The Sewer Rat: Design and Construction of a Sewer Line Inspection System Transporter

Client: Mr. John W. Smith,
Superintendent, City of Lexington Department of Public Works

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SUMMARY

Sewer lines are a non-glamorous but vital component of every city. Each city must take measures to ensure proper flow through the sewer lines by having the capability to inspect sewer lines for upkeep and quality. The Superintendent of Lexington Public Works, Mr. John W. Smith, tasked the 2006 CEC Design team to design and construct a sewer line transporter camera inspection device for use by the City. The transporter was to operate in small diameter pipes and long distances dragging a power and video cable. The transporter needed to operate in the wet and damp sewer conditions. Because of the small pipes and the likelihood of the transporter flipping over, the transporter needed to be able to operate in an inverted state.

After conducting analysis on previous designs, the team calculated the torque necessary to overcome the drag force produced by the long length of power and video cable. Once the torque required was known, a compact, high torque, high output RPM motor was researched and purchased. The motor was totally enclosed, non-ventilated (TENV) and further sealed with silicone sealant for improved waterproof capability.

The team assembled the transporter on a steel plate and spray-painted for rust protection and aesthetic appeal. Motor mounts were fabricated and welded on the steel plate. Miter gears were used for transmission to the drive wheels. Wheels were nylon

pulleys with aluminum hubs. Urethane round belts were placed over the wheels as tires to provide traction for the transporter. Steel shafts were used for the front drive shaft and rear wheel shaft. Double-sealed ball-bearings mounted in self-fabricated bearing mounts secured the shafts in place. The camera and light were mounted together at a slant for maximum space conservation. Steel, sheet metal was used to make a debris cover which was placed over the motor and miter gears. Gaps in the debris cover were sealed with expanding and hardening foam.

Initial testing conducted on the transporter included distance testing, inverse operation testing and camera operation testing. The transporter performed well on dry land. The transporter was turned over to Mr. Smith for testing and operations in wet sewer lines.