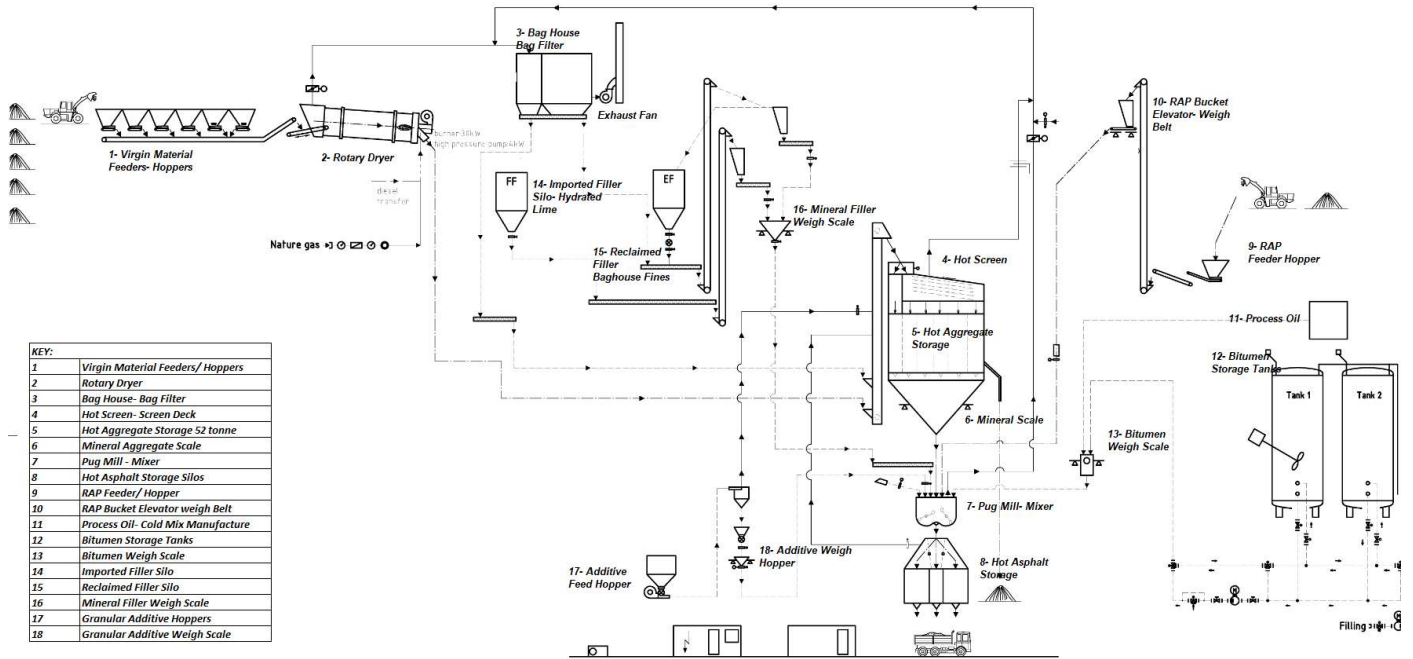


Asphalt Manufacturing Process

S. Jordan- 06/05/2024

Process Flow Diagram Asphalt Plant



1- Virgin Material Feeders/ Hoppers

The cold feeders are receiving hoppers, where virgin aggregate and sand materials are bulk fed using a front-end loader, where the loader collects the desired material from the stockpile or storage bunker and transports the material to the desired receiving hopper.

The hoppers are labelled with the material that they hold, and the job of the front-end loader operator is to maintain each of these hoppers to above half full capacity as the Asphalt plant is running.

Each of the hoppers will empty and feed the plant at a different rate dependant on the Asphalt Recipe- which is governed by the mix design.

Materials held within the hoppers are normally as follows:

- Natural Washed Sand
- 5mm minus aggregate
- 7mm minus aggregate
- 10mm minus aggregate
- 14mm minus aggregate
- 20mm minus aggregate

Each of the hoppers has its own conveyor belt that is calibrated to the density and moisture of the material within each hopper, the conveyor belt will then run at a desired speed inline with the mix design or recipe set by the plant operator.

Each conveyor then discharges the material continuously running onto another main collecting conveyor belt- where all of the materials are combined together- as they are then transferred to the Rotary Dryer in Zone 2.

2- Rotary Dryer

The Rotary dryer is a rotating inclined Counterflow drying drum with internal flights and lifters that lift and veil the incoming virgin materials as they travel down the incline of the dryer- where a controlled burner flame generates radiant heat which dries both the moisture that is contained within the materials and then superheats the materials to between 160 and 240 degrees Celsius dependant on the asphalt product being produced.

The burner unit of the rotary dryer is dual fuel where it can run on either Natural Gas or XLS- Diesel.

The material then exits the rotary dryer at the bottom end and is now at the desired temperature, where it enters into the virgin bucket elevator- which is a vertical enclosed chute that has an elevating rotating chain with small buckets attached to the chain, the buckets collect the material as it enters the base of the elevator and elevate the material all the way to the top of the plant, where the material is discharged as the buckets pass over the head sprocket and discharges the material into a discharge chute and into the Screen deck.

3- Bag house- Dust extractor

As part of the rotary dryer process in order for the burner flame to exist inside the enclosed rotary dryer, we need fuel and air. Where the fuel source is either Natural Gas or Diesel, and the oxygen is provided by an exhaust air fan, creating suction within the rotary dryer- whereby the suction for the air, also extracts finer particles from the drying process and passes the exhaust air through a baghouse filter module, where all particulates and exhaust stream air is filtered through Nomex high temperature filter bags before the exhausting air and steam generated from the inherent moisture within the material is sent to the plant exhaust stack as clean air.

The particulate captured within the baghouse filter are then elevated up and into a sealed storage silo- where they are then metered back into the asphalt mix as a part of the recipe.

4- Hot Screen

Once the heated virgin materials have been elevated to the top of the asphalt plant, they are then re- screened back into more refined fractions, and then held in in section 5 the hot aggregate storage silos.

The material that passes over the screens is screened out into the following fractions

- Fines- 0-3.5mm
- 7mm- 3.6mm-7mm
- 10mm- 7mm- 10mm
- 14mm- 10mm-14mm
- 20mm- 14mm-20mm
- Oversize- any foreign or oversize material is rejected and into a separate holding chute for disposal.

5- Hot aggregate Storage Silo

The hot aggregate storage silos are individual holding silos where the hot and dry material is stored awaiting the next stage of the process. It is important to point out that up until this point every part of the process is continuous. Material is constantly being fed, conveyed, dried, elevated and stored.

6- Mineral Scale

The Mineral Scale is a large calibrated weigh hopper, where dependant on the mix design or recipe that the operator has selected. The above hot stored material is weighed individually to generate a batch.

A full batch may be a total weight of 2 tonnes. Whereby a percentage of fines will be weighed up to a desired weight, then the 7mm will be weighed up and then the 10mm and so until all of the desired materials and weights are achieved.

Whilst the mineral scale is weighing up the Virgin materials, the following materials are also weighing up in parallel:

- Bitumen Weigh Scale 13
- Mineral Filler Scale 15
- RAP Weigh Belt Scale 10
- Granular Additive weigh Scale 18

Once all of the above-mentioned components have weighed up to the desired recipe and to the percentage within the recipe, they then discharge from their applicable weigh scale and into the pug mill mixer 7.

7- Pug Mill Mixer

The pug mixer is a twin shaft counter rotating mixing chamber where all of the materials within the recipe combine together and mix until a homogenous finished asphalt product is produced, where normal mixing cycle times are between 45 and 60 seconds.

Where the finished batch of asphalt is then discharged from the mixer and into one of 3 designated hot asphalt storage silos where the asphalt is stored in readiness for loading.

8- Hot Asphalt Storage- Load out

The hot Asphalt storage silos consist of 2 x 50 tonne storage silos and a single 6tonne silo, whereby different mixes or quantities can be stored in the individual silos ready for loading into the customers vehicle. The two large silos are

designed in order to hold enough capacity to fully load a truck and trailer with asphalt- where the asphalt can be mixed in advance of the truck arriving and stored for several hours without loss in temperature.

Once the truck arrives the truck is positioned on the inground weighbridge under the designated storage silo where the weighbridge automatically communicates with the asphalt plant load out to accurately load the truck- where the truck will then be visually inspected and temperature checked at the Laboratory sampling stand- before departing the site.

12- Bitumen Storage Tanks

Bitumen Storage tanks are 3 x 60m³ Vertical tanks that are insulated and clad with electrical base heating, the tanks are located with a suitably sized concrete bund area.

The liquid Bitumen is received into the tanks via road tanker, generally 25,000 litres per load.

The bitumen is sucked into the tanks via a plant-controlled pump, where the bitumen is then stored at 165degrees Celsius. The bitumen is then fed to the batching plant as required through electrically heated and insulated bitumen pipework, where the bitumen is then weighed in the bitumen weigh scale as required by the batching computer and forms part of the asphalt recipe (13).

Note bitumen is only pumpable above 150 degrees Celsius.

With Bitumen being stored at elevated temperature, the tanks have a co-joined breather pipe which allows the tanks to vent to air, where normally this is an emission point, The vent is plumbed into a suitable activated carbon filter for any vapours/ odours to be captured before being freely vented to atmosphere.

14- Imported Filler Silo

Imported Filler is normally Hydrated Lime, which is received into the plant via road pneumatic tanker, where the tanker pneumatically pumps the lime into a 60m³ vertical silo for storage.

The filler is then elevated via an enclosed bucket elevator up to a small enclosed holding hopper ready for batching, where the filler is augered across to the filler weigh scale (16) as required by the batching computer and forms part of the asphalt recipe.

15- Reclaimed Filler

Reclaimed filler is the fine particulates that are captured in the baghouse filter system, these fines are then elevated via an enclosed bucket elevator and into a small enclosed holding hopper where they too are augered across to the filler weigh scale (16) as and when required via the batching computer as part of the Asphalt recipe.

17- Granular Additives Addition hopper

Granular additives can be a variety of additives as follows

- Cellulose Fibre- Paper fibre granules used in SMA- Stone Mastic Asphalts to prevent bitumen draining within the open grade of asphalt added at 0.3% of total asphalt mix
- Crumb Rubber- Granulated recycled truck tyres added to crumb rubber specific asphalt mixes.

The above-mentioned materials are elevated via a bucket elevator to small holding hopper, where they are augered and weighed via the additive weigh scale (18).

Normally only one of the above-mentioned materials are incorporated into current mix designs as they are each unique to specific mix designs or recipes.

These materials are introduced into the pug mill mixer cold (7), as part of the wet mix process, where the elevated temperature of the heated virgin materials is transferred into the small quantity of additives as they mix together within the pug mill.

9- RAP Feeder Hopper

RAP stands for "reclaimed asphalt pavement", where the old, aged asphalt pavements and any waste asphalt produced is stockpiled and re screened to generate controllable fractionated RAP with a known particle size distribution and known residual binder content.

Where the processed RAP is fed into a feeder hopper via the front-end loader, where it is also metered via a conveyor belt and into a bucket elevator (10), where it is elevated to a small holding hopper. Where when required the RAP, material is metered directly into the pugmill mixer via a weigh belt, to achieve the required weight inline with the recipe.

The plant is capable of running up to 30% RAP addition through this system.

11- Process Oil

Process oil system is a liquid dosing pump that adds an oxidizing agent (Recosol 185) liquid additive to the bitumen weigh scale, when manufacturing Cold Mixed Asphalt.

Cold mix Asphalt is an asphalt that is produced at lower temperatures than standard hot mixed asphalt, where the additive is added to the binder to slow down the oxidizing properties of the finished asphalt, allowing the asphalt to be used for longer in smaller quantities, for works such as pot holes, temporary trench reinstatements etc.