

## Case Study: Foundry Sand as Structural Fill

### Kohler Co. and a “Big Box” Store

Founded in 1873 and headquartered in Kohler, Wisconsin, Kohler Co. is one of America’s oldest and largest privately held companies. Kohler is a global leader in the manufacture of kitchen and bath products, engines and power generation systems, cabinetry, tile and home interiors, and is international host to award-winning hospitality and world-class golf destinations.

Because of its global presence, Kohler is involved in a variety of industrial waste recycling activities worldwide. This case study addresses just one of the company’s recycling initiatives in which Kohler beneficially reused spent foundry sand as structural fill for a “big box” store development. The big box store was an expansion to an existing strip mall in the Village of Kohler, Wisconsin. The existing mall was built on a hill, and the site for the new store ranged from the top of the hill onto the slope of the hill. The big box store wanted to raise the site’s grade so that the entire site of the new store would be level with the existing strip mall.

As a generator of spent foundry sand interested in promoting reuse, Kohler realized the importance of familiarizing potential end-users with its byproduct. Prior to this “big box” store project, the foundry connected directly with area contractors in the Village of Kohler to demonstrate how spent foundry sand may be used as a substitute for virgin fill materials. By building these relationships, contractors were more likely to contact Kohler when they had construction projects that required structural fill.

Further, Kohler also developed procedures to ensure that they supplied quality spent foundry sand to their end-

users. During the waste generation process, Kohler sorted spent foundry sand from other foundry waste materials. For each work station in the foundry, Kohler identified where that work station’s waste must go in order to keep reusable material (like spent foundry sand) separate from other materials. These procedures enabled Kohler to provide “cleaner” fill material to its beneficial reuse customers.

Given these sensible business practices, Kohler partnered with the big box store’s building contractor to supply spent foundry sands to be used as structural fill material for the project. Kohler provided 36,000 tons of spent foundry sands to the project. With the assistance of engineers and other experts, the team conducted geotechnical testing on the spent foundry sand to evaluate its properties. The geotechnical testing revealed that the spent foundry sand reached its maximum density when the moisture content of the sand reached 7-9 percent. The required moisture content for the project was approximately 8 percent. To achieve the required construction moisture content, Kohler mixed its spent foundry sand with water at the foundry site, then loaded the foundry sand onto a truck and hauled it to the construction site.

Once at the site, the contractors spread the foundry sand in thin horizontal lifts, and compacted the lifts using vibratory smooth drum rollers and the construction equipment. During the compaction efforts, a geotechnical engineer oversaw the testing as field technicians performed density and moisture content tests.



Figure 1. Transferring spent foundry sand to the construction site.

Placement of the foundry sand followed a specific process to ensure that it met density and moisture requirements. If the foundry sand density and moisture levels met the requirements at placement, the contractors added another layer of sand and repeated this process. If not, the contractors had to re-compact the foundry sand and/or perform moisture conditioning to achieve the moisture and density specifications. This process was repeated until the layers of foundry sand raised the project site up to the grade of the rest of the strip mall. Each step in the project required close coordination between Kohler and the earthwork contractor in order to keep the operation running efficiently.

Kohler completed the big box store project in 2003. The project resulted in a variety of benefits. First, this project saved virgin resources from being used because without Kohler's spent foundry sand, the project team most likely would

have used virgin materials as fill, rather than a recycled material. In addition, Kohler's alternative to reusing foundry sand was to send sand to a landfill. Therefore, this project kept 36,000 tons of spent foundry sand out of a landfill, and reduced the demand for landfill space.



Figure 2. Compacting fill material at the project site.

In terms of technical advantages, by using foundry sands, the project started earlier in the construction season than would have been the case with virgin materials. The native soil in this region of Wisconsin is largely clay. As with foundry sand, clay soils must have the right moisture content if they are to be placed for structural fill. However, unlike foundry sand, clay's moisture content is weather-dependant and can only be used during drier times of the year. Therefore, by using foundry sand, the building contractor started the project earlier than it would have with virgin soil.

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<b>Personnel</b>	<p><b>End User:</b> “Big Box” Store development</p> <p><b>Foundry:</b> Kohler Co.</p>
<b>Site</b>	<p><b>Recycling Location:</b> Kohler, Wisconsin</p> <p><b>Site Description:</b> A big box store wanted to raise the grade of its construction site so that the entire site of the new store would be level with an existing strip mall adjacent to the site.</p>
<b>Materials Utilized</b>	Spent foundry sand used as structural fill.
<b>Project Costs and Benefits</b>	<p><b>Costs Include:</b></p> <ul style="list-style-type: none"> <li>• Kohler’s operating costs for sorting beneficially-reusable foundry waste materials from unusable waste.</li> </ul> <p><b>Benefits Include:</b></p> <ul style="list-style-type: none"> <li>• This project kept 36,000 tons of spent foundry sand out of a landfill, and reduced the demand for landfill space.</li> <li>• The project team would have used virgin materials as the fill material, rather than foundry sand. So, this project saved virgin resources from being used.</li> <li>• By using foundry sands, the project started earlier in the construction season than would have been the case with virgin materials.</li> </ul>