



Engineer Andrey Rudenko "printed" out this authentic looking castle layer by layer, using a machine he built himself. Castle measures 15 ft. wide, 12 ft. deep and 9 ft. tall.

## He "Printed" A Concrete Castle Using A Home-Built Machine

The first concrete 3-D printed building in the world was completed in a Minneapolis, Minn. suburb in August, 2014. Engineer Andrey Rudenko "printed" out the authentic looking castle layer by layer using a machine he invented in his garage.

After considerable trial and error, Rudenko was able to design a custom-made 3-D printer so that it prints nearly perfect layers of concrete. "My current standard is 10 millimeters in height by 30 millimeters in width, but countless other options are available with just the click of a button," he says. The 9-ft. tall castle is 12 by 15 ft. in size. He made it to prove the technology can now be used to "print" a house.

"A new era of architecture is inevitable, and I'm excited to see where the next few years will lead in terms of construction and design," Rudenko says. "Prior to the castle I believed I could print homes, but having finished the castle, I now have proof that the technology works."

Rudenko's printer extrudes concrete in very fine, high-quality layers. It's controlled by a computer that prints directly from CAD files using a chain of software tools. The printer is based on the RepRap project, which started the open-source 3-D printer revolution. The machine includes rails, beams and a control box that uses computer designs to print various shapes. The concrete is a custom blend of bagged concrete, sand



Printer is controlled by a computer that prints directly from CAD files using special software.

and additives. Rudenko says his castle cost about \$1,000 for cement and sand. He says the cost of the 3-D machine "is undefined at this point."

After his concrete castle was publicized locally, Rudenko says he started receiving requests to print castles and other art structures. His next priority, however, is to get his printer ready for a full-scale livable 2-story house. He'd like the printer to work 24 hrs. a day until the project is completed.

"The first house is going to be experimental," says Rudenko. "Hopefully, architects will come up with some unique design. My focus will be on delivering high-quality 3-D printing of the house walls."

Contact: FARM SHOW Followup, Andrey Rudenko (www.totalkustom.com; 3dprint@totalkustom.com).

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Ruth Macias had a local contractor build this 6-sided, screened-in gazebo and anchor it to the concrete slab from an old grain bin.

## Old Grain Bin Floor Makes Ideal Foundation

An old grain bin slab made a perfect base for a screened-in gazebo on Dean Turner's Minnesota farm. The bin, which had not been used for several years, overlooked a creek and a nice rolling pasture.

The slab was solid and free of cracks. Ruth Macias, Turner's daughter, had a local contractor build the 6-sided wood gazebo and anchor it firmly to the concrete base. The gazebo has three 6-ft. patio doors and three solid walls with half windows. The exterior has painted white trim and white lattice beneath the windows and a shingled roof. The inside is trimmed with tongue and

groove pine and shades are installed on all of the windows and doors. Electricity operates a TV, refrigerator, microwave, a ceiling fan, a heater and reading lights.

"The gazebo is the perfect place to spend the summer," says Macias. "We open it up as soon as possible in April and use it until late October. When it's cool we turn on the electric heater and when it's hot we open the windows, turn on the fan and there's always a breeze. It's a great place to eat, relax, watch TV and hang out."

Contact: FARM SHOW Followup, Ruth Macias (ph 561 714-1282; rumaci@aol.com).

## High School Senior Restores Rare Schafer 4-WD Tractor

By Lorn Manthey, Contributing Editor

Cody Garrett isn't afraid to take up a challenge the size of his home state of Texas. During his senior year at Cuero High School in 2013, Garrett tackled the restoration of a big Schafer tractor that took him more than 900 hrs. to complete.

"I went into the project thinking I could get it done in 300 to 400 hrs., but one thing led to another and the time just kept adding up," says Garrett. He was so excited about the work, however, that he rarely thought the project was too time consuming.

Garrett says he researched tractors on the internet and found out about the Schafers. A nearby rancher agreed to front the cost, having seen what Garrett did with two previous restorations of smaller tractors.

"They only made about 25 of these big Schafer tractors in Pratt, Kansas in the 1960's," says Garrett. "I found out there was one for sale in North Dakota, and another restored one that was located in Minnesota." Garrett and his family visited the Minnesota museum to see the restored tractor, then picked up the used Schafer to restore in North Dakota. The machine cost \$6,500. On their trip home from Dakota they stopped in Pratt

and several people asked them about the tractor they were trailering, knowing it was originally built in their town.

"We met Lawrence Voss, who had worked for the tractor manufacturer years earlier, and he told us some interesting stories about the tractors," Garrett says.

As he started the restoration Garrett found it difficult to locate parts because so few of the tractors were produced. He and his father made trips to Colorado and the FP Smith Company in California, where they found engine parts and almost every seal they needed. They also bought a badly damaged Schafer for parts in Colorado. During the restoration, which he started in June 2013 and completed in early August, 2014, Garrett removed every bolt, washer, gasket and seal on the tractor. He inspected, cleaned, repaired or replaced each part. The refurbished tractor has a R96 Fuller transmission and a completely overhauled UD554 engine that produces about 130 hp at the drawbar. He was able to rebuild the engine himself, except for making replacement sleeves, which he had custom-produced in Iowa.

"The tractor starts easy and runs smooth,"



Cody Garrett restored this rare 1960's Schafer 4-WD tractor during his senior year in high school. It took him more than 900 hrs. to complete and he won overall Grand Champion in Chevron's 2014 Delo National Tractor Restoration Competition.

says Garrett. It has new hydraulic hoses, new electrical harnesses, a new paint job and new decals. Garrett did the sandblasting and spray painting himself. Titan provided 4 new 23.1 x 26 10-ply tires. Garrett says the sponsor has invested more than \$58,000 in the restoration, but he doesn't know how much the tractor would be worth on the open

market. It might be worth a lot more since he was just named Grand Champion in the 2014 Delo Tractor Restoration Competition. The win means he'll be traveling across the U.S. representing Chevron Delo at shows.

Contact: FARM SHOW Followup, Cody Garrett, 2411 Friar Rd., Cuero, Texas 77954 (ph 361 275-6549).