
RUSSTECHNICAL NOTES

OPTIMIZATION OF CONCRETE MIX DESIGNS

DESCRIPTION:

Concrete mix design optimization is the process of adequate workability and other desired properties at the lowest possible cost given the selected ingredients. Optimization of concrete mix designs can shift market shares, increase profits, and improve competitiveness. Technical and economic optimization of concrete is a four step process. The purpose of this document is to outline each of these steps.

FOUR-STEP PROCESS:

1. **Ingredient selection**
2. **Optimize the Aggregate System**
3. **Optimize the Cementitious Paste**
4. **Optimize the Paste Content**

INGREDIENT SELECTION:

It is of prime importance when selecting individual ingredients that they not only meet ASTM specifications, but when combined into a concrete mix design increase the durability and reduce defects. It is not unusual to see a concrete specification that allows a wide range of ingredients.

AGGREGATE SYSTEM:

The aggregate system is optimized by minimizing the void space between particle sizes. The smaller the voids the less cementitious paste will be required. This will greatly increase density and compressive strength. **RUSSTECH** has a software package which will optimize particle packing of concrete aggregate. The software calculates the optimum combination of up to four aggregates.

The software will identify the optimum aggregate combination that requires the minimum amount of cement.

CEMENTITIOUS PASTE:

Optimization of the cementitious paste composition involves:

- An adjustment of the water-cementitious ratio
- Analysis of the affect of mineral admixtures
- Analysis of the affect of chemical admixtures
- Resulting in the determination of paste composition which achieves *the highest psi/pound of cement.*

PASTE CONTENT:

The fourth and final step in the mix design optimization process is the determination of the optimal paste content to be incorporated in the concrete. This can be determined by performing a few small laboratory trial mixes to find the minimum paste content required to manufacture workable concrete meeting slump, slump loss, setting time, and finishability requirements.



RussTech Inc.

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