2023 INNOVATION CHAMPIONS CONTEST

Fifth-Wheel Quick-Attach Sander

COUNTY: McKenzie County Highway Department

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PROBLEM STATEMENT:
There are inefficiencies within the department resulting from vehicles in the fleet only being used seasonally. Dump trucks were used primarily in the winter for sanding the roads. In the summer, the semi-tractors with a fifth wheel connection were hooked up to semitrailers and used for hauling gravel. During the winter months the semi-tractors and semitrailers were not used. Dump trucks are used randomly in the summer for hauling small amounts of gravel and dirt.

SOLUTION: Designed and fabricated the fifth-wheel quick-attach sander. The frame of the quick attach sander sets on the frame of a semi-tractor, and is secured with the fifth-wheel and king pin connection. The cavity at the rear underside of the sander frame allows the back end of the tractor a snug fit for greater securement.

The frame of the quick-attach sander is fabricated using flat steel, I-beams (serve as frame rail), and square and rectangular tubing. The bed is reinforced with cross beams. The legs (2 – 2”x3” lengths of steel tubing welded together) on each corner can be retracted or lowered with landing gear jacks. The legs can also be extended away from the frame. The legs allow for the quick-attach sander to be free standing so a semi-tractor can easily back under it when needed. Tubing welded on the I-beam serves as a conduit so hoses are protected. The tank/spreader is welded to the sander frame.

Semi-tractors with the fifth-wheel quick-attach sanders are another means for salting and sanding hazardous roads. In addition, each semi-tractor is also equipped with a plow for removal of snow on the road.

LABOR, EQUIPMENT, AND MATERIAL:
Equipment used to build innovation:
Band saw
Welder
Torch
Overhead crane
Drill press

Materials:
New material:
Steel tubing: 92' - 2" x 3" x ¼"
20' – 2"x 4" x ¼"
Square steel tubing: 12' - 5" x 5" x 3/8" (sleeves)
6' - 6"x 6" x 3/8" (sleeves for sleeves)
Steel sheets: (4) 4" x 8" x 3/8"
15 gauge I-beam: 54' – 4" x 8"
15 gauge I-beam: 92" – 3" x 8"
Flat bar: 20' – 6" x 1/2"
Black pipe: 3' – 2" diameter (sleeve for crank shaft – protects from salt/sand)
Landing gear jacks: (2)
Bolts: (16) 5/8" x 1-1/2"
Nuts: (16) 5/8"
Washers: (32) 5/8"
King pin: (1) 2" (welded to underside of sander)
Tail light buckets: (2)
Round LED taillights: (4) 4"
16 gauge 7 connector wire: 20'
7 pin round trailer plug: (1)
Stainless steel sand box with spinner and motor (1)
Hydraulic hoses (2) length varies depending on semitractor used.
Hydraulic quick attach couplings (2)
Stainless steel sand box with spinner and motor (1)

Salvage material:
Angle iron (2) 2' 2x2" used to hold electrical wiring for lights

Total Labor Hours: (includes time needed for design and discussion.)
1 person
160 hours

COST SUMMARY:
92' steel tubing 2" x 3" x ¼" = $1209.80
20' Rectangular steel tubing 2"x 4" x ¼" = $333.00
12' Square steel tubing: 5" x 5" x 3/8" = $493.20
6' Square steel tubing: 6"x 6" x 3/8" = $1162.00

4 Steel sheets: 4” x 8” x 3/8” = $2528.00
15 gauge I-beam: 54’ – 4” x 8” = $1260.90
Flat bar: 20’ – 6” x 1/2” = $263.00
3’ Black pipe: 2” diameter = $35.11
Landing gear jacks set (2) = $625.00
1 Stainless steel sand box with spinner and motor = $26,000
= $33,910.01 plus items listed below
16 Bolts, nuts, 32 washers
1 2” King pin
2 Tail light buckets
4 4” Round LED taillights
1 16 Gauge 7 connector wire
1 7 Pin round trailer plug
2 Hydraulic hoses
2 Hydraulic quick attach couplings

Total Approximate Cost: $ 33,910.01 plus labor

SAVINGS AND BENEFITS:
With the fifth-wheel quick-attach sander, the road department is using its semi-tractors year around. When roads are icy, creating hazardous driving conditions, more vehicles are available to apply salt or sand to the roads. More sanders on the road result in safer roads for the traveling public. Each semi-tractor is also equipped with a snow plow for snow removal.

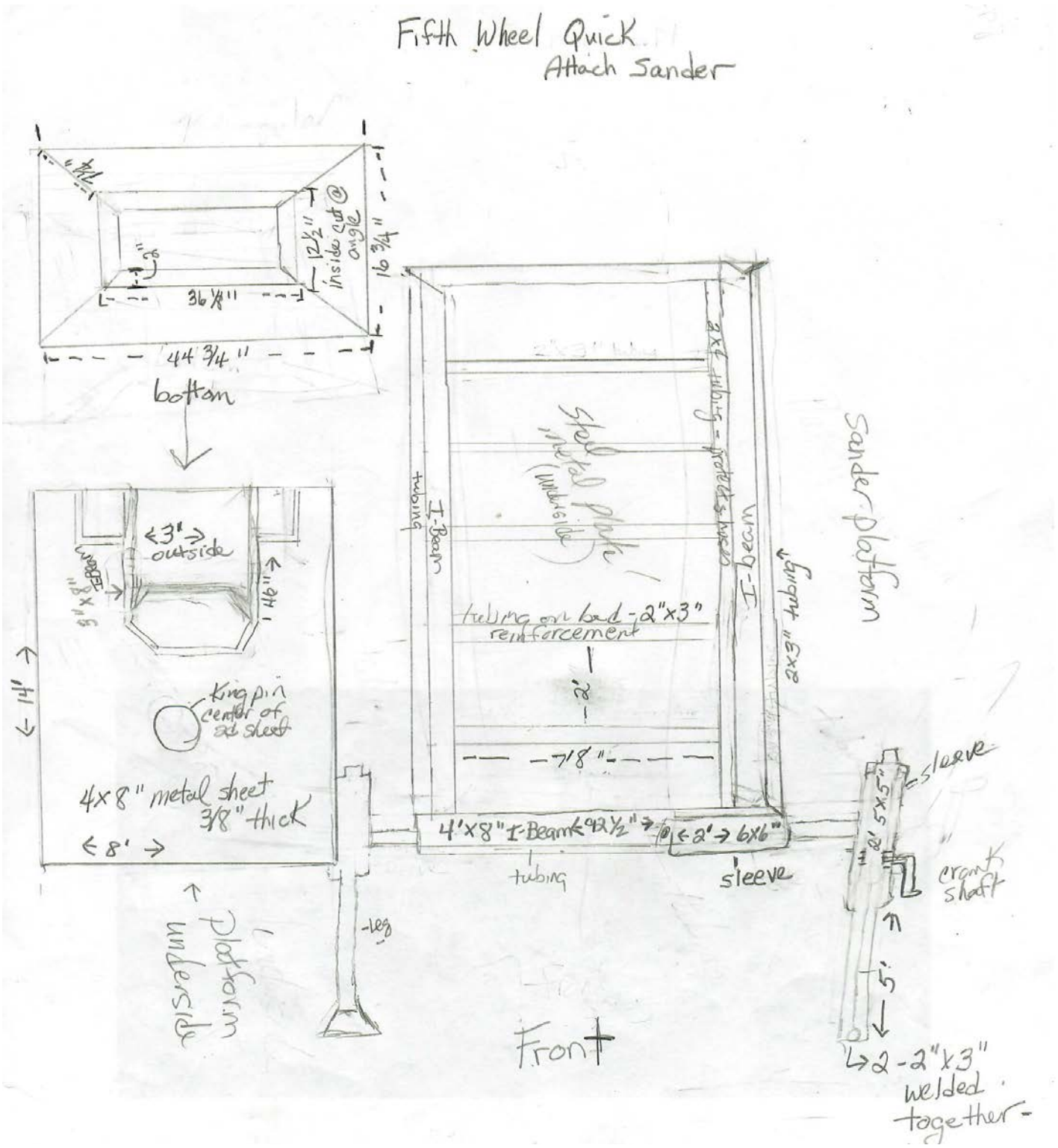
As a result of this innovation, fewer dump trucks are needed. With fewer vehicles requiring maintenance there is savings of time, manpower, and money. The fifth-wheel quick-attach sander is larger than those on dump trucks, so larger volumes of sand and salt are hauled. This reflects a cost savings to the road department and tax payers. Money that is typically used for buying dump trucks will be used elsewhere. The fifth-wheel quick-attach concept opens the door for utilization of a water tank, hydro seeder box, or car carrier as well.

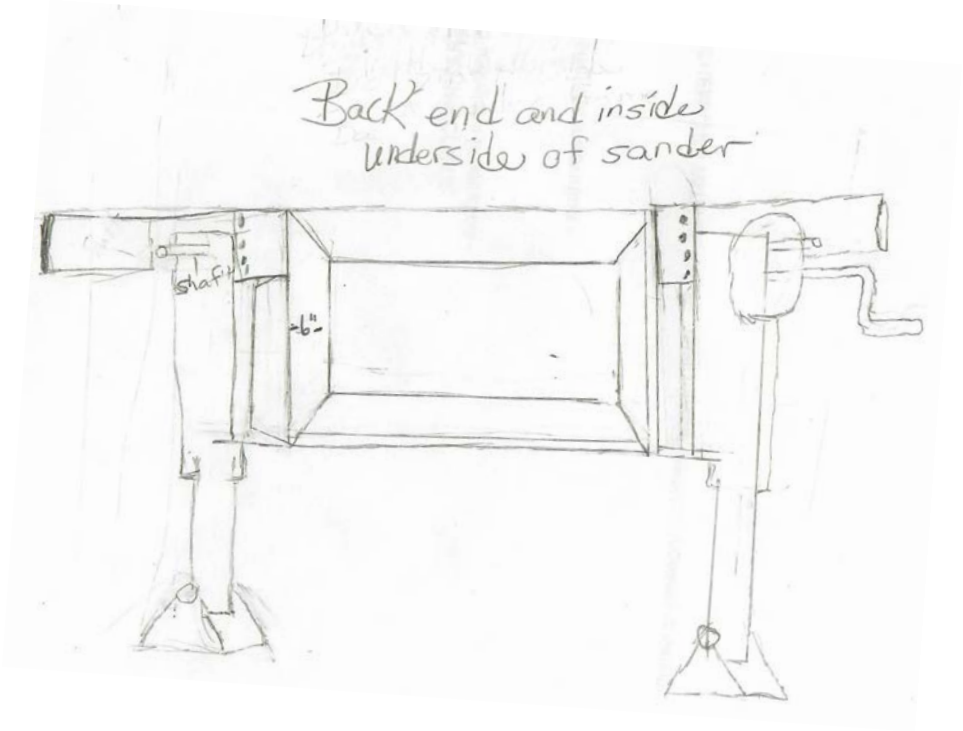
ANNUAL OPERATING COSTS:

Prior to using the innovation – Only dump trucks were used for sanding icy roads. Semi-tractors were being used with a semi-trailers were being used only to haul gravel and dirt during the warm weather construction season. During the winter months, semi-tractors were not be utilized for any type of work.

After using the innovation – The road department does not foresee purchasing additional dump trucks specifically for sanding. They have recently purchased two larger dump trucks. The trucks can be used to pull an end dump semitrailer when hauling gravel. The road department is utilizing their trucks and semi-tractors year around.

DRAWING (SCHEMATIC) WITH DETAILS-- (label material parts/components in detail):




Back end and inside
underside of sander
shaft
6"

Fifth-wheel quick-attach sander on semi-tractor.

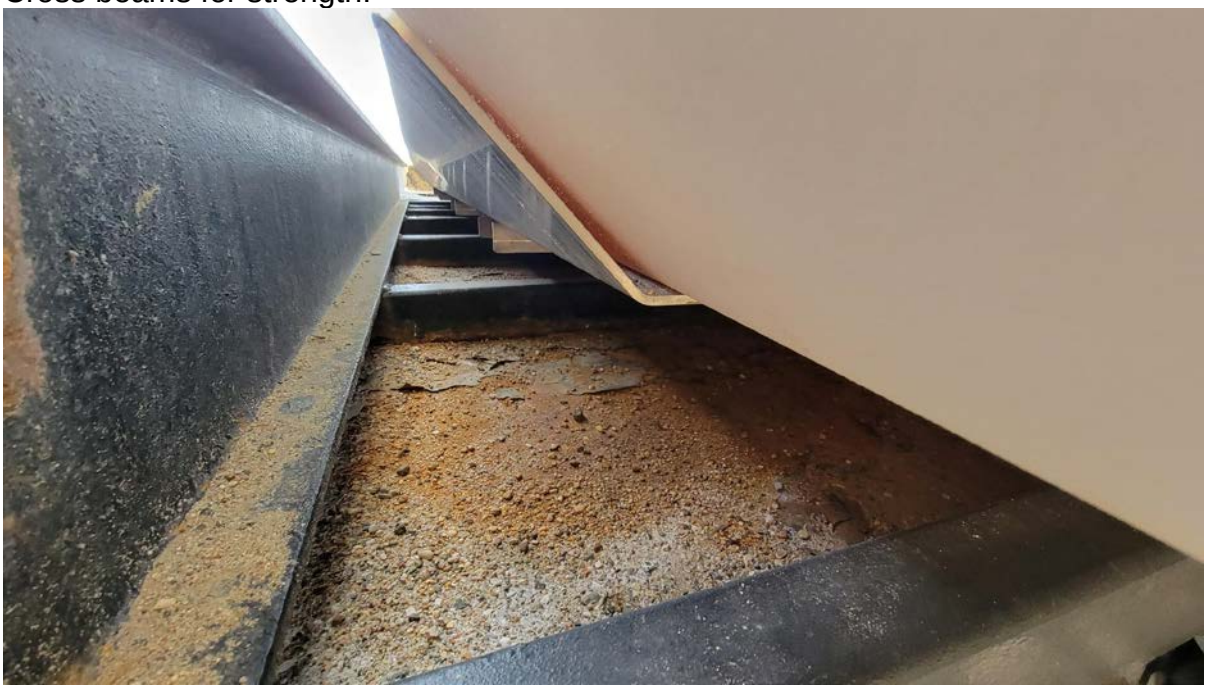
Legs retracted when in use.

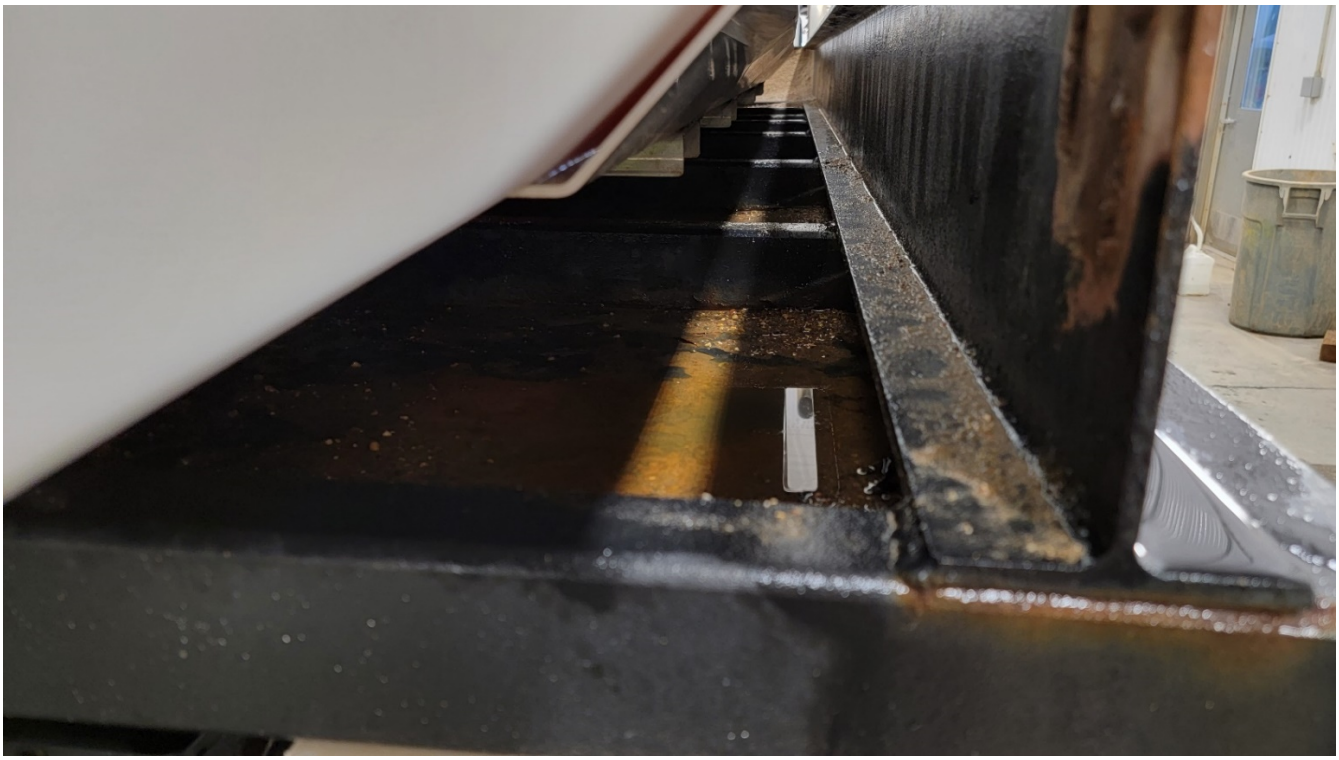
When not in use, the fifth-wheel quick-attach sander is free standing.

Landing gear crank and shaft for legs.

Fifth-wheel, king pin, and sander frame cavity secure the fifth-wheel quick-attach sander to the semi-tractor.

Cross beams for strength.





Sander tank/spreader welded to sander frame.

Conduit to protect hoses.

Hydraulics attached to semi-tractor.

Sander and snowplow.