A STUDY ON THE SIZE AND CONFIGURATION OF KDOT DUMP TRUCKS

August 15, 2014

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This document provides an overview and analysis of the size and capabilities of the snow plow trucks used by the Kansas Department of Transportation.

CURRENT FLEET

The current fleet of snow plow trucks is comprised 100 percent of tandem axle units equipped with front mounted plows and hopper body spreaders with pre-wetting capabilities. Trucks within the fleet have varying capabilities depending upon the age and optional configurations. The current standard plow truck has a 330 horsepower diesel engine with an automatic transmission. The dump body is constructed of stainless steel with an approximate struck capacity of 14 cubic yards. Each truck is equipped with a 12 foot snow plow and a side wing. The hopper body spreaders have a struck capacity of 12 cubic yards. Around 20 years ago, KDOT added a second ¾ ton pickup to the subarea fleet for use by the crew. The addition of this pickup gives the crew the capability to perform light summer maintenance activities that previously could have been served with a smaller single axle dump truck.

COST VERSES CAPABILITY OF SINGLE AND TANDEM AXLE PLOW TRUCKS

The major differences between a single axle snow plow truck and a tandem axle plow truck are in the bed size, truck length and the additional axle. All the major components (engine, transmission, cab, hydraulics, lights, plow and wing) are very similar. The overall height and width of the trucks are the same. The bed size for a single axle truck would be approximately 6 cubic yards compared to 14 cubic yards for the tandem truck and the overall truck length would shrink by 5 to 6 feet.

The 12 cubic yard capacity of the spreader for the tandem axle truck will provide a range of around 32 miles treating one lane of straight salt applied at a rate of 400 lbs. per lane mile. A single axle plow truck with a 5 cubic yard spreader will have less than half of the range of a tandem truck, 13.5 miles under the same scenario. In addition, the suspension of a tandem axle truck is much more robust than the single axle suspension. State DOTs that utilize single axle plow trucks report that the tendency to overload those single axle trucks result in a higher repair frequency for those components.

KDOT dump trucks are utilized for winter and summer maintenance activities. Summer maintenance activities of hauling hot mix, aggregate, dirt and brush can all be performed more efficiently with the use of a tandem axle truck.

The cost of our current plow truck is approximately $150,000 including the cost of the plow, spreader and wing. Kansas Truck Center, the current supplier of KDOT plow trucks, estimates the savings for a single axle truck to be in the neighborhood of 10 percent, in this case $15,000. This reduced cost is a result of the material savings in producing a smaller bed, spreader/hopper, the elimination of an axle and 4 rims with tires and utilizing a slightly less powerful engine.

The power requirements for both trucks would be very similar with the single axle truck utilizing only a slightly less powerful engine. The majority of the power requirement is dictated by the plowing capability of the truck. Each truck would have the same requirement during plowing operations provided each would be equipped with a 12 foot plow and wing. The only significant difference would be the power necessary to move the additional load and the necessary power to overcome the power losses inherent in the additional differential.

Truck maneuverability is one of the factors that historically fleets have used to determine the need for a single axle truck. While the single axle truck is more maneuverable with a shorter wheel base than the tandem axle truck, the industry has improved the turning radius of the tandems significantly over the last 10 years. Certainly for city applications where the requirement is to plow around obstacles such as parked cars and tight intersections, this is still a concern. For KDOT, this issue is no longer a significant factor in determining truck configurations.

FY 1998 was the last time a single axle plow truck was requested and purchased. The option of purchasing a single axle truck would be considered if there was a desire expressed from a district. At the last Budget meeting, each district was specifically polled about their desire to utilize a smaller, single axle truck. None of the districts wanted to deviate from the current dump truck configuration.

Over the last 10 years, KDOT has progressively purchase more and more dump trucks with wing plows. There are DOT fleets that are utilizing single axle plow trucks equipped with wings; however, the tandem axle truck provides a much more stable platform for wing operations. The side forces exerted on the chassis from a wing plow will tend to push the truck toward the adjacent lane. The addition of the axle and four wheels of a tandem truck will help resist these forces and will result in the safer operation at higher speeds. As a side note, the addition of the wings to KDOT plow trucks has significantly improved the productivity of snow and ice operations. In the past, it would likely be necessary for a truck to make at least two passes to clear a 12 foot lane. With a wing, the total clearing path is approximately 15 feet. This additional path width makes it much less likely that traffic has pulled additional snow into the recently cleared path providing a much safer travel way and reducing the need to re-plow a portion of a path just cleared. The wing also has provided a safer operation for the plow and driver since it allows a driver to push snow off the shoulder while keeping the truck on a stable

surface. In the past, many trucks have tipped or gotten stuck when a wheel drops off the pavement while trying to push snow back off the shoulder utilizing the front plow.

OTHER PLOW FLEETS

In general, KDOT tandem axle trucks are conservatively equipped when compared to other snow-belt states. The size and bed capacity are all very similar but most states are utilizing more powerful and expensive engine and transmission configurations for a fair percentage of their fleet. With the exception of the two trucks just ordered for pulling tow plows, KDOT specifies mid-range truck engines in the 330 HP range. Many other DOTs require engines of higher torque and horsepower which result in more expensive engines and transmissions for their trucks, usually in the $20,000 to $40,000 range. Below are the results of contacting a selected number of plow fleets to determine the size composition of their fleets and their plans for future purchases:

KANSAS TURNPIKE AUTHORITY – Currently operates a plow fleet with a mix of single and tandem axle trucks but is transitioning to a fleet of exclusively tandem axle trucks. Their recent purchases have been 100% tandem trucks and their plans are to continue to replace their older single axle trucks with tandems. The size and configuration of the KTA dump truck is very similar to the KDOT truck. Over the years KTA and KDOT have worked together which has resulted in similarly equipped trucks.

NEBRASKA DOR – Currently operates a plow fleet of 100% tandem axle trucks. Like Kansas, they made the commitment years ago to purchase only the more productive tandem axle trucks and do not have plans for purchasing any single axle plow trucks. The majority of the Nebraska trucks have dump bed lengths that are a bit shorter than KDOT. They also utilize a more premium engine/transmission package on many of their tandems.

MISSOURI DOT – Currently operates a fleet with an approximate mix of 50 percent single axle and tandem axle plow trucks but is transitioning to a heavier mix of tandems. Their goal is to be at a mix of 70 percent tandems. Their metro areas have elected to utilize a heavier mix of single axle trucks for the added maneuverability. Their recent downsizing has resulted in the elimination of a large number of facilities with material storage. With this, they are needing to add more tandem axle trucks to accommodate the necessary range required between stockpiles.

IOWA DOT – Currently operates a fleet with a mix of 55 percent tandem axle trucks. The decision of single verses tandem is dictated by the plow routes that each truck is assigned to treat. As lanes are added to routes that previously only needed a single axle truck, that truck may be replaced with a tandem axle truck. Iowa is slowly migrating to a heavier mix of tandems based on several factors such as the addition of lane miles, the reduction of their maintenance staffing and the re-evaluation of their plow routes. Iowa has a wide range of variability in their fleet configuration. They range from their single axle trucks to large tandem trucks with dual wings.

SOUTH DAKOTA DOT – Currently operates a fleet with only 6 percent single axle trucks. These single axle trucks were purchased 6 or 7 years ago and located in the Sioux Falls and Rapid City locations based on a request at the time from those locations. The fleet manager expects for these trucks to be replaced with tandem axle trucks when they are eligible based on the cost and capability predictions. South Dakota added a 1 ton truck to their fleet for the local crews to perform routine summer activities such as trash pickup and other light maintenance work. This addition reduced the desire from their maintenance crews to have a smaller plow truck to perform these summer activities. The South Dakota fleet of tandems is primarily equipped with premium engine and transmission configurations.

WASHINGTON DOT – Currently operates a fleet of 100 percent tandem axle plow trucks. The fleet manager conducted an analysis and concluded that the benefits of owning and operating a fleet of tandem axle trucks far exceeded the cost. Washington DOT utilizes a large percentage of trucks with the premium engine and transmission configurations.

PENNSYLVANIA DOT – Currently operates a fleet with a mix of single and tandem axle trucks. PennDOT assigns the single axle fleet to their low volume rural routes. These trucks are only required to treat intersections and trouble areas so the range for the lower capacity trucks is less of an issue. PennDOT utilizes a large percentage of trucks with the premium engine and transmission configurations.

CONCLUSIONS

KDOT is not alone in exclusively utilizing tandem axle plow trucks and the trend in the states that use single axle trucks is to migrate toward a heavier mix of tandems. KDOT has held cost down compared to other DOTs by staying with the mid-range diesel requirement. With the cost savings for a single axle truck being around $15,000, we believe the tandem axle plow truck is a more capable and safer truck for maintenance crews to operate.