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PRODUCTION OF CONCRETE

The present invention relates to the production of concrete.

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Presently, ready-mixed concrete is produced using the so-called wet-mix and dry-mix methods.

10 In the wet-mix method, the required weights of all raw materials, namely cementitious material (such as cement, flyash, and silica fume), coarse aggregate, fine aggregate, chemical additives, and water are weighed and added to a forced-action mixer and are wet mixed together by the mixer to produce concrete. After mixing, the ready-
15 mixed concrete is discharged into a drum of a mixer truck and is delivered by the truck to a site where concrete is required.

In the dry-mix method, the required weights of
20 the raw materials, as described above, are discharged directly into a drum of a mixer truck. The drum is then rotated to mix the raw materials, and the mixer truck is dispatched to a site where concrete is required.

25 Currently the major part of the area of batching plants for carrying out the wet-mix and dry-mix methods is taken up for the storage of the aggregates. This is a inefficient use of land especially in urban built-up areas where land cost is high and large areas are not easily
30 available.

The current practice of the construction industry is to reject ready-mixed concrete that is not used within a specified time period, typically two hours, after being
35 produced.

The specified time period is a very short period

of time in many situations and in such situations is a significant problem for both suppliers and users of ready-mixed concrete.

5 The common practice of the construction industry is for construction contractors to place an order for ready-mixed concrete while inspectors are making an inspection of the site of a proposed concrete pour. If the concrete supplied to order is not used within the specified
10 time period, the concrete cannot be used. If the failure to use the concrete within the specified time period is not due to the concrete supplier, the construction contractor is required to pay for the concrete and therefore suffers an economic loss. This applies even in situations where
15 the specified time period is exceeded due to unforeseen delays such as on-site adjustments of a pour site that are required by the inspectors. In addition, whilst the concrete supplier is paid for supplying the concrete, invariably the concrete supplier is left with the task (and
20 expense) of disposing the concrete. Indiscriminate disposal creates an environmental hazard and recycling is costly. Thus, there is a significant onus on construction contractors in relation to the timing of orders for ready-mixed concrete.

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 An object of the present invention is to provide a process for producing ready-mixed concrete that alleviates the above-described problem of inefficient land use.

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 Another object of the present invention is to provide a process for producing ready-mixed concrete that makes it possible to maximise the possibility of using ready-mix concrete within the specified time period and
35 thereby alleviates the above-described economic loss and concrete disposal problems when the time period is exceeded.

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According to the present invention there is provided a process for producing concrete which includes the steps of:

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- (a) charging a required amount of aggregate into a drum of a mixer truck;
- (b) forming a slurry of cementitious material, water and chemical additives, in required proportions; and
- (c) charging a required amount of the cementitious material slurry into the drum of the mixer truck and mixing the slurry and the aggregate in the truck to produce concrete.

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The present invention is based on the realisation that the above-described inefficient land use problem and the above-described economic loss and concrete disposal problems that arise when the specified time limit is exceeded can be significantly alleviated by separating the process steps of (a) aggregate weighing and loading and (b) cementitious material blending as described above.

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Preferably step (a) includes charging required amounts of coarse aggregate and fine aggregate into the drum of the mixer truck.

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More particularly, the process of the present invention includes the steps of:

- (a) weighing and loading required amounts of coarse and fine aggregates into the drum of the mixing truck at an aggregate weighing/loading station;
- (b) weighing and loading required amounts of

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cementitious material, water and chemical additives into a blender at a cementitious material weighing/blending station and operating the blender to form the slurry; and

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(c) adding a required amount of the cementitious material slurry to the mixer truck and rotating the drum of the mixer truck to evenly coat the aggregates.

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Preferably the process includes calculating the required amounts of cementitious material, water and chemical additives in a given situation by reference to the specified mix proportions and actual amounts of coarse and fine aggregates in the mixer truck.

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Preferably the calculation step takes into account mixing losses.

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The aggregate weighing/loading station and the cementitious material weighing/blending station may be at one geographic location or at two separate geographic locations.

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The aggregate weighing/loading station and the cementitious material weighing/blending station may be permanent fixtures, mobile units, or a combination of permanent fixtures and mobile units.

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The process of the present invention is described further by way of example with reference to Figure 1.

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Figure 1 is a flow sheet of the process steps carried out at an aggregate weighing/loading station and a cementitious material weighing/blending station in accordance with a preferred embodiment of the process of the present invention.

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With reference to Figure 1, in accordance with the preferred embodiment of the process, coarse and fine aggregates that are stored in separate storage bins are discharged from the bins into a weighing hopper to provide the exact amount of the aggregates to produce a given volume of concrete of a given concrete specification that is required for a concrete pour. The weighed aggregate is then transferred to the drum of a mixer truck for transportation to a cementitious material weighing/blending station.

At the cementitious material weighing/blending station, cementitious material, water, and chemical additives that are separately stored in silos/tanks are discharged into separate weighing hoppers in required amounts to produce a required amount of cementitious material slurry for mixing with the aggregate carried by the mixer truck to produce the required concrete. As required, the separately weighed cementitious material, water and chemical additives are discharged into a blender and are blended to form the cementitious material slurry.

As required, the cementitious material slurry is discharged into the drum of the mixer truck and the drum is rotated to coat the aggregates with the cementitious material slurry and the ready-mixed concrete that is produced is transported by the mixer truck to the concrete pour.

The process of the present invention has the following advantages.

1. Reduction of rejection rate.

The specified time period commences only after the addition of cementitious material slurry to aggregates.

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Thus, the required weight of aggregates can be stored separately in readiness for use and the required weight of blended cementitious material slurry can be produced and mixed with the aggregates at the latest possible time having regard to progress at a construction site. This is particularly significant in situations where the cementitious material weighing/blending station is located at the construction site at which concrete is required.

In the circumstances, in general, the rejection rate of concrete that exceeds the specified time limit is minimal compared to the known wet-plant and dry-mix methods. This significantly alleviates the above-described cost penalty and concrete disposal problems that arise when concrete is rejected in such circumstances.

2. Reduction of maintenance costs.

The cost of production is significantly lower. There are lower maintenance costs as the system requires less machinery and causes less wear on drum mixers of mixer trucks due to reduced mixing time in drum mixers.

3. Reduced fuel consumption.

In situations where the cementitious material weighing/blending station is a mobile unit and is located at a construction site, the mixer truck carries less weight per unit volume of concrete because the aggregate is the only component that is transported to site by the mixer truck.

Thus, there is reduction of fuel consumption of the mixer truck by virtue of lower weights carried.

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4. Better quality control.

The separate production of aggregate and cementitious material slurry batches makes it possible to
5 improve quality control.

5. Less equipment required.

The number of aggregate loaders required is
10 proportional to the number of aggregate weighing/loading stations. The number of aggregate weighing/loading stations is expected to be less than the number of conventional wet-mix and dry-mix plants.

15 Thus, the process of the present invention requires lower equipment requirements.

6. Reduction in stockpile areas.

20 The cementitious material weighing/blending station can be a stand-alone plant and there is no need for a stockpile area. Only a small space is needed for the stand-alone plant making it highly suitable for heavy built-up areas where land is scarce.

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7. Reduction of double handling of aggregate.

Aggregate can be loaded directly at stockpile areas, such as quarry or aggregate landing areas.

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8. No wastage due to delays during transit.

In the event of a delay during transit, for example due to vehicle breakdown and traffic jams, so long
35 as the cementitious material slurry has not been added, the materials can be reused.

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9. Road pollution in event spillage

As the trucks are carrying only aggregates prior
to addition of cementitious material slurry, wet spillage
5 is prevented.

Many modifications may be made to the present
invention as described above without departing from the
spirit and scope of the present invention.
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CLAIMS:

1. A process for producing concrete which includes the steps of:
 - (a) charging a required amount of aggregate into a drum of a mixer truck;
 - (b) forming a slurry of cementitious material, water and chemical additives, in required proportions; and
 - (c) charging a required amount of the cementitious material slurry into the drum of the mixer truck and mixing the slurry and the aggregate in the truck to produce concrete.
2. The process defined in claim 1 wherein step (a) includes charging required amounts of coarse aggregate and fine aggregate in the drum of the mixer truck.
3. The process defined in claim 1 includes weighing and loading required amounts of coarse and fine aggregates into the drum of the mixing truck at an aggregate weighing/loading station.
4. The process defined in claim 3 wherein step (b) includes weighing and loading required amounts of cementitious material, water and chemical additives into a blender at a cementitious material weighing/blending station and operating the blender to form the slurry.
5. The process defined in claim 4 wherein step (c) includes adding a required amount of the slurry to the mixer truck and rotating the drum of the mixer truck to evenly coat the aggregate to produce concrete.

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6. The process defined in any one of the preceding claims includes calculating the required amounts of cementitious material, water and chemical additives in a given situation by reference to the actual amounts of aggregate in the mixer truck.

7. The process defined in claim 6 wherein the calculation step takes into account mixing losses.

8. The process defined in any one of claims 4 to 7 wherein the aggregate weighing/loading station and the cementitious material weighing/blending station are at one geographic location.

9. The process defined in any one of claims 4 to 7 wherein the aggregate weighing/loading station and the cementitious material weighing/blending station are at two separate geographic locations.

10. The process defined in any one of claims 4 to 9 wherein the aggregate weighing/loading station and the cementitious material weighing/blending station are permanent fixtures.

11. The process defined in any one of claims 4 to 9 wherein the aggregate weighing/loading station and the cementitious material weighing/blending station are mobile units.

12. The process defined in any one of claims 4 to 9 wherein the aggregate weighing/loading station and the cementitious material weighing/blending station are a combination of permanent fixtures and mobile units.