQ -- CA-6	32.7%	32.6%
	3/4" GMQ -- CA-5	20.4%	20.4%
	Midwest Concrete Materials -- MA-2	46.9%	47.0%
Date:	April 24, 2009		
Contractor:	Quality Construction Co.		
Project:	County Road 443		

Sieves Openings Nominal	mm	Percent Retained *(by weight)* on Each Sieve Aggregate Designation CA-6	CA-5	MA-2
1.5"	37.5	0.0%	0.0%	0.0%
1"	25	17.0%	0.0%	0.0%
3/4"	19	27.0%	0.0%	0.0%
1/2"	12.5	28.0%	26.0%	0.0%
3/8"	9.5	13.0%	26.0%	0.0%
No. 4	4.75	15.0%	45.0%	4.0%
No. 8	2.36	0.0%	3.0%	20.0%
No. 16	1.18	0.0%	0.0%	26.0%
No. 30	0.6	0.0%	0.0%	20.0%
No. 50	0.3	0.0%	0.0%	21.0%
No. 100	0.15	0.0%	0.0%	9.0%
No. 200	0.075	0.0%	0.0%	0.0%
pan	NA	0.0%	0.0%	0.0%
SUM		100.0%	100.0%	100.0%

Specific Gravity:	2.64	2.64	2.63
Fineness Modulus:	7.29	6.49	3.39

Figure 13

Note: When the values entered for Percent Retained do not sum to 100% for an individual aggregate, KU Mix normalizes the values for that aggregate to 100% during the optimization process.

Step 4 of 5: Update the Report Header and Footer Information
On the Home Page:

a. Click **Change Header/Footer**

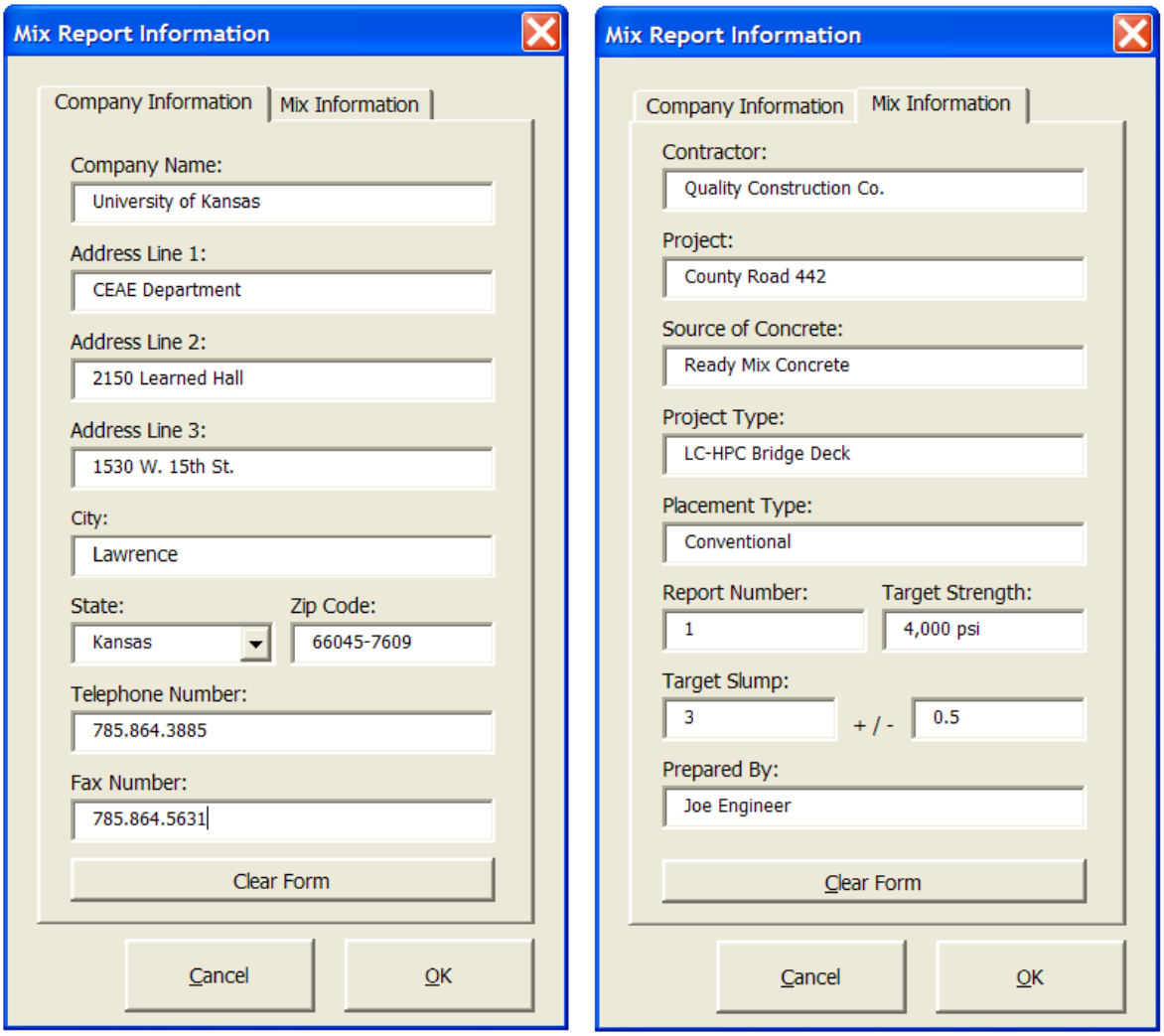


Figure 14

b. Update information as necessary and click **OK** to update the mix design report, or click **Cancel** to return to the home page without making any changes.

Step 5 of 5: Save the Optimized Mix Design Report and Gradation Details (Optional)
Click **Save Mix Design** to save the report as a new Microsoft Excel Workbook.

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CONCRETE MIX DESIGN REPORT #1
Compressive Strength: 4,000 psi

Contractor: Quality Construction Co.
Project: County Road 443
Source of Concrete: Ready Mix Concrete
Project Type: LC-HPC Bridge Deck
Placement Type: Conventional

Material / Source or Designation / Blend[1]	Quantity (SSD)	S.G.	Yield, ft^3
Type I/II Cement / Cement Producer / 100%	535 lb	3.20	2.68
Water	224 lb	1.00	3.59
1-1/2" PCCP GMQ / CA-6 / 32.69%	998 lb	2.64	6.06
3/4" GMQ / CA-5 / 20.41%	623 lb	2.64	3.78
Midwest Concrete Materials / MA-2 / 46.9%	1432 lb	2.63	8.72
Total Air, percent	8%		2.16
Air Entraining Agent / Air R Us	4 fl oz (US)	1.01	0.00
Superplasticizer / Admixtures R Us	10 fl oz (US)	1.20	0.01
			27.00

*The blend percentage indicated (by weight) is listed separately for cementitious materials and aggregates.

Total Water Content (including water in admixtures), lb		225		
Water / Cementitious Material Ratio:		0.42		
Concrete Unit Weight, pcf		141.2		
Target Slump, in.		3 ± 0.5		
Paste Content, percent		23.26%		
Workability Factor (WF)	Target:	35.1	Actual:	35.1
Coarseness Factor (CF)	Target:	59.6	Actual:	59.6
Prepared On:		12/19/08 1:44 PM		

Prepared By:

Diane S Reynolds

Figure 15: Example of completed concrete mix design

PART 3: INPUT MATERIAL DETAILS

Part 3 includes descriptions of all the data entered and stored in the material input pages (accessed using the **Input Materials** button). Not all of the information entered is required to complete an optimized mix design but may be entered for future reference if desired. *Asterisks indicate information that is required to complete the mix design.

3.1 Cementitious Materials

Material*	Enter the material name.
Producer	Enter the cementitious material producer name.
Sample #	Enter the sample number or batch number of the product.
Specific Gravity*	Enter the specific gravity as provided by the producer.
Date Obtained	Enter the date the cementitious material was obtained.
Notes	Enter any additional information regarding the cementitious material.

3.2 Aggregates

Name*	Enter a descriptive name for the aggregate. The name may include material type, quarry, source location, date or other information helpful for identification.
Designation	Enter a designation for the aggregate. Designations may be used by the source quarry for identification and ordering purposes.
Specific Gravity*	Enter the specific gravity (saturated surface dry) of the aggregate. Current test data is necessary for accurate mix optimization.
Percent Retained*	Enter the percent retained on each sieve
% Absorption	Enter the percent absorption for the aggregate.
Supplier	Enter the supplier or quarry name for the purpose of additional identification.
Notes	Enter any additional information regarding the aggregate.

3.3 Air Entraining Agents

Name*	Enter the product name.
Percent Solids*	Enter the percent solids by weight as provided by the producer.
Specific Gravity*	Enter the product specific gravity as provided by the producer.
Recommend Dosages	Enter the minimum and maximum recommended dosages (in US fl oz AEA per 100 pounds of cementitious materials).
Producer	Enter the AEA producer name.
Sample #	Enter the sample number or batch number of the product.
Date Obtained	Enter the date the AEA was obtained.
Notes	Enter any additional information regarding the AEA.

3.4 Other Admixtures

Name*	Enter the product name.
Percent Solids*	Enter the percent solids by weight as provided by the producer.
Specific Gravity*	Enter the product specific gravity as provided by the producer.
Recommend Dosages	Enter the minimum and maximum recommended dosages (in US fl oz of admixture per 100 pounds of cementitious materials).
Producer	Enter the admixture producer name.
Sample #	Enter the sample number or batch number of the product.
Date Obtained	Enter the date the admixture was obtained.
Notes	Enter any additional information regarding the admixture.

PART 4: TROUBLESHOOT

For Microsoft Excel 2000 and newer:

4.1 "Compile Error: Can't find project or library"

1. Click **OK** in the error box.

   Make sure that you are in the window for **Microsoft Visual Basic**.
2. Click the ***Reset*** button on the toolbar (or go to Run → Reset).
3. Go to: Tools → References

   Uncheck any box that is marked as "MISSING".
4. Click **OK**.
5. Close **Microsoft Visual Basic** application.
6. **Save** KU Mix.