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Most ethanol travels in non-insulated, general-purpose tank cars. This 30,000-gallon car is typical.

from Pikestuff (HO and N) and Micro Engineering (N) kits.

Plastruct offers a huge selection of tanks, piping, and related details appropriate for any scale. Walthers also has a couple of refinery piping kits, safety cages and ladders, and truck and tank car loading racks that could be modified to represent those at an ethanol plant.

Walthers and others offer concrete grain elevators (and related conveyors and piping) that could be kitbashed to represent grain storage structures, or these items could be scratchbuilt starting with plastic tubing or pipe.

The track plan below shows one option for modeling a plant.

You could build a model on a fairly narrow shelf, including just the tank car and hopper loading areas with a limited number of tanks and structures. If you have the room, you can add additional features, including truck access roads, scales, and other details.

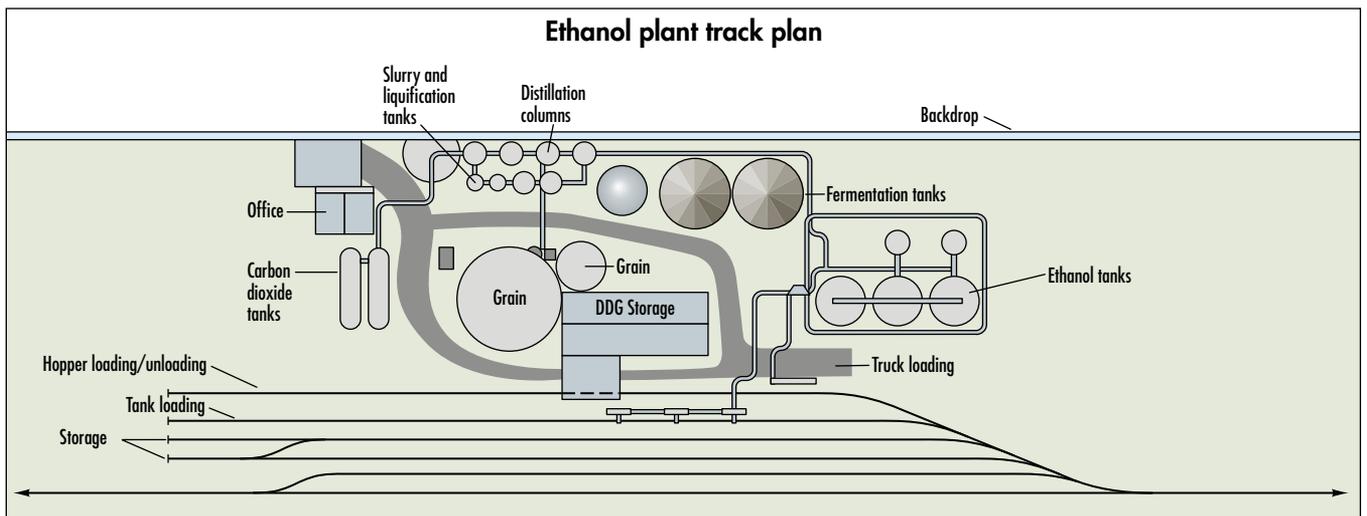
At minimum, include at least two tracks: one for hopper loading/unloading and one for tank loading/unloading. Try to make room for an extra track or two for storing cars. These tracks can parallel the main line to save space, or they can curve and go into the plant.

Vehicles are important details on a layout. Modelers in HO have

the best selection, with Lone Star's nice Wilson grain trailer and farm trucks from other manufacturers. Modern tank trucks from Department 1-87 or Model Power would also add to the scene.

Don't forget the small details: Workers with hard hats are made by Preiser, Woodland Scenics, and others, and modern safety and warning signs are available from Blair Line and JL Innovative Design. The name of the facility is often painted on the concrete grain silo; this can be added with dry-transfer or decal letters.

Appropriate modern rolling stock is available from Athearn, Atlas, Proto 2000, Walthers, and others.



# Cement



Cement is the key ingredient in concrete and mortar, and it played a major role in construction as far back as the building of the Erie Canal (1817-1825). At that time, production of natural hydraulic cement in the United States began, followed by the introduction of portland cement in the 1870s. Shipped by rail since the 1800s, cement was one of the first products to be carried in bulk in covered hoppers. The huge manufacturing plants that convert limestone and other materials into cement offer many possibilities for modeling.

Modern cement plants are huge operations. The Keystone Cement Co. near Bath, Pa., sprawls over nearly 1,000 acres. The plant's horizontal 15 x 550-foot main kiln is at the upper left; the rest of the plant is dominated by storage structures and silos for raw materials, clinker, and finished cement. *Jim Hediger*

TWO



Limestone passes through crushers at the quarry and then goes to the cement plant by conveyors or large dump trucks. *Historic American Engineering Record*



Several large concrete and steel storage silos dwarf the two-bay hopper cars ready for loading at the Southwestern Portland Cement Co. at Victorville, Calif., in the early 1950s. Two loading tracks run among the silos. *Donald Sims*

### Cement and concrete basics

The words *concrete* and *cement* are often used interchangeably – and incorrectly. Cement is the powder that serves as the binder for the raw materials that go into concrete, which is the mix of cement, aggregates, and water.

Common cement has been around for centuries (made from volcanic ash and other materials), but its composition and strength were inconsistent. The discovery of portland cement, which makes up about 95 percent of the cement used today, helped make concrete a strong and versatile construction material.

Portland cement dates to the 1820s, when British stone mason Joseph Aspdin developed a powdered mix of heated limestone and clay that hardened when water was added. Aspdin dubbed the mix portland cement for its color, which resembled a highly desired type of building stone found on the Isle of Portland. Portland cement is now made by many manufacturers around the world.

The first portland cement plant in the United States dates to 1875 in Pennsylvania's Lehigh Valley, an ideal location with easy access



Raw materials at the Keystone plant are stored in a large partially covered shed. *Jim Hediger*

to high-quality limestone and coal. Cement plants are now located across much of the country. As of 2007, 115 plants in 36 states annually produce about 120 million metric tons of cement.

Modern portland cement is a mix of calcium, silicon, aluminum, and iron. These elements come from different raw materials, with limestone, silica, clay, and sand being the most common. About 3,500 pounds of raw materials are needed to produce 2,000 pounds of cement.

Limestone (providing calcium) is the main ingredient of cement, making up about 80 percent of the needed raw material. Clay and sand provide silica, aluminum, and iron. Many plants use slag from iron blast furnaces as a source material; others use fly ash or bottom ash from power plants. Other raw materials include shale, copper slag, foundry slag, and spent sandblast grit.

These materials are blended, ground to a powder, and heated in a kiln to produce clinker, which, in turn, is finely ground into cement.

Concrete is a combination of cement, coarse and fine aggregates, and water. The water triggers a chemical reaction (hydration) that hardens the cement, which acts as a binder to hold the aggregates together. The resulting concrete is as hard or harder than most natural rock.

Concrete is versatile because, when wet, it can be readily shaped, formed, and molded. It can be precast in standard shapes such as blocks, pipes, beams, and other structural components. As ready mix, it can be poured into forms at construction sites.

The cement industry presents several opportunities for modeling, including the huge factories that produce cement, smaller terminals and cement dealers that reload cement from hopper cars

to trucks, and concrete batch plants that make and deliver ready-mix concrete.

### Cement plants

Cement plants are huge operations that can take up more than a thousand acres between manufacturing and quarry operations. It's not economically practical to haul limestone long distances, so plants are often situated near a source of that key ingredient. Limestone can enter the plant by conveyors, large dump trucks, or railcars, depending upon the distance involved. A primary crusher at the quarry breaks rocks to manageable (baseball) size, and a secondary crusher at the quarry or plant grinds the materials to the consistency of gravel. Other raw materials (clay, slag, sand, and ash) are shipped by rail, as is coal that fires the kiln.

Some plants store raw materials outdoors in large piles, with