The current world economy has put additional pressures on the cement industry to cut costs and make every process more efficient. Improving plant performance requires the process to be monitored more closely using fewer plant personnel.

One of the areas that can offer a measurable improvement is **process sampling**. Often times sampling for quality and compliance purposes is accomplished by manual means using a batch method (shovel/scoop). Some plants utilize automated batch type samplers that were provided by the plant designer. In both cases, the quality of the sample itself (how well the sample represents the process) and ease of use (does the operator actually take the sample at the appropriate time) are suspect.

The use of automatic samplers that were properly selected for the application can improve the sample quality by providing a representative sample taken at the appropriate time while reducing operator workload.

**Typical Cement Plant Sampling Points**

Typical sampling points in a cement plant for quality and compliance, as well as for making process adjustments, include:

- Raw meal prior to storage
- Raw meal line after crusher
- Clinker after the cooler
- Additives
  - Gypsum
  - Fly ash
  - Slag
- Finished cement
Poor Sampling Technique

Typical sampling techniques range from taking a shovel full of material from an access chute to diverter gates that dump material on the ground next to a silo. In many cases the samples taken are not consistent because:

- They are grab samples that represent a moment of time as it relates to product flow
- The exact point and method that each operator takes the sample varies from time to time and person to person
- Manual samples can be limited to several samples per shift due to the time required to get to each point
- Diverters or improperly placed sample probes often do not take a sufficient cross section of material

Safety

Another aspect of sampling that has recently received attention is the fact that many of the sampling points, specifically load-out areas, are dangerous to access and work in. Several plants have experienced accidents involving operators taking samples during load-out to trucks and barges. Manually accessing product in a flow stream is always hazardous with an element of personal risk. At the expense of process control, perceived or actual hazards may be a serious disincentive for the operator to take the samples.

Automated Sampling

There are a variety of automatic sampler types available for the applications that exist within a cement plant. The three primary sampler types are:

- **Point** — takes a sample from a single point within the process stream. Point samplers rely on product homogeneity to produce samples that are representative of the process stream. Point samplers are usually more compact and are good fits for space-limited applications.

- **Strip** — takes a sample from a strip of the product flow stream. Strip samplers are an economical way to get a representative sample from a product stream.

- **Crosscut** — takes a complete cross-section “cut” of product from a flow stream. Statistically, this is sampler style provides the most representative samples. Cross-cut samplers are typically rather large and require a good amount of “head space”.

![Sampling Modes](image)
Advantages of automatic samplers

Automatic Samplers are More Representative of the Process
In most cases, samplers used for cement applications are used to take small, incremental samples of the flow stream to provide an integrated composite sample. A composite sample is statistically and empirically more representative of the process than a single grab or batch sample.

Automatic Samplers Eliminate Variability
Samplers that are automated using PLCs or DCS systems are very repeatable and do the same action each and every time they operate. Taking human variability out of the sampling equation, the resulting samples are much more consistent and representative of the process.

Higher Productivity - More Samples Can Be Taken for Less Cost
Since automatic samplers are programmed to repeat the sampling function as often as necessary and in conjunction with the process, more samples can be taken within the same time period as compared to samples being taken by an operator.

Automatic Samplers Offer More Flexibility
Automated samplers can be integrated with weighing systems, motor or belt speeds or other product flow measuring systems. These samplers can actuate proportionally to changing product flow rates. Samplers can also be re-programmed for variable process configurations.

Where to locate the automatic sampler

An automatic sampler can be located on a vertical or sloped gravity discharge chute, a straight-sided or sloped hopper, vertical or horizontal pneumatic conveying lines, screw, belt, or drag conveyors, and most kinds of process equipment. Space restrictions at the desired sampling location is often a factor in the choice of sampler model.

A tube sampler is typically mounted at a 45-degree angle off the equipment, while a tube-and-auger sampler can be mounted horizontally. Therefore, if both samplers will work for the particular application and space is at a premium, the most likely choice is the tube-and-auger sampler. The cross-cut sampler with pelican diverter takes much more space than the other types. Because its housing needs to be big enough to contain the pelican diverter on each side of the equipment component it is attached to, it will be at least twice as wide as the component. This type of sampler also requires a lot of flange to flange space vertically. If the application requires a crosscut sample but there isn't enough space, it may be possible to modify the equipment. If not, the next best choice is a tube or tube-and-auger sampler that works in a strip sampling mode.

A range of samplers from various manufacturers is available in all of the basic sampling modes and operating types described here, in varying configurations. In addition to the sampling purpose, the material’s physical properties, and the sampler’s intended location, these factors will help determine which model best suits the specific application:

• Available utilities for powering the sampler
• Equipment the sampler will be interfaced with
• The sampler’s control method
Applications

Several large global cement producers use automated sampling on their air-slide or air-box loaders to take composite samples of final product during the load-out process.

In one example an ISOLOK® automated point sampler is used on an air-slide during the loading of barges. The ISOLOK® point sampler was chosen because of its compact design and simplicity. The ISOLOK® is used in lieu of a person taking a sample from the barge itself or from the man-bridge over a truck or train loading area.

The Sentry Model RX Sampler is also used widely for air-slide applications. This type of sampler takes a representative sample from the center of the product flow using a special adapter allowing it to penetrate through the air slide’s fabric membrane.

The photo on the next page shows a typical air slide used in a truck loading area. This is an excellent place to utilize the RX, strip-style sampler.

Another area where automatic sampling is utilized in the silo or feeding system just prior to mixing on a conveyor belt. In this example, clinker, gypsum, fly ash and slag are all loaded onto a conveyor belt from different silos. The plant is currently taking manual samples one time every four hours. This plant has budgeted to install automatic samplers in order to take automated, composite samples every hour for each silo.
Conclusion

It can be seen that automated samplers in the cement process offer:

- Samples that are more representative of the process
- Reduced variability
- More sampler productivity
- Improved safety

Cement companies that employ automated samplers enjoy improved sampling with less labor cost with the cost savings moving to the bottom line.