EQUINOX Software

Equinox BATCHtech

User Manual

(metric version)

Weigh ahead batching

Version 15.01 1-Aug-2015

Equinox BATCHtech automated batching.

Units.

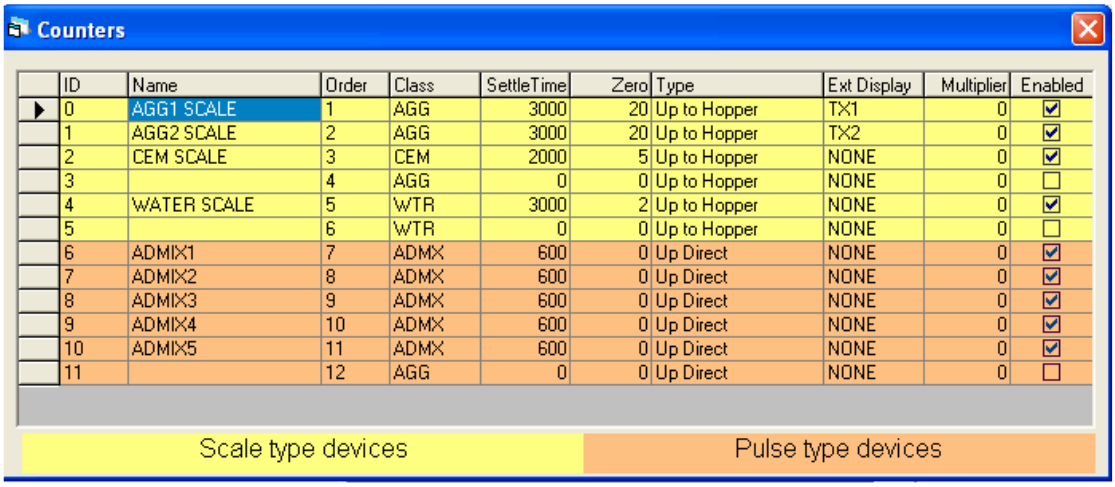
Aggregates and cements are measured in **kilograms**
Water is measured in **litres (or Kg)**
Admixtures are measured in **milli litres or milli litres / 100kg Cementitious**
Unless explicitly stated otherwise times are measured in **milli seconds** e.g. jog a jog time of 200 would pulse the corresponding air solenoid for 1/5th of a second.

Plant Configuration

The Equinox batching software is the same for all batch plants whether it be a simple single aggregate hopper end loader configuration with one cement or a very large overhead bin design with several cementitious products. One single program is very beneficial for operators owning several plants and for the rapid distribution of software improvements and updates. In order for this to happen the actual plant is configured by parameters at initial setup.

After initial plant setup most parameters never need changing

The standard Equinox Batching system supports up to 16 counters divided into 8 weigh type devices and 8 volumetric pulse devices



	ID	Name	Order	Class	SettleTime	Zero	Type	Ext Display	Multiplier	Enabled
▶	0	AGG1 SCALE	1	AGG	3000	20	Up to Hopper	TX1	0	☑
	1	AGG2 SCALE	2	AGG	3000	20	Up to Hopper	TX2	0	☑
	2	CEM SCALE	3	CEM	2000	5	Up to Hopper	NONE	0	☑
	3		4	AGG	0	0	Up to Hopper	NONE	0	☐
	4	WATER SCALE	5	WTR	3000	2	Up to Hopper	NONE	0	☑
	5		6	WTR	0	0	Up to Hopper	NONE	0	☐
	6	ADMIX1	7	ADMX	600	0	Up Direct	NONE	0	☑
	7	ADMIX2	8	ADMX	600	0	Up Direct	NONE	0	☑
	8	ADMIX3	9	ADMX	600	0	Up Direct	NONE	0	☑
	9	ADMIX4	10	ADMX	600	0	Up Direct	NONE	0	☑
	10	ADMIX5	11	ADMX	600	0	Up Direct	NONE	0	☑
	11		12	AGG	0	0	Up Direct	NONE	0	☐

The **Class** for each counter is selected from a drop down when the field is clicked. The Class is one of
AGG, CEM,WTR,ADMX,ADDV standing for Aggregate, Cement, Water, Admix and Additive. Chemical admixtures such as plasticizer may be either Admix or Additive. The only reason for having 2 admixture classes is to give added flexibility to the loading sequence. E.g. it is possible to specify that some admixtures are loaded up front and some with the tail water.

The **Order** is the position that the counter is to be displayed on the computer screen and is generally chosen so that the computer screen has a similar layout to the position of the actual scale indicators in the batch room.

Settle Time is to eliminate the effects of dynamic loading when recording batch weights. When falling material lands in the weigh hopper the scale reading will be greater than the steady weight. The final batch weight reading is not taken until after the settle time has elapsed. Choose the value by using the manual controls to drop some material and observe how long after closing the actuator the scale takes to assume a steady reading.

Zero is the scale reading that below which a hopper is considered to be empty. It is common for some product to adhere to the sides of a weigh hopper. A scale reading may be zero before the weigh hopper was filled, but after the hopper is emptied a true return to zero reading may not be achievable. The batch computer will attempt to empty a hopper to the original start reading, but if after a finite time zero can not be achieved the batch computer will consider the job done as long as the reading is less than the **Zero** value**.**

The **Type** allows for different measuring configurations. If a weigh hopper is on load cells then the weight increases as material is batched (Up to hopper), but if for instance a cement silo is on load cells then the weight decreases as cement is batched (Down no hopper). The value (Up Direct) is for when there is no hopper and material is direct into the truck bowl – typical of admixtures and water measured by flowmeter.

End loader plants generally have a remote display visible to the loader driver. The **Ext Display** value is the port to which the external display is connected. Except for an end loader weigh hopper, the value is generally **None**

Multiplier converts a physical measurement to a true measurement. For scales the value can be left as zero (which is treated as a multiplier of 1) i.e. there is no difference between the weight displayed on the scale and the actual scale weight. If however an admixture flowmeter gives one pulse for every 10 ml then the multiplier needs to be set to 10 to convert pulses to milli litres of admixture. If water is measured by a flow meter that gives 50 pulses per litre then the multiplier would be 0.02

Enabled is a yes/no value (tick box) to indicate the counter is available for use. If for example at a dual aggregate weigh bin plant one hopper was damaged it can be taken off line simply by unticking the check box then re ticking after repair. This is a lot more convenient than deleteing then re entering the whole line.

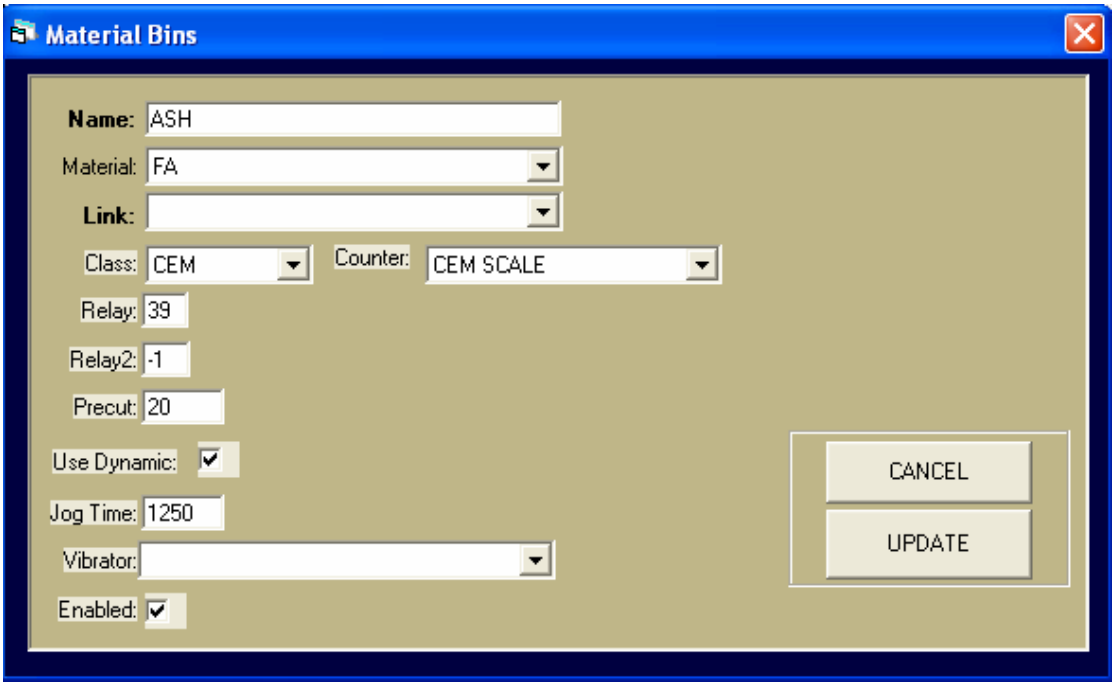
Raw Materials

Code	Name	Short Name	Class	Units	SG	Tol %	Tol Max	Cost/1000	Modifiable	Enabled
MP10	Moy Pocket 10mm	MP10	AGG	Kg	1	5	50	0	☐	☑
MP20	Moy Pocket 20mm	MP20	AGG	Kg	1	5	50	0	☐	☑
MP7	Moy pocket 7mm	MP7	AGG	Kg	1	5	50	0	☐	☑
SAND	Ningi Fine Sand	SAND	AGG	Kg	1	5	50	0	☐	☑
WHITE	EXP WHITE	EXPW	AGG	Kg	1	5	50	0	☐	☑
CFA	Calide Flyash	FA	CEM	Kg	1	3	20	0	☐	☑
FA	Sunstate - Tarong Flyash	FA	CEM	Kg	1	3	20	0	☐	☑
GP	Sunstate GP	GP	CEM	Kg	1	3	20	0	☐	☑
WATER	WATER	WATER	WTR	Litre	1	2	10	0	☐	☑
AEA	Sika Air	AEA	ADMX	mL	1	5	50	0	☐	☑
HRWRRE	Sika Visocrete PC HRF2	HRWRRE	ADMX	ml/100Kg Cem	1	5	50	0	☑	☑
RAPID	Sika Rapid AF	RAPID	ADMX	ml/100Kg Cem	1	5	50	0	☑	☑
RE	Sika Retarder N	RE	ADMX	ml/100Kg Cem	1	5	50	0	☑	☑

Code is used to identify a material in a mix wheras the **Name** appears on most printed reports. The **Short Name** is shown on the outdoor weight display used by the loader driver at loader style plants. The Short Name must be chosen to satisfy the constraints of the outdoor display – it must consist only of characters the outdoor display is capable of showing and have no more characters than the display accommodates. Some displays can only show numeric and upper case and are limited to as few as 5 characters.
Class is chosen from a drop down and is one of AGG, CEM, WTR, ADMX, ADDV.
Units are chosen from a drop down and are **Kg** for Aggregate and Cement classes, **Litre** or **Kg** for Water and **ml** or **ml/100kg** Cem for admixtures.
The specific gravity **SG** is used to calculate the volume of weighed materials.
Tolerances Tol % and **Tol Max** are used during batching. The tolerance used in batching is the minimum value of the two and depends on the batch size. E.g. if Tol % is 5 and TolMax is 50 for a material in a mix that uses 400kg / cubic metre of that material then when batching a 3 metre load the tolerance will be the lesser of 50 and 5% of 1200 (= 60) ie a tolerance of 50 kg. In a 1 metre load the tolerance is the lesser of 50 and 5% of 400 giving a tolerance of 20kg.
Cost/1000 is used to calculate the actual raw material cost of a mix design. May be left as zero if this ability not required or entered as the cost per tonne for aggregates and cements or the cost / litre of admixtures.
Modifiable means that the quantity of this material in a mix design may be altered at batch time. This usually only applies to admixtures such as retarders or accelerators. Only materials that are **Enabled** may be batched. If a material is temporarily unavailable then unticking Enabled will prevent the batching of a mix containing this material from starting.

Bins

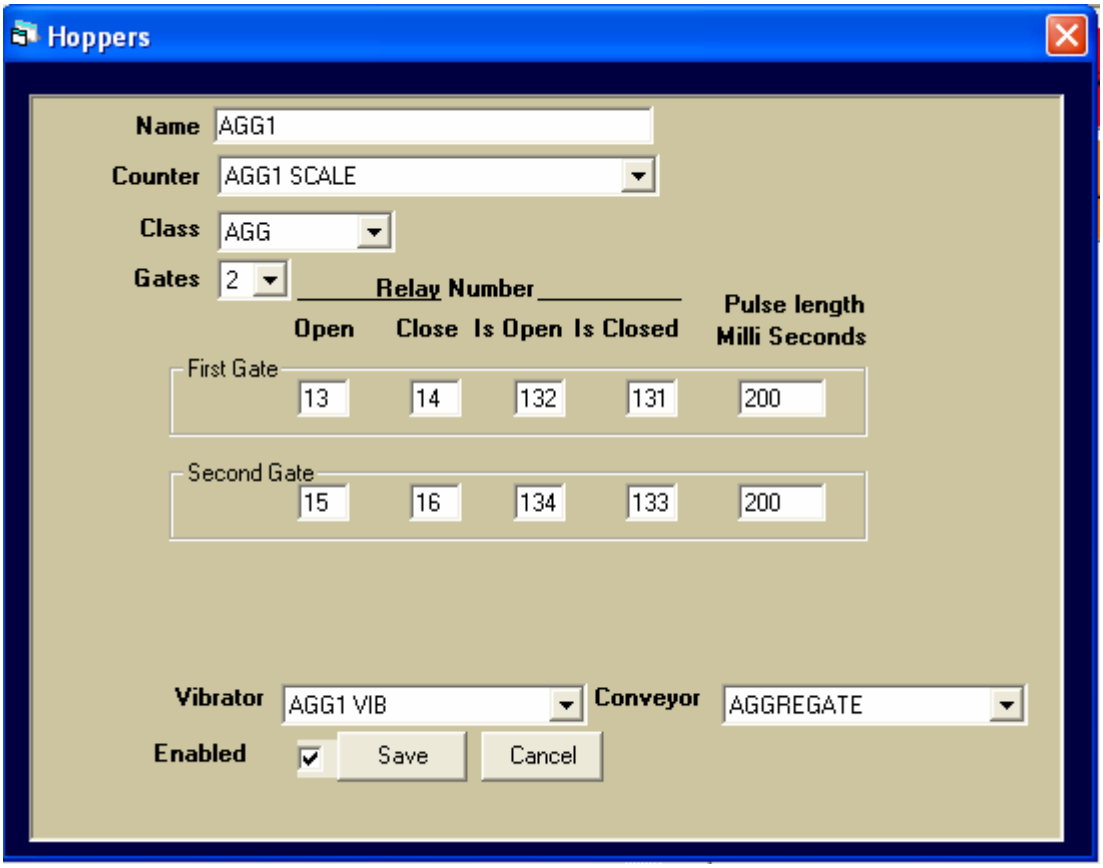
Raw materials are stored in a bin for batching. The bin parameters describe the operation of that bin



Choose any descriptive **Name** and select the **Material** that the bin holds from the dropdown. In an overhead bin plant it is common for two or more bins to contain the same material because a lot of that material is used in the mixes. If you **Link** a bin with another then during batching the material will be drawn from both bins simultaneously. If bin A is linked to bin B then you must also link B to A.. Although uncommon in practice, 3 bins A, B and C could be linked by A links to B, B links to C, C links to A..
Bins can only be linked if they contain the same material. The **Class** of a bin must match the class of the material. The **Counter** is the scale or pulse meter that is used for measurement when this bin is used. **Relay** is the electrical relay number that operates the bin and would never be changed after initial set up. If a bin has a fast and slow feed ability then **Relay2** is the slowfeed relay. Whenever a relay is not present then it must be given the value of -1 (At an end loader plant an Aggregate bin would typically have both relays set to -1 as there is no automatic operation to start the feeding of material to be weighed.)
Precut is to make allowance for inflight material and is the amount to be subtracted from the required target weight to determine when the relay switches off so that the final weight will be the target weight. The value to be given is determined by observing the scale during manual operation. **Use Dynamic** indicates that the precut value will change automatically between batches based on what happened in previous uses. E.g. if a material went over by 30 kg then the precut would increase by 30kg for that bin on the next batch in order to get the correct target weight. Whenever the batch program is restarted, the original precut is used on the first batch.

The **Jog Time** is in milli seconds and is the incremental time that the feed will operate in order to feed some more material to achieve target. If the Precut is too large, then the batch time will be excessive as lots of jogs will be required to reach target. The jog time needs to be chosen by experiment. A small value will give accuracy in reaching the target but may require an excessive number of jogs, Too large a value will feed material in larger increments with the possibility that the increment is so big that the last jog takes the material over tolerance. A properly tuned plant will have good values for precut and jog time. If the jog time is zero then no jogging will take place. It is usually not advisable to jog bins that are pump operated. In this case spend time getting the precut right.
If the bin has a connected **Vibrator** to help with slow or stopped feed then select the correct vibrator from the drop down.

Weigh Hoppers



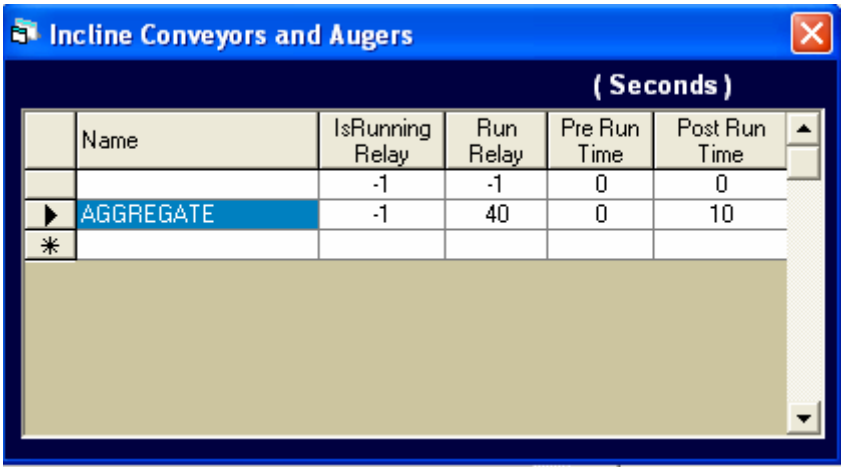
The **Class** of the hopper must be the same class as its counter.
Gates specify how many discharge gates the hopper has. Most aggregate hoppers have a front and rear gate. Water weigh tanks have just one outlet. If a hopper has inching gates (the gate can move to and stay in any position between closed and open) then there will be a relay for **open** and a relay for **close**. Non inching gates just use the **open** relay and the gate fully opens when the relay is on and closes fully when the relay is off. Any not used relay must be given a value of -1. (Close is always -1 for non inching gates)

Pulse length applies to inching gates only (set zero for non inching) and is the incremental time that that either open or close is applied in order to increase or decrease the gate aperture. If an inching gate takes one second to fully open or close then a pulse length of 200 would allow for 5 different apertures. This enables the computer to control the exit rate from the hopper so that conveyor belts do not overflow etc.

IsOpen and **IsClosed** are the relay numbers for limit switches that indicate the fully open or fully closed position of a gate. Most plants are designed so that the second gate does not start opening until the first gate is fully open. Also most plants have interlocks that prevent a hopper being loaded unless the Isclosed relay is ON

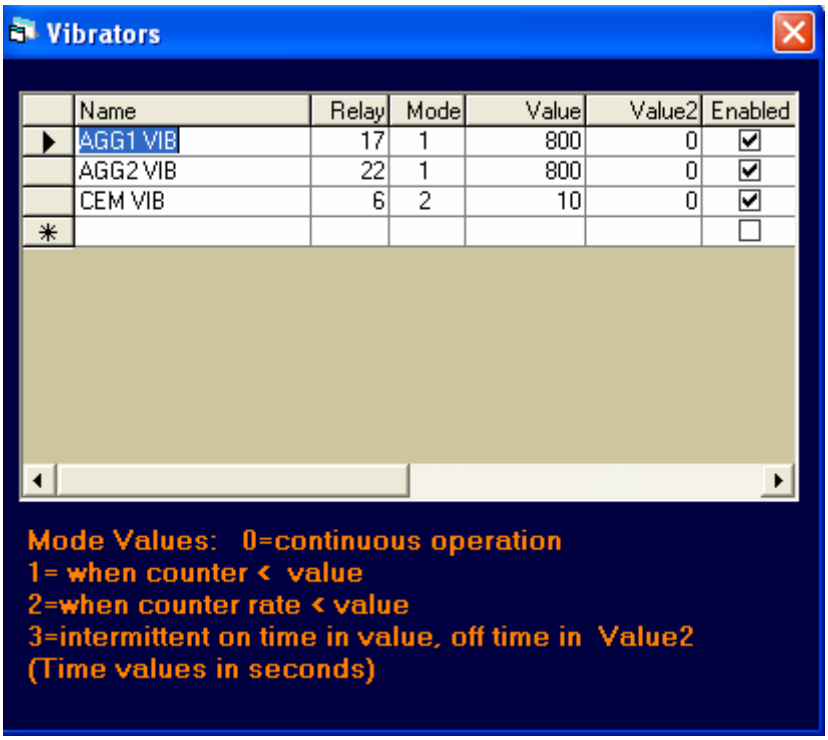
If the hopper has a **Vibrator** then choose from the dropdown, if the hopper requires a **Conveyor** motor to be started before discharge then select from the dropdown.

Conveyors



The **Run Relay** is the relay number for turning the conveyor on and off. Some motors have an output that comes on when the motor is up to speed. This is the input to the **Is Running** relay. If there is no Is Running then set to -1 and the computer assumes the conveyor is running if the run relay is on. The **Pre Run Time** is the number of seconds from the activation of Run before any feeding hopper will open. May be necessary if a conveyor takes a while to get up to speed. **Post Run Time** is the number of seconds the conveyor will continue running after a discharging hopper is empty. On an aggregate incline conveyor this is the time that material takes to get from the bottom of the belt to the top.

Vibrators



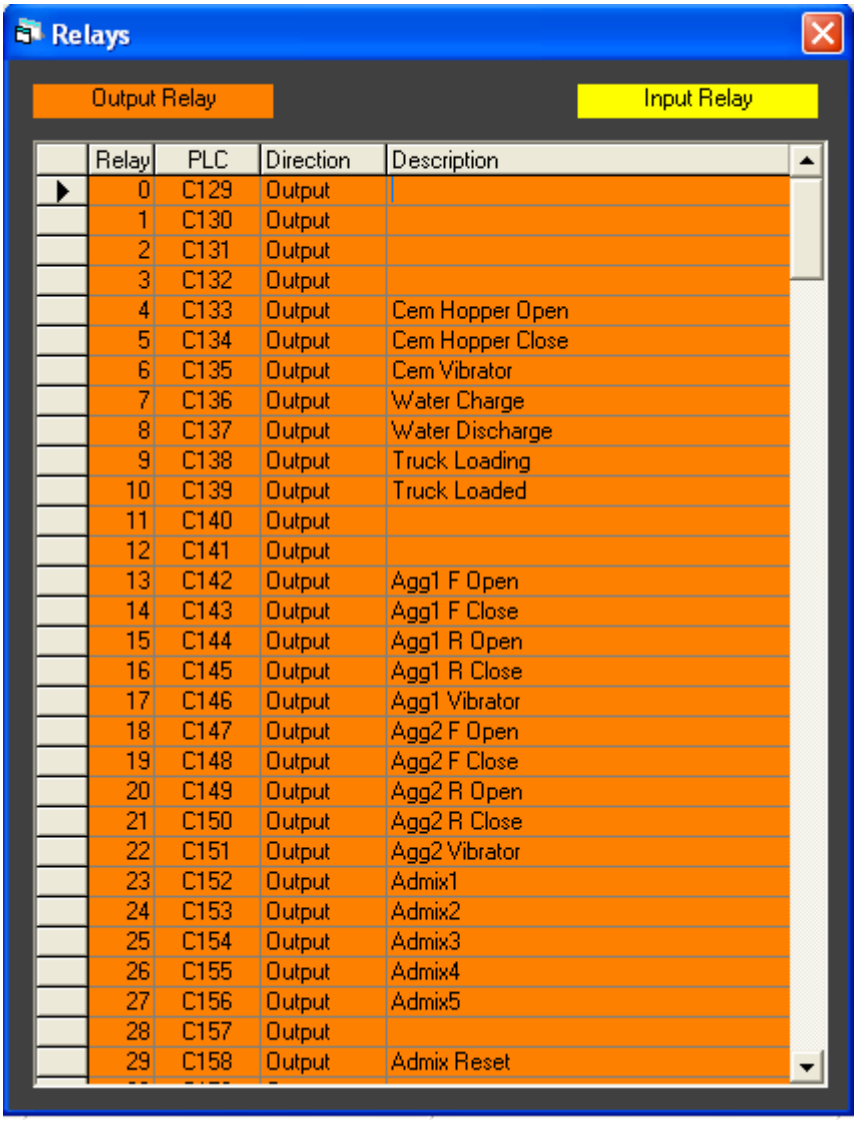
Vibrators can be set to operate in one of 3 **Modes** as appropriate.

- Mode 1. The vibrator comes on when the counter is less than the set **value**. E.g. when the scale of an aggregate hopper gets below the value. A good mode for hoppers that have difficulty discharging when nearing empty.
- Mode 2. The vibrator comes on when the rate of flow is lower than the **value.** The value is measured in units per second. For cement this would be in Kg/second
- Mode 3. The vibrator cycles on and off . On for Value seconds then off for **Value2** seconds.

Relay is the relay number for activating the vibrator.

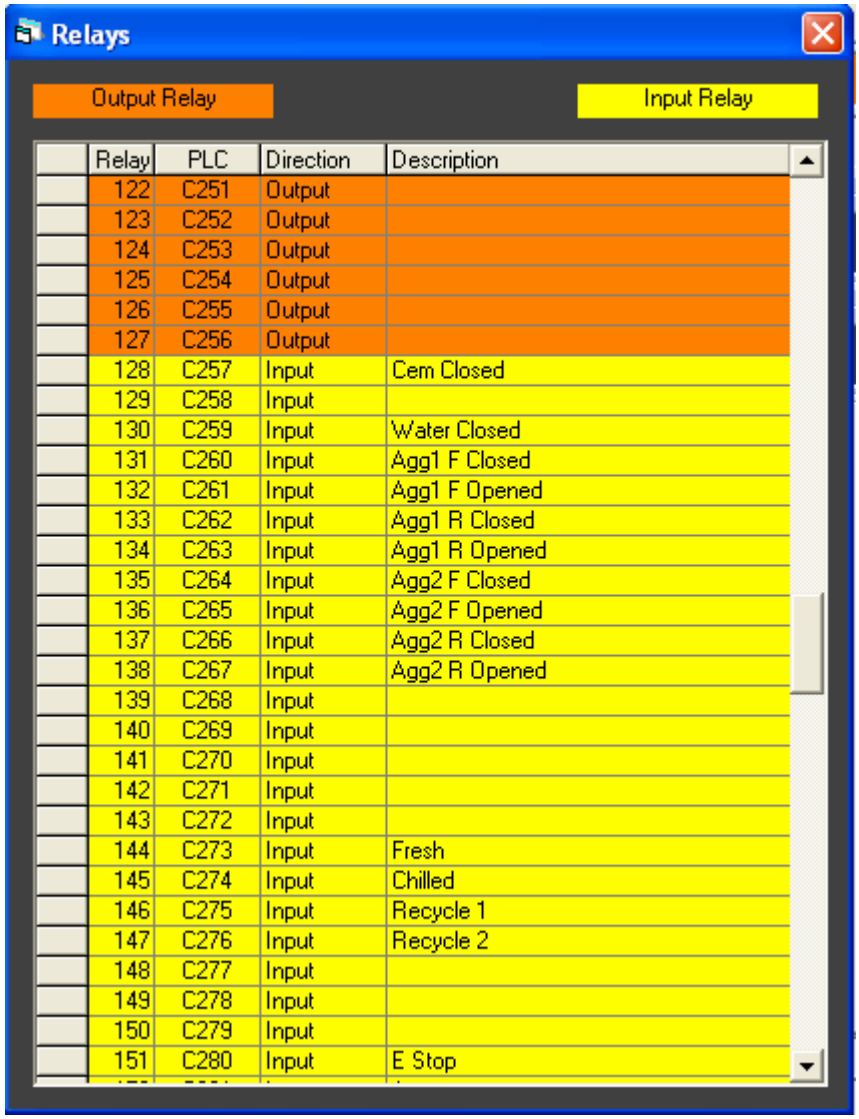
Relays

There is a table for documenting relay usage.



Relay	PLC	Direction	Description
0	C129	Output	
1	C130	Output	
2	C131	Output	
3	C132	Output	
4	C133	Output	Cem Hopper Open
5	C134	Output	Cem Hopper Close
6	C135	Output	Cem Vibrator
7	C136	Output	Water Charge
8	C137	Output	Water Discharge
9	C138	Output	Truck Loading
10	C139	Output	Truck Loaded
11	C140	Output	
12	C141	Output	
13	C142	Output	Agg1 F Open
14	C143	Output	Agg1 F Close
15	C144	Output	Agg1 R Open
16	C145	Output	Agg1 R Close
17	C146	Output	Agg1 Vibrator
18	C147	Output	Agg2 F Open
19	C148	Output	Agg2 F Close
20	C149	Output	Agg2 R Open
21	C150	Output	Agg2 R Close
22	C151	Output	Agg2 Vibrator
23	C152	Output	Admix1
24	C153	Output	Admix2
25	C154	Output	Admix3
26	C155	Output	Admix4
27	C156	Output	Admix5
28	C157	Output	
29	C158	Output	Admix Reset

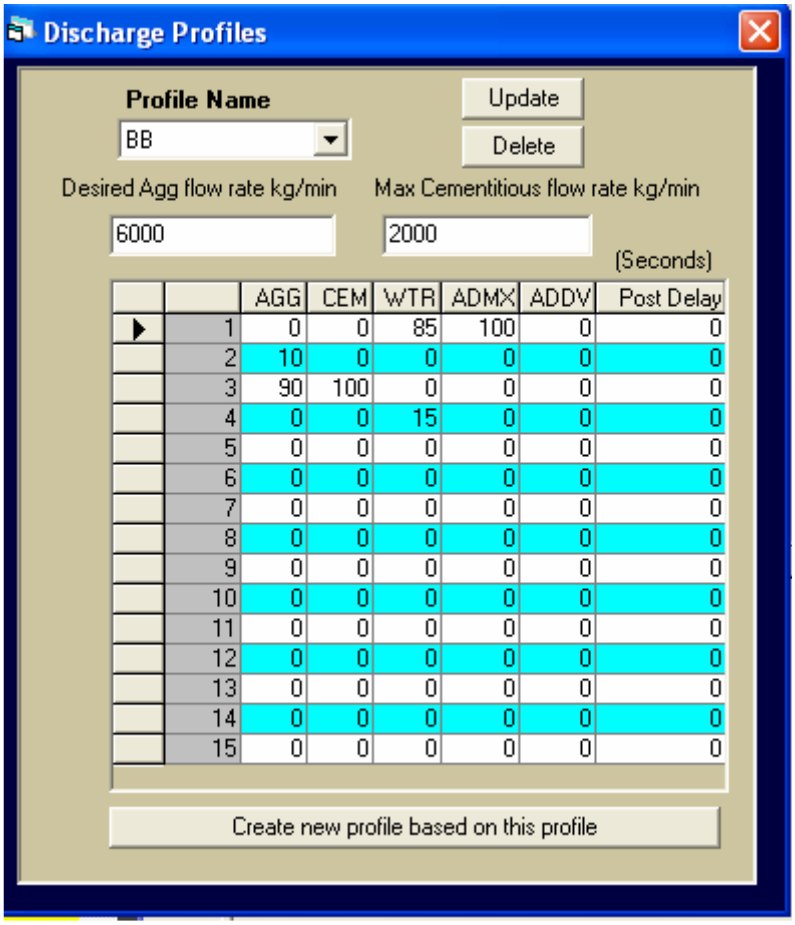
Relays 0 to 127 are used as outputs i.e. for turning something on



Relay	PLC	Direction	Description
122	C251	Output	
123	C252	Output	
124	C253	Output	
125	C254	Output	
126	C255	Output	
127	C256	Output	
128	C257	Input	Cem Closed
129	C258	Input	
130	C259	Input	Water Closed
131	C260	Input	Agg1 F Closed
132	C261	Input	Agg1 F Opened
133	C262	Input	Agg1 R Closed
134	C263	Input	Agg1 R Opened
135	C264	Input	Agg2 F Closed
136	C265	Input	Agg2 F Opened
137	C266	Input	Agg2 R Closed
138	C267	Input	Agg2 R Opened
139	C268	Input	
140	C269	Input	
141	C270	Input	
142	C271	Input	
143	C272	Input	
144	C273	Input	Fresh
145	C274	Input	Chilled
146	C275	Input	Recycle 1
147	C276	Input	Recycle 2
148	C277	Input	
149	C278	Input	
150	C279	Input	
151	C280	Input	E Stop

Relays 128 to 255 are used as inputs e.g. a limit switch is closed

Discharge Profiles



	AGG	CEM	WTR	ADMX	ADDV	Post Delay
1	0	0	85	100	0	0
2	10	0	0	0	0	0
3	90	100	0	0	0	0
4	0	0	15	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0

Discharge profiles control how a batched mix is loaded into the truck. The profile controls both the speed and sequence of loading. Different sized trucks may have different discharge profiles, special mixes may require a special profile.

In the above example the computer will control the aggregate discharge hopper so that 6000kg / minute is discharged onto the incline conveyor, the cement will be discharged at 2000kg/minute maximum.

The loading sequence may be up to 15 distinct intervals, the last indicated by a row of all zeros.

The computer does not move on to the next sequence until everything in the current sequence has completed.

Each cell in the loading sequence table represents a % of the total activity. Every column in the sequence table will add up to 100% (or zero if unused)

In the above example, firstly 85% of the total water and all the admixtures will be discharged together into the truck.

When that has fully completed 10% of the aggregate will be discharged.

When that has happened the cement and remaing aggregate are discharged together.

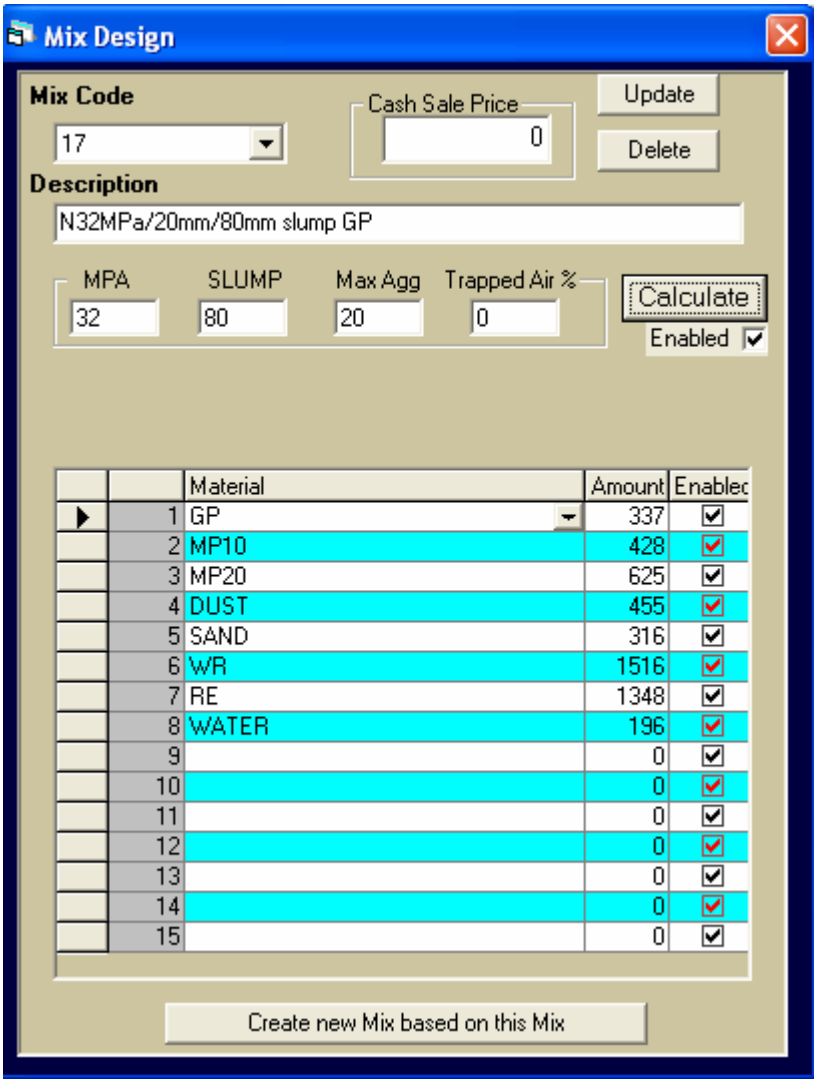
Finally the remaing 15% of water is added on its own.

The easiest way of creating a new profile is to first select a profile close to that required and click the *Create new profile based on this profile* button. Then modify as required and save.

The **Post Delay** column allows for entering a value in seconds. When a sequence completes if there is a non zero post delay on that row the next sequence will not be started until after post delay seconds. One could for instance create a profile that pauses for 60 seconds halfway through the loading to allow for the manual loading of colored oxide or fibres into the bowl.

Mix Designs

Mix designs are the recipes for concrete products. The mix designs must be based on the dry weights of constituent materials. (Wet materials are compensated for at batch time by an assigned moisture %)

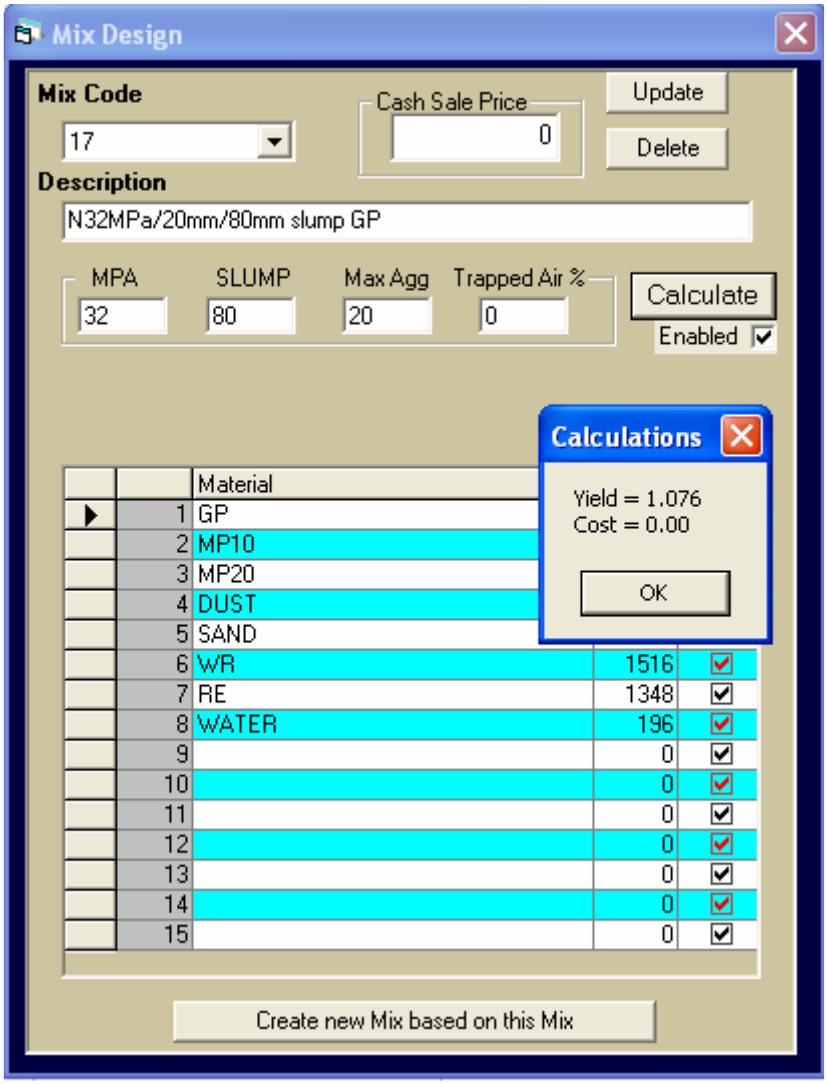


Each row of the mix design has the material and quantity required for one cubic metre of product. If a product is not **enabled** it will not be batched.

The batching sequence of materials using the same counter is the order in which they occur in the mix design. Materials using different counters can batch simultaneously e.g. cement and water weigh up at the same time.
In the above example MP10, MP20, DUST and SAND which are all aggregates will batch up in that order into the aggregate weigh hopper of any plant that has one weigh hopper for all aggregates.

If correct specific gravity's have been entered against materials (in the material setup) then the **calculate** button will show the yield that would be achieved if these exact quantities were batched.

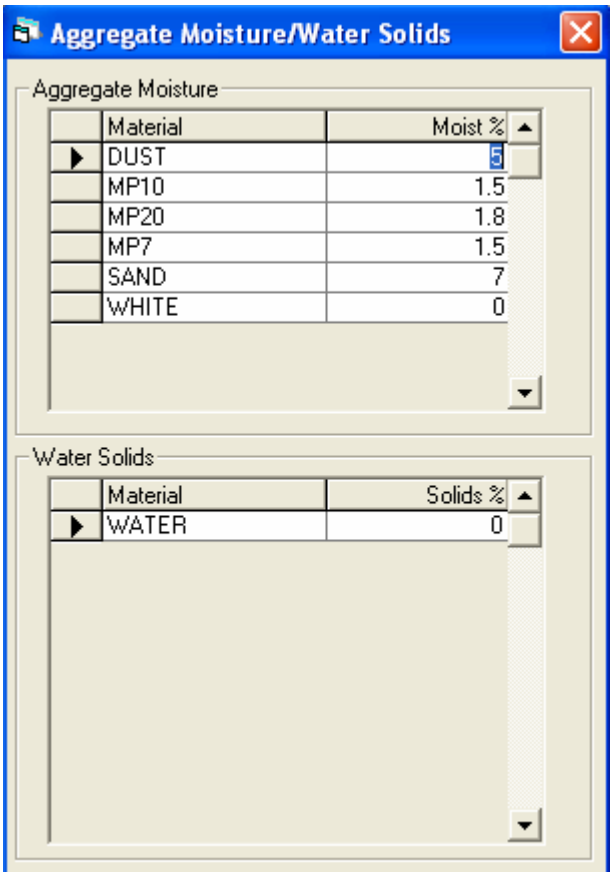
After entering a new mix design it is a good check to verify the yield as a number not close to 1 is an indication of a material omitted or a wrong quantity.



If raw material costs have been entered then the calculation also gives the material cost of the mix.

As mentioned previously, all mix designs are based on dry weights.

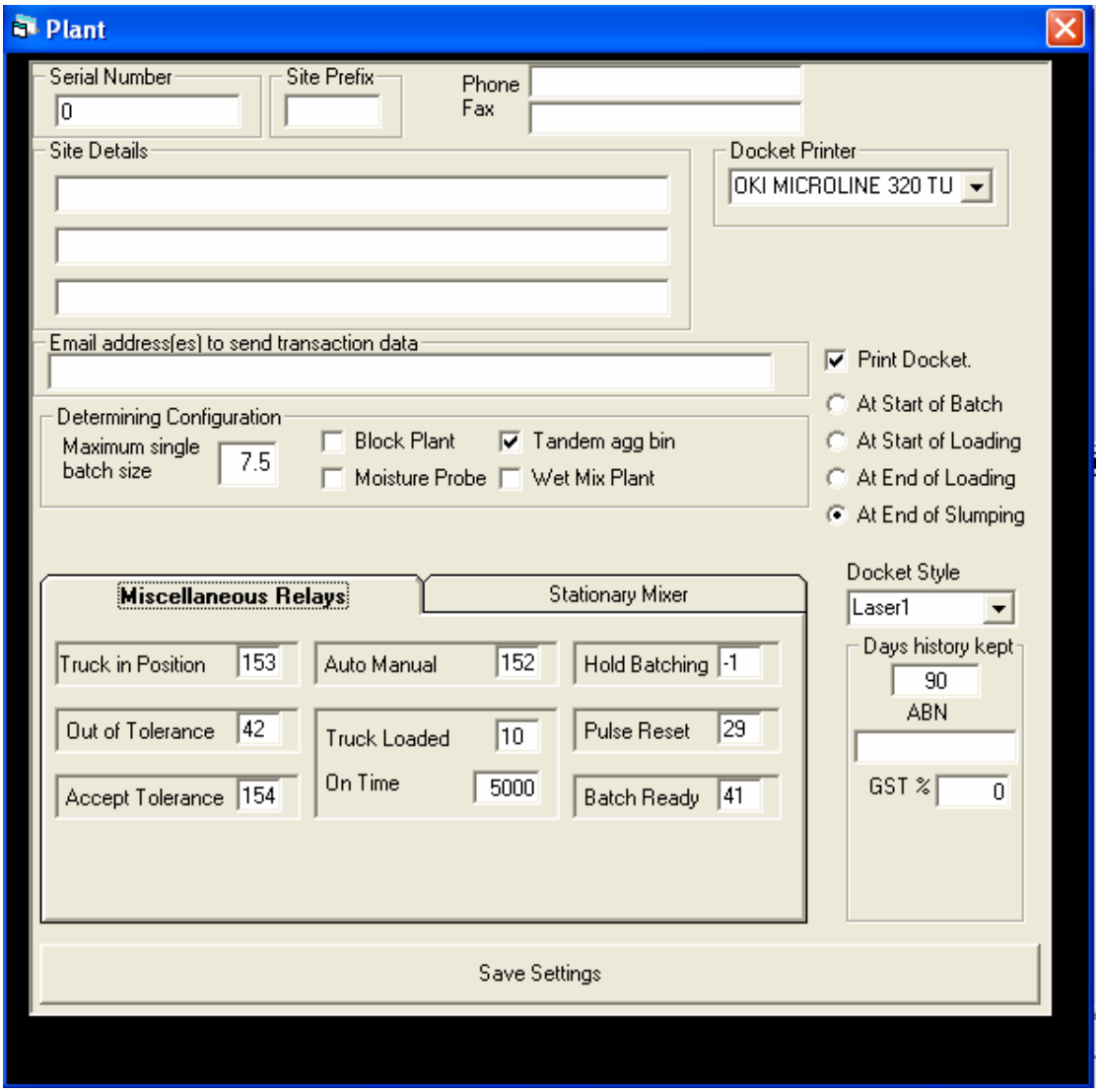
To compensate for water included in actual materials that are not dry, the computer increases the batched weight of the non dry material so as to be equal the required weight of dry material. The extra weight is water that the computer then subtracts from the batched water in the mix design.



The moisture % may be adjusted in the table at any time. Direct measuring moisture probes may also be connected to the batching system.

If recycled water is being used the % weight due to suspended solids may also be set. The batch computer will increase the water content to compensate for the weight attributable to the suspended solids.

The plant screen is used for setting miscellaneous relays and other details. After initial setup there is nothing in the plant screen that requires changing or fine tuning.



The **Maximum single batch size** is generally governed by the physical sizes of the weigh hoppers, and may well be less than the capacity of the largest truck bowl. If a requested batch is larger than this value then the load will be batched in two or more drops. E.g. a request for 8 cubic metres would result in two drops each of 4 cubic metres. These drops would have the same batch number and a single docket is generated.

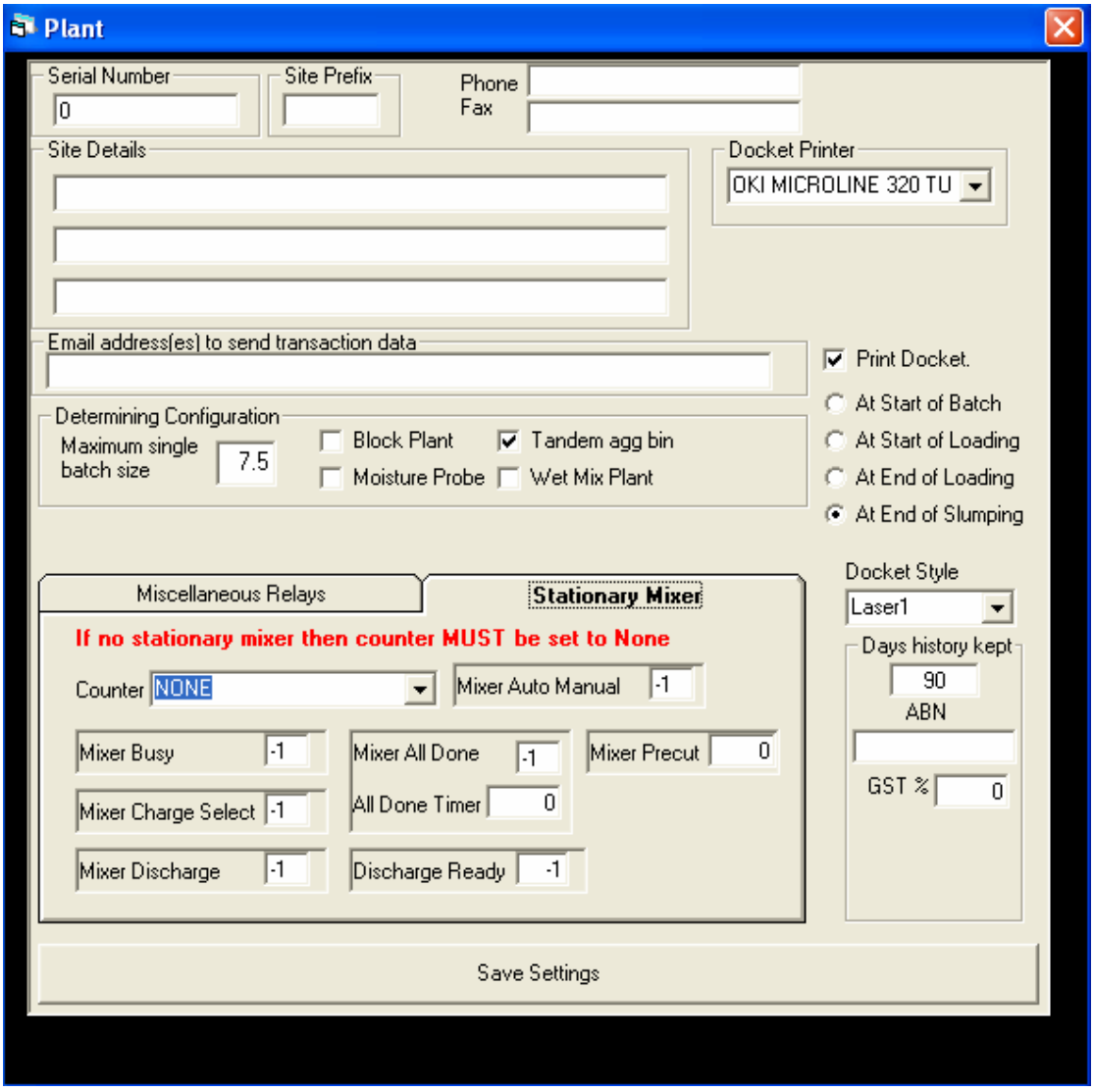
Docket printing can happen at one of 4 different places in the batch cycle as shown above. The batch time printed on the docket will be the time that the docket was first generated.

Reports are always printed to the Windows default printer. The printer for dockets may be selected form the **Docket Printer** drop down which lists all printers installed to the batch computer.

The **Docket Style** allows for different printer types and stationery.

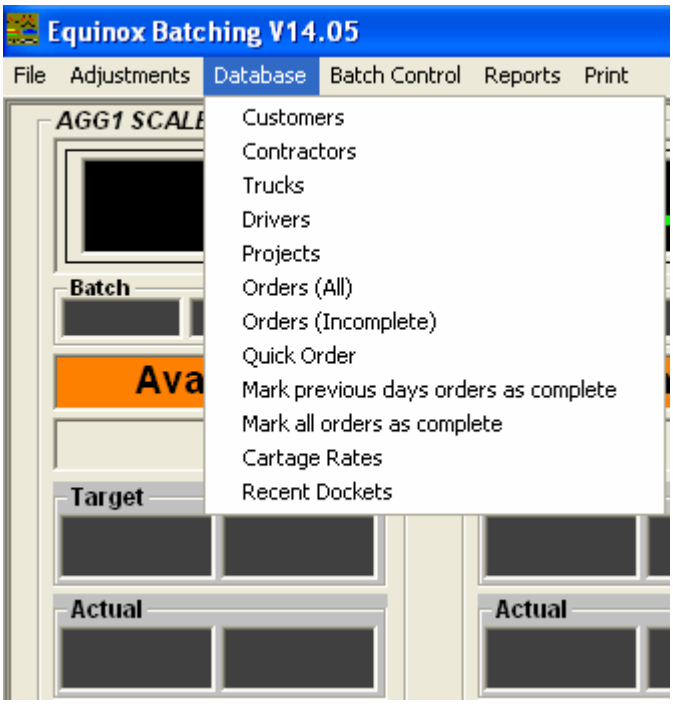
Laser1 setting produces a single page output and is suitable for both laser printers and impact printers that have multi part continuous forms.

Laser2 and Laser3 settings are for laser style printers only and will produce 2 or 3 copies of the same docket allowing plain single sheets to be used rather than multipart forms.



Some plants run a stationary mixer onsite (typically for loading mini trucks) The settings for controlling the stationary mixer are also set up from this screen.

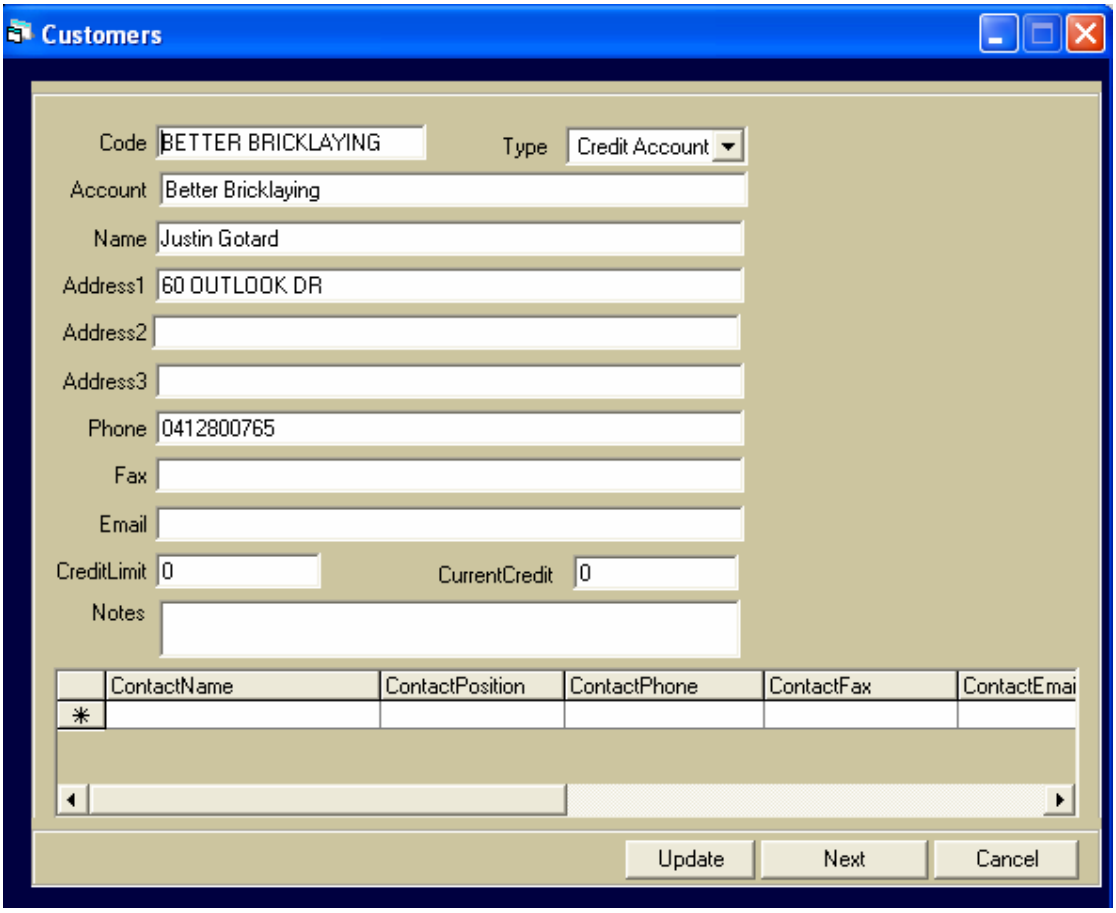
Database



Database menu option is for creating tables that are not to do with the plant setup. The tables are about the administration and generation of loads.

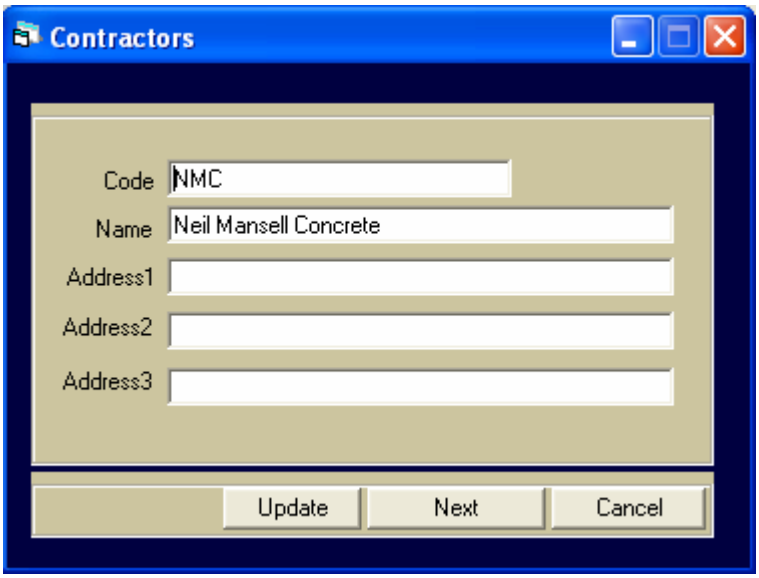
The tables are

- Customers - Person or company buying concrete
- Contractors - Anyone who owns one or more trucks operating.
- Trucks - All of the trucks
- Drivers - Details about truck drivers
- Projects - Delivery location and mix pricing at location.
- Order - Detail about a single mix for project delivery.
- Recent Dockets - Individual docket loads resulting from an order.



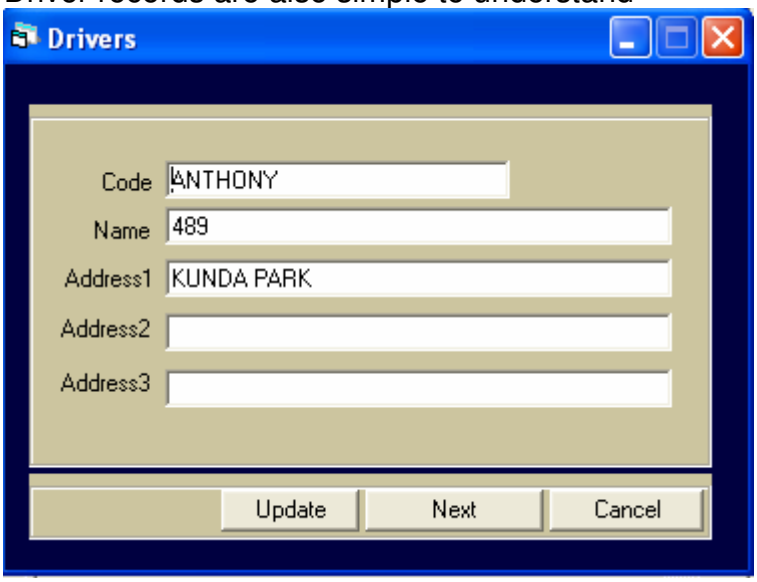
The customer record is self explanatory. The address is an invoicing address which may be different from a customers order delivery address.

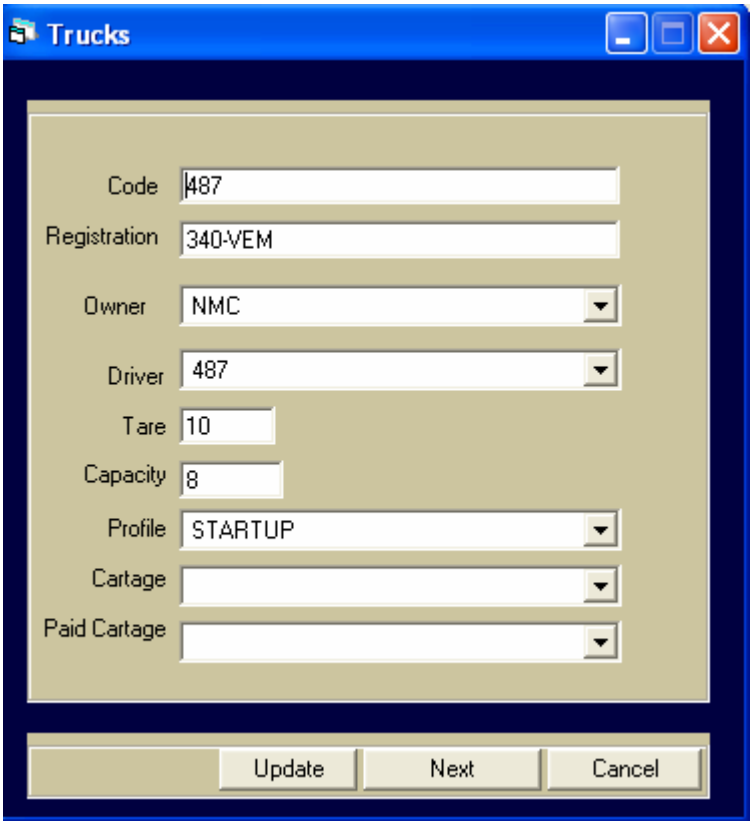
Most plants set up a single cash sale customer for one off cash jobs.



The contractor (truck owner) record is very simple.

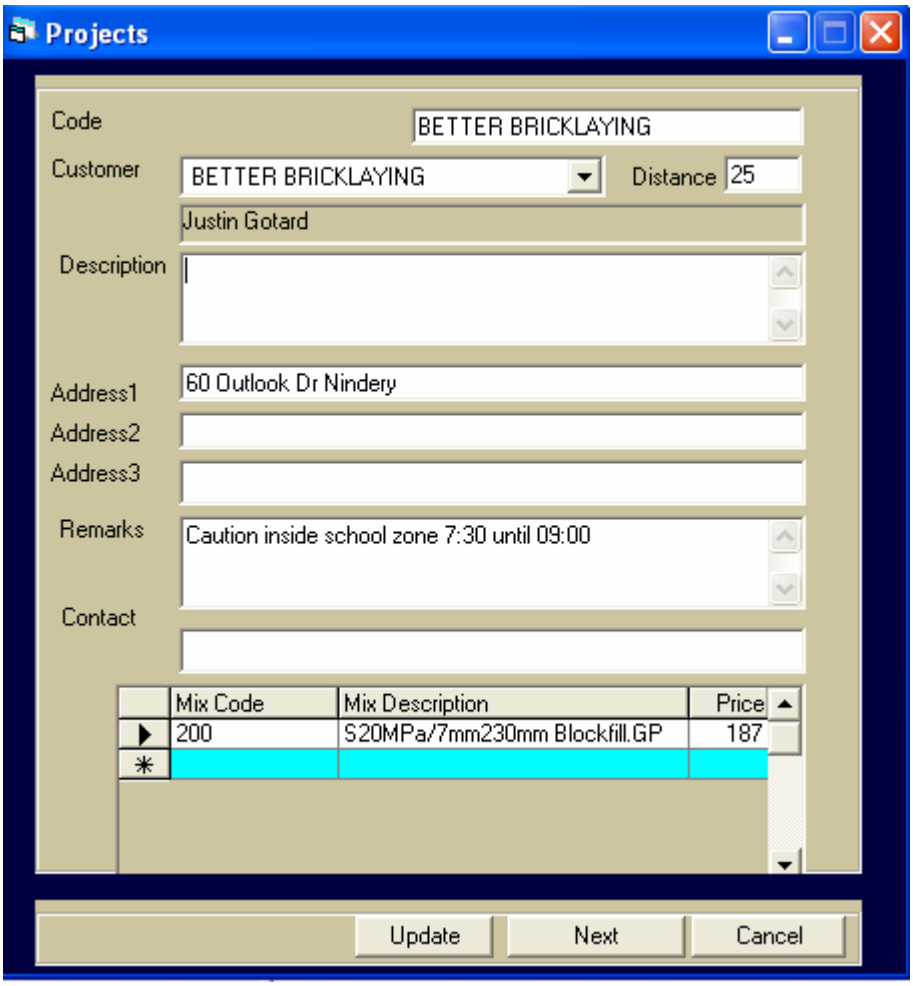
Driver records are also simple to understand





Contractors (Owner) and Drivers must already be in their corresponding tables before a truck record can be completed. The **Capacity** is the largest load this truck may take. A warning is produced at batch time if you attempt to batch a load that exceeds the truck capacity.

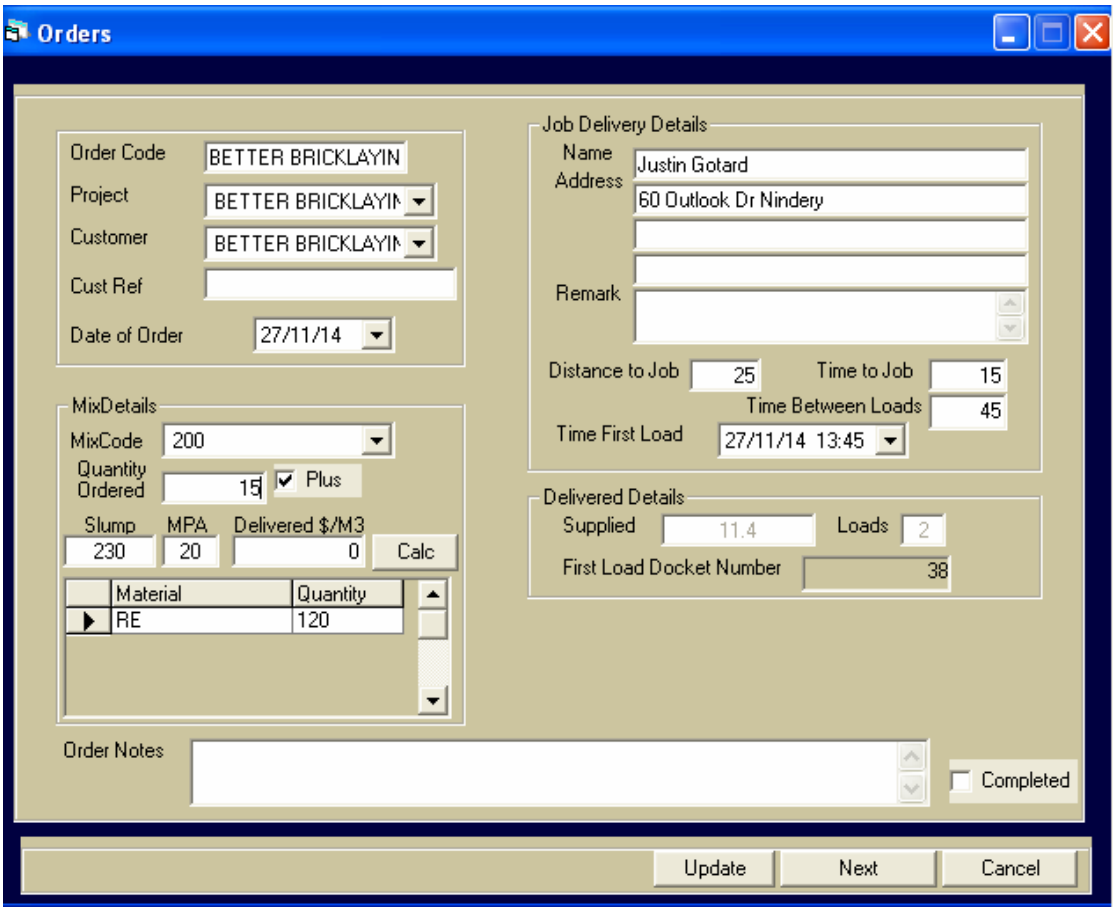
Projects



A project is created for each customer delivery address. Pricing for different mixes to the project location goes here. A project may run for a very long time or may just be for one load. A single Cash project could be created for one off jobs and all the detail recorded on an **Order.** Anything written in **Remarks** is printed on delivery dockets.

Orders

Every Job, no matter how small will require an order.



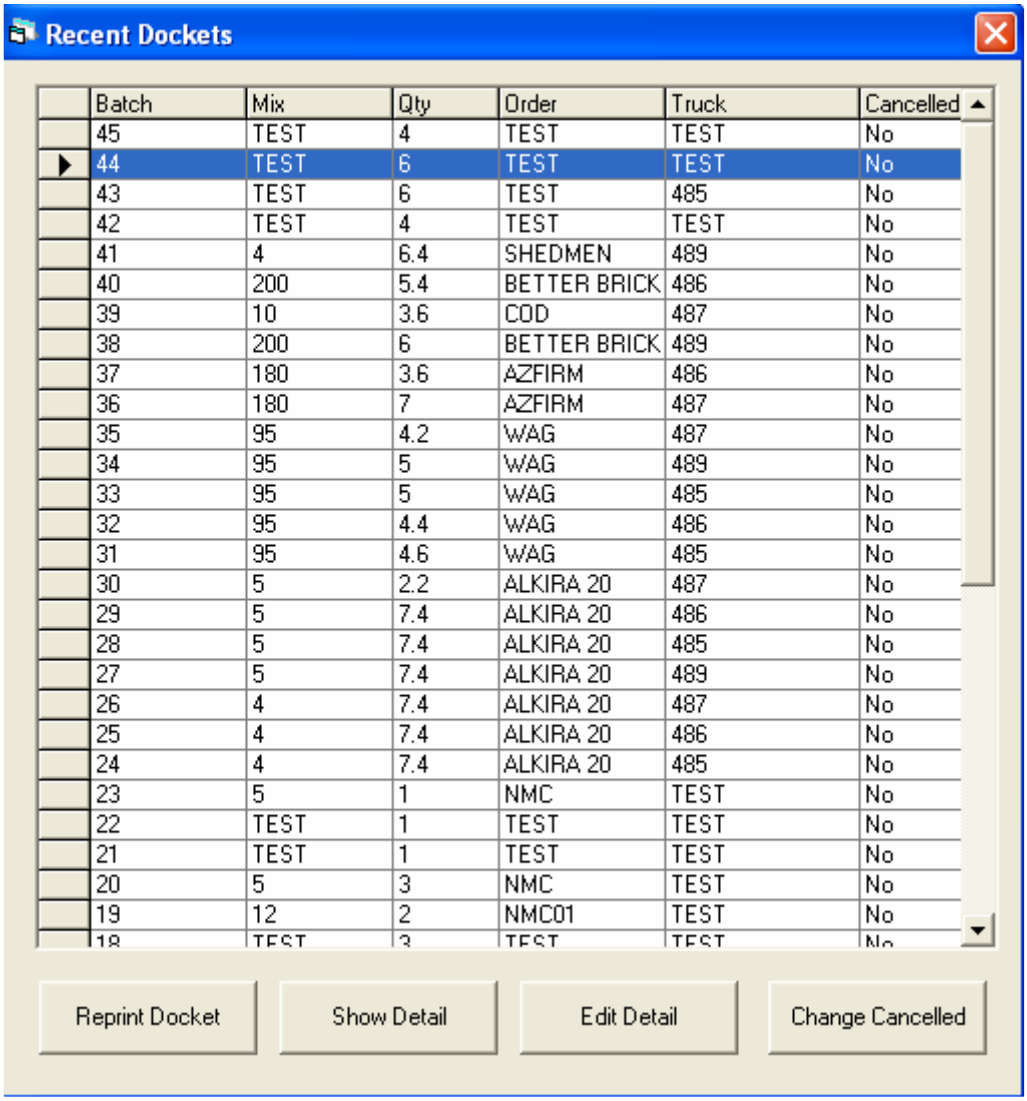
The order is for one mix design only and largely controls everything other than the load size and truck when a load is batched.

Materials that have been set up as modifiable will show on this screen (Retarder RE in this case, the mix design value of 120mls/100 kg cementitious may be changed). The changed value will replace the mix design value whenever this order is used – modifiable materials can also be changed at batch time without changing the order.

Plus means that more than the ordered quantity can be batched against this order.

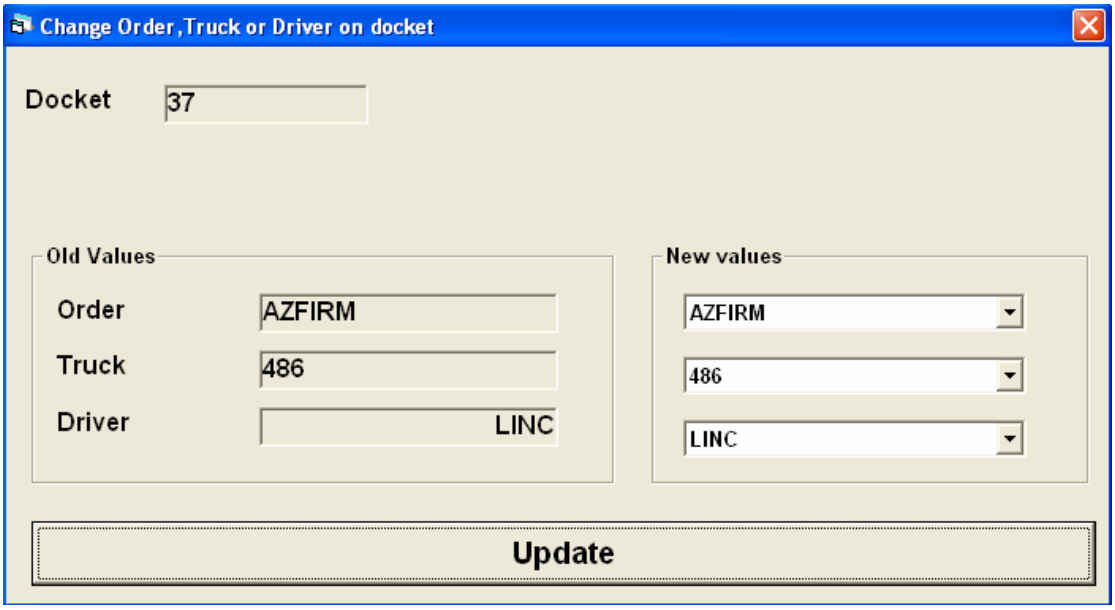
Completed should be ticked when the order is finished to limit the number of orders to choose from on the **new batch** screen.

Recent dockets firstly gives a list of dockets with the most recent docket listed first



Highlight a docket by clicking the left blank column of the row.
Once a docket is chosen in this way, options to reprint or make changes become available.

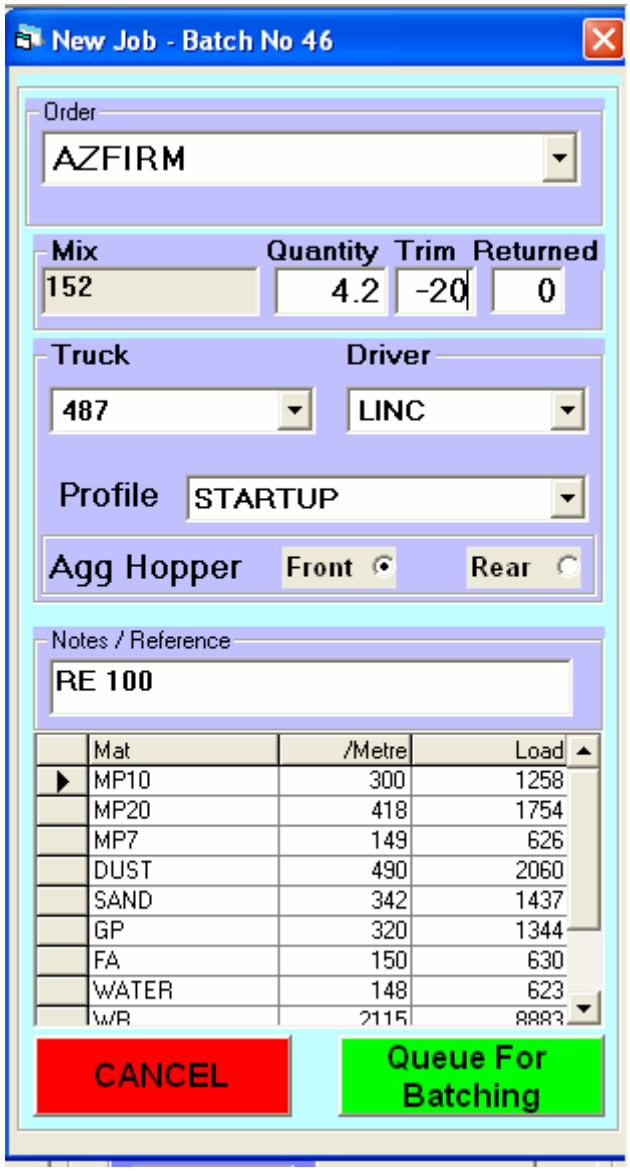
Limited changes only are allowed to a docket. It is possible to correct for using the wrong order, truck or driver. Other batch details remain unchanged for quality assurance purposes.



Ready to batch.

With a plant that has been set up, a database of mix designs, orders and trucks we are ready to let the batching computer do the rest of the work.

Batching a load of concrete requires just an order, a quantity and a truck. The computer knows the project from the order and the project knows the customer.

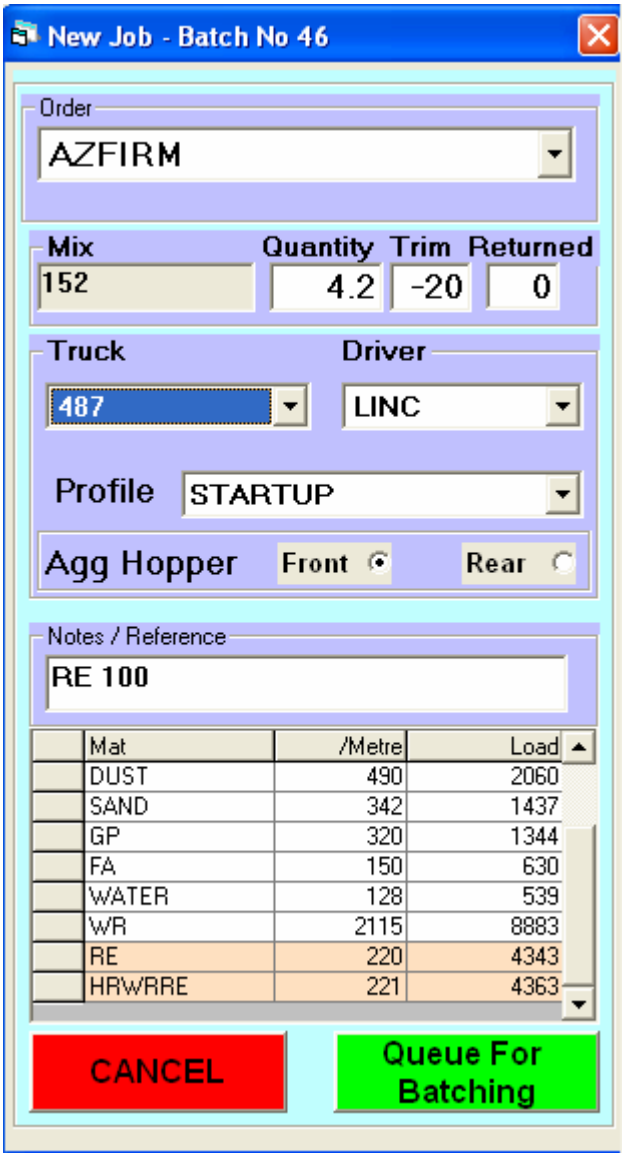


Select the **order** from the drop down.
Enter the **quantity** to be batched and select a **truck**

The **Trim** varies the water from the mix design values and is expressed as litres / cubic metre. (In the above a total of 4.2 x -20 = 84 litres will be held back.

Returned allows for a non empty truck to use a returned load. All documentation is for the load quantity, but the amount actually batched will be (Quantity – Returned)

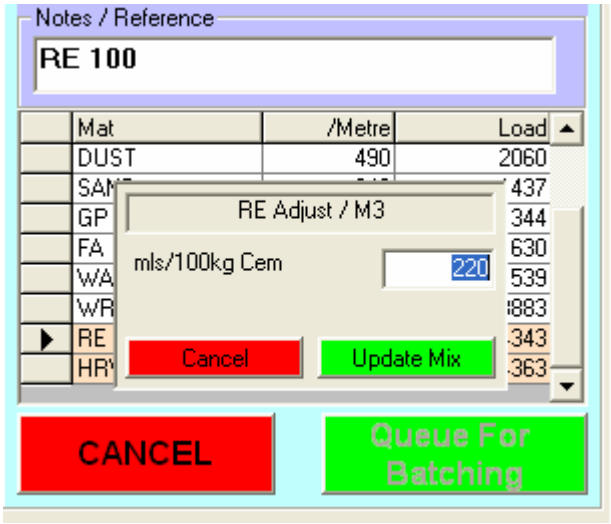
The **Driver** and **Profile** that was originally assigned to the truck in the database may be altered and the alteration is for this load only.



Materials that are modifiable are highlighted in the batching materials list.

Note that materials with units of mls/100kg cementitious use that figure in the /metre column but the total load column is the actual quantity that will be batched (in this case total cementitious (FA and GP) is 630 + 1344 = 1974
So total of RE at 220mls / 100kg cementitious will be 220 x 1974 / 100 = 4343

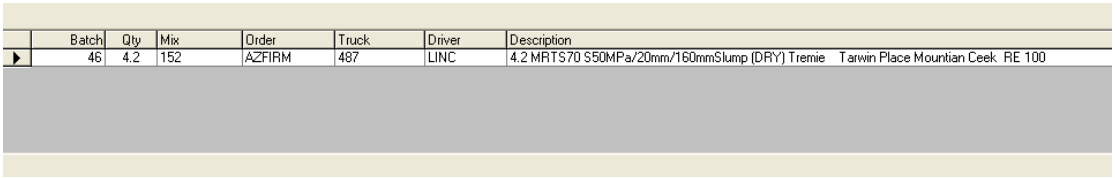
To change a modifiable material prior to batching, click that materials /metre value.



Change the value and click **Update Mix**.

Once batch details are as required, click the **Queue for Batching** button

The batch will be entered into the batch queue

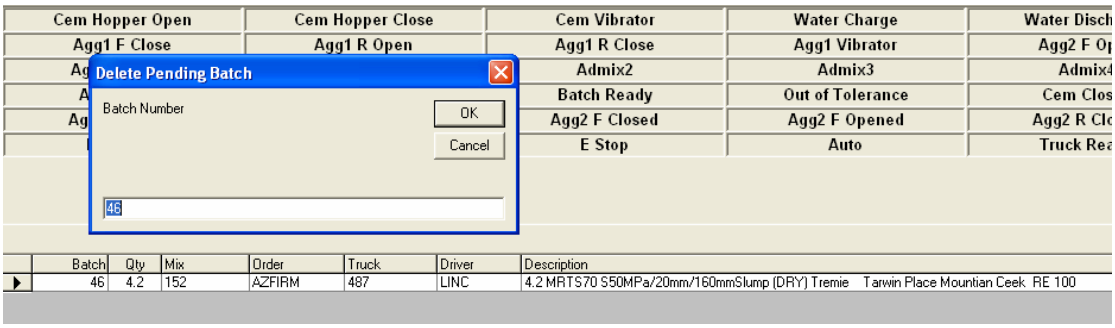


If the plant is in automatic and ready the batch will be removed from the queue immediately and the load will be batched.

The batcher must press the **Truck Ready** button on the control panel before the batched load will move from the weigh hoppers to the truck.

Batch Control

The batch control menu option affects the current or queued batches.



Delete Pending Batch allows for a single batch number to be selected. Delete all pending batches removes everything from the queue. Neither affects the current batch once it has commenced.

Abort current batch clears the process control computer and PLC. Everything will stop and relays will all switch off. The batch can not be restarted. For a temporary halt, switch the plant to Manual then back to Auto when ready.

If the batcher should switch the plant to manual and complete a batch manually for any reason then it is essential to click the Abort current batch menu option before another batch is queued.

Cancel Truck in Position allows the truck ready signal to be removed. It only has effect before the truck has started loading. The batching of materials into weigh hoppers will complete but the load will not go into the truck until the Truck Ready button is pressed again.