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
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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

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Updated 5/24/11
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 installed 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)
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.

![Security Settings](image.png)

**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:


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

- **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.

found on each page.
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 B of this guide, “Detailed Instructions,” for a more in-depth explanation of the optimization process.

A. Quick Reference Navigation

Enter the materials information which may be used in the concrete mix optimization (aggregates, cementitious materials, admixtures).

Select the materials and mix properties for optimization.

Optimize the concrete mix using the selected materials.

View the completed concrete mix design (Home).

Review the optimized combined gradation details (recommended).

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](image)
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.

<table>
<thead>
<tr>
<th>Material</th>
<th>Producer</th>
<th>Sample #</th>
<th>Specific Gravity</th>
<th>Date Obtained</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type VII Cement</td>
<td>Cement Producer</td>
<td>1</td>
<td>3.20</td>
<td>12/23/2006</td>
<td></td>
</tr>
</tbody>
</table>

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.

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**.

**Figure 7**

![Cementitious Material Selection diagram](image)

PART 2: USING KU MIX
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).

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”

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.).
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.

![Image of Select Aggregates window](image)

**Figure 9**

- 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 affect the combined gradation.

3. Go to: “Select Chemical Admixtures”

<table>
<thead>
<tr>
<th>3. Select Chemical Admixtures</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Press the button at right to select an Air Entaining Agent (AEA)</td>
</tr>
<tr>
<td>b. Enter the Air Entaining Agent Quantity (US fl oz) into the table below</td>
</tr>
<tr>
<td>Air Entaining Agent</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Air Entaining Agent</td>
</tr>
<tr>
<td>c. Press the button at right to select additional Chemical Admixtures</td>
</tr>
<tr>
<td>d. Enter Chemical Admixture Quantities (US fl oz) into the table below</td>
</tr>
<tr>
<td>Chemical Admixture</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Superplasticizer</td>
</tr>
</tbody>
</table>

*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

- Press the button at right to optimize the mix design
- Press a button at right to view the completed mix design or combined aggregate gradation details

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.

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.
Step 3 of 5: Evaluate Optimized Mix Design Details (continued)

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.

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**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**

![Image of Mix Report Information dialog boxes](image)

**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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**Part 2: Using KU Mix**
**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

<table>
<thead>
<tr>
<th>Material / Source or Designation / Blend</th>
<th>Quantity (SSD)</th>
<th>S.G.</th>
<th>Yield, ft³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types III Cement / Cement Producer / 100%</td>
<td>536 lb</td>
<td>3.20</td>
<td>2.68</td>
</tr>
<tr>
<td>Water</td>
<td>224 lb</td>
<td>1.00</td>
<td>3.59</td>
</tr>
<tr>
<td>1-1/2&quot; PCCP GMO / CA-5 / 32.69%</td>
<td>938 lb</td>
<td>2.64</td>
<td>6.06</td>
</tr>
<tr>
<td>3/4&quot; GMO / CA-5 / 20.41%</td>
<td>523 lb</td>
<td>2.64</td>
<td>3.78</td>
</tr>
<tr>
<td>Midwest Concrete Materials / MA-2 / 46.9%</td>
<td>1432 lb</td>
<td>2.63</td>
<td>8.72</td>
</tr>
<tr>
<td>Total Air, percent</td>
<td>8%</td>
<td></td>
<td>2.16</td>
</tr>
<tr>
<td>Air Entraining Agent / Air R Us</td>
<td>4 fl oz (US)</td>
<td>1.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Superplasticizer / Admixtures R Us</td>
<td>13.1 fl oz (US)</td>
<td>1.20</td>
<td>0.01</td>
</tr>
</tbody>
</table>

*The blend percentage indicated (by weight) is listed separately for cementitious materials and aggregates.*  
Total Water Content (including water in admixtures), lb: 225  
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

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

### 3.4 Other Admixtures

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