

P.A. 207 of 2018 – Section 670
Complete Refurbishment of Winter Maintenance Trucks (WMTs)

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I. Purpose

Per Section 670 of P.A. 207 of 2018, the department shall investigate, by way of solicitation and all other practical means, the complete refurbishment of all winter maintenance trucks scheduled for sale or retirement in the fiscal year ending September 30, 2019. The department shall submit a final report to include an analysis of the costs and benefits of the complete refurbishment of winter maintenance trucks compared to the sale and purchase of new equipment.

II. Background

With respect to refurbished parts, the Michigan Department of Transportation (MDOT) has historically used remanufactured parts when economically and operationally feasible, and when refurbished parts meet the safety needs and components of the MDOT fleet. For years, MDOT has used re-manufactured parts for engines, automatic transmissions, drive axles, alternators, starters, water pumps, hydraulic components, air compressors, etc. MDOT currently performs limited refurbishment (both in-house and outsourced) to include, but not limited to, things such as recycling/reuse of stainless-steel salt delivery systems, painting/corrosion treatment of selected WMTs, and corrosion treatment of electrical connectors during preventive maintenance services. Also, for several years, refurbished parts vendors have been referred to MDOT central and region fleet contacts, so those vendors have the same opportunity/contacts that new parts vendors have. As it relates to WMT refurbishment, particularly complete refurbishment, information solicited and obtained from vendors in the past has resulted in being very cost prohibitive considering both the complete refurbishment costs and annual corrective maintenance costs for a fully depreciated unit particularly when the department is typically able to recoup the depreciated value on a WMT when it is sold. However, although complete refurbishment of WMTs has not been deemed suitable from a cost or safety perspective, the department has utilized refurbishment on a smaller scale.

III. Comprehensive Asset Management

MDOT uses a statewide comprehensive asset management approach and strategy for vehicle and equipment retention and replacement criteria and guidelines. All MDOT vehicles and equipment, including WMTs, are grouped by type and function and are assigned a unit and group number. Additionally, each has a fiscal life in months (i.e. 60-180 depending on the type) assigned as a guide to assist in determining optimal replacement. Fiscal life is not the sole determinant in making a maintenance, retirement, replacement, or disposal decision for a specific unit. MDOT also considers criteria such as mileage, engine hours, work order/maintenance costs, and unit condition in the decision-making process. Optimal fleet management practices dictate that before retirement or sale of unit, the department evaluate whether such units can be reassigned statewide and older, more utilized units be considered for sale or retirement. To assist in making retention decisions, MDOT utilizes a variety of tools and methodologies including, but not limited to, a fleet management system; a prioritization tool taking into consideration things such as mileage, age, engine hours, work order costs, depreciation, usage, condition, and preventive maintenance; as well as core function and operational need. These tools assist in determining break even points, life cycle costs, and making statewide comparisons to assist with retention decisions.

IV. Winter Maintenance Trucks (WMTs)

As referenced previously, there are multiple determinants in making a maintenance, retirement, replacement, or disposal decision regarding a vehicle or piece of equipment; thus, there is no annual schedule for replacement. The same applies to WMTs. The current fiscal life for a WMT is ten years (120 months). The current average age of the approximately 295 permanent MDOT WMTs is 9.2 years (approximately 110 months).

At the time of this report, 149 (51.03%) of the 292 permanent WMTs were past the replacement cycle of ten years. Of those past the replacement cycle, the average age is just over 13.5 years. When including the 53 contingency WMTs (units previously replaced but retained and used in emergency situations to support trunkline operations), the average age is approximately 14.6 years. The oldest permanent unit is 20 years old and the oldest contingency unit in the MDOT fleet is 23 years. All 183 WMTs (permanent and contingency) past retention have accrued an average of over 131,000 miles and 5,900 engine hours. Additionally, repair costs for these units have exceeded their depreciated value by over 121 percent. All these factors are taken into consideration with MDOT's comprehensive asset management and decision-making approach.

V. Refurbishment

The definition of equipment refurbishment has been the subject of numerous business articles and research studies. It has various meanings and the scope can be quite broad. Typically, refurbishment can be defined as "restoring an item to its original condition". This includes anything from cosmetics, operator comforts, to mechanical and electrical components. The goal is to continue meeting operational needs while improving lifespan and reducing overall costs. However, that often comes at an expense in terms of pursuing

updated technology, meeting safety and environmental standards, and cost effectiveness. As referenced in many of these articles and studies the following key points should be considered when undertaking refurbishment:

1. ***The type of unit being refurbished*** – WMTs have a variety of components and technology that can be very expensive to recondition and/or replace. Minor improvements to emissions are feasible; however, bringing a Tier 0 engine (no emission control devices, mechanical fuel feed system) to Tier 4 emission standards (computer-controlled fuel delivery system along with particulate filter and catalytic converter), for example, would not be cost effective. It would be better to replace the unit.
2. ***The size of the fleet*** – full refurbishment can be time consuming; thus, result in critical equipment downtime due to lack of back-up units.

Note: Currently, MDOT has approximately 300 permanent WMTs assigned based upon designated statewide operations and snow routes so the ability to operate effectively minus assigned units for up to 150 days could prove problematic. In addition, WMTs are used for other purposes in the non-winter months, and so while there is an approximate six-month time frame when WMTs are not needed for winter for many areas of the state, their absence from the fleet would reduce the effectiveness for other critical road maintenance repairs and may increase costs if supplemental equipment had to be rented during the time that WMTs are out of service for refurbishment.

3. ***The age and condition of the units being refurbished*** – older equipment may have structural issues due to corrosion and/or age, parts obsolescence, and/or technological or environment advancements, and not be feasible candidates for complete refurbishment.
4. ***Post refurbishment expectations*** – Commercial literature suggested a lifespan of vehicles/equipment post refurbishment should be extended by approximately 80%. With a retention period of ten years for WMTs, this would equate to a lifespan from ten to 18-20 years.
5. ***Refurbishment Service Center*** – it was recommended to utilize a brand-certified refurbishment center versus a “flat rate, replace-everything-no-matter-what” service center. Brand-certified utilizes standard inspection and testing procedures, facility standards strictly enforced by the manufacturer, has credentialed technicians, and offers some type of standard warranty for refurbished units.

VI. Request for Information (RFI)

During FY 2018, MDOT posted a RFI for WMT refurbishment, and the timeline was as follows:

Event	Time	Date
RFI issue date	N/A	3/6/2018
Pre-proposal meeting		N/A
Deadline for vendors to submit questions about this RFI	3:00 p.m. EST	3/20/2018
Anticipated date State will post answers to vendor questions on www.michigan.gov/SIGMAVSS	3:00 p.m. EST	3/29/2018
RFI deadline	3:00 p.m. EST	4/24/2018

As part of the RFI, specifications were made available to vendors regarding refurbishment. The following list includes examples of some of the items:

1. Corrosion treatment/paint
2. Replacement of all wiring and hoses
3. Component replacement to upgrade to stainless steel
4. Frame repair/refurbishment
5. Engine/transmission/differential work
6. Electronic or technology upgrades
7. Update current emission standards as necessary

The RFI also requested vendors to provide estimates to include the length of refurbishment, based upon the specifications, and to include throughput capability each year. Once posted, SIGMA (Statewide Integrated Governmental Management Applications) sent the RFI via automated notification to the following vendors:

1. ABCO-Services
2. Sign on the Spot
3. Mobility Transport
4. Jorgenson Ford Sales
5. German Bliss Equipment
6. Shepard Bros Inc.
7. Nomad Globle Communication Systems
8. Hoeks Transport
9. R&R Car Company

Two additional vendors (“Truck & Trailer” and “Valley Truck”) were forwarded the RFI via e-mail as they were not included in the automated notification/distribution.

VII. RFI Summary/Results

Only one vendor response from “Valley Truck” was received. A separate vendor declined to bid due to cost, complexity, and this not being their niche/area of expertise. The following is a summary of the one vendor that responded:

1. *Founded in 1954 and been performing refurbishment since 2011.*
2. *Completed over 125 truck refurbishment projects with over 75 related to snow and ice removal vehicles.*
3. *Current projects are with counties and cities in the State of Michigan.*
4. *WMT refurbishment costs for five different counties ranged from approximately \$28K (frame rail replacement) to approximately \$104K for what appears to be a more detailed truck refurbishment (on average approximately 53% of the cost for a new fully built-up MDOT WMT – see next section for more detail). The vendor indicated each truck refurbishment will differ; thus, costs will differ as well.*
5. *Refurbishment typically occurs on WMTs 12-20 years old.*
6. *Each project has specific needs requiring varied levels of refurbishment.*
7. *Nearly all snow/ice truck refurbishment includes frame rail replacement due to severe corrosion.*
8. *Refurbishment is not a stand-alone strategic replacement for new equipment.*
9. *Most customers adopt a replacement strategy that includes both new purchases and refurbishment.*
10. *The two most challenging repair and common issues on a vehicle after 10-15 years of service are rusted frame rails and rot to the cab. Remaining items on a truck can typically be repaired/reconditioned.*
11. *Replacement of frame rails can generally result in another 10 years of service coupled with replacement and maintenance and repair for other components.*
12. *More common is a blended comprehensive truck refurbishment to include reconditioning, remanufacturing, and repair to the chassis and up-fit components.*
13. *Refurbishment projects are typically 4-6 weeks depending on the scope of work.*
14. *Currently, can complete approximately three refurbs a month depending on the scope of work.*
15. *Typically refurbishes WMTs between April 15 and October 15.*
16. *With six months of notice, can increase refurbishment to six trucks per month.*
17. *Will provide a minimum 18-month parts and labor warranty on all components replaced, rebuilt, or new. Original items that were removed, cleaned, inspected, functioning properly and reused will not be covered.*
18. *Frame rails have a 5-year parts and labor warranty against cracks or breaks. The vendor parts remanufactured transmissions or drive axles have a two-year parts and labor warranty.*
19. *Will use only Original Equipment Manufacturer (OEM) quality parts.*
20. *Will deliver and pick-up trucks for a mileage fee (\$2 driven per mile or \$3 hauled per mile).*

21. *Completed specification for tandem axle truck to include estimated costs as feasible. Can provide quotes if needed for specific items/areas.*
22. *Can avoid complying with emission standards with refurbishment.*
23. *Note – vendor did not complete single axle truck specification.*

VIII. MDOT Review of RFI

The following is a summary of the RFI review:

1. The potential for increased component and wiring failures exist when simultaneously using existing and new parts (wiring and switch issues).
2. Refurbishment information focuses exclusively on chassis versus spreading components, valves, plows, wings, etc. Inclusion of these components could drive costs substantially higher.
3. Pricing for refurbishment items does not appear comparable to work being accomplished (not always able to determine depth and extent of work accomplished from quotes provided).
4. Based upon specification responses it was not clear that refurbishment will last long enough to sufficiently extend WMT life, while proving cost effective at the same time.
5. MDOT would expect new wiring, hoses and other parts as part of standard refurbishment process.
6. Refurbishment could in some cases avoid compliance with emission and EPA standards (although this would reduce refurbishment costs, it may not be optimal).
7. Quotes/invoices initially provided did not reference age of WMTs.
8. Requested vendor to perform a physical assessment and provide an estimate (include labor and flat rate charges) to refurbish a MDOT tandem axle WMT (04-1541). This would be at no cost to MDOT. Quote is included in the attachments.
9. Vendor did not complete the specification for a single axle WMT.
10. Partial or selective refurbishment (i.e. corrosion treatment, painting, and frame rail replacement) as done now, will likely continue to prove beneficial.
11. Refurbishment of WMTs might prove more beneficial on trucks 8-12 years old by reducing repair costs (repair costs exceeding value versus age break-even points for the average WMT is approximately 8.5 years) and extending life earlier based upon improved truck condition (versus waiting until the truck is 12 or more years old).
12. Followed up with counties that refurbished WMTs using the vendor to determine satisfaction and received the following comments:

County A: "They were awarded the refurbs as they were low bid. That was my intention as they had performed several frame rail replacements for us prior, so I was confident in the end results. Ultimately, should we entertain refurbs in the future, I will hope this vendor wins the bid as I have been pleased. All of this needs to be under the consideration that the units refurbished are 1998 models, they did not come back as "new" trucks just some really nice used ones."

County B: They have had six units reconditioned by the vendor and their experience has been positive with the reconditioning. Their goal was to get an additional 10 years of service out of these units after reconditioning. The six units that have been refurbished were 2001 through 2004 model year chassis. The work was completed approximately two years ago, and they have only had minor issues with these trucks after the refurbishment. The vendor was very responsive in terms of addressing these issues. The vendor did not do any refurbishment of the snowplows or spreader bodies as the county does that work themselves. They have one unit scheduled to be refurbished this year.

County C: No response to inquiry.

On 5/30/2018, MDOT met with the vendor to discuss the RFI and review invoices for WMT refurbishment of municipal trucks (county and city). Additionally, the vendor performed an on-site assessment of a MDOT tandem WMT. The vendor provided an estimated refurbishment quote for the MDOT tandem axle truck, which is a 2001 unit with 6,674 engine hours and 150,879 miles. A summary of the quote is as follows:

Based on only a visual inspection (truck not torn down), and following specification in C04-4001R, the quote for the reconditioning/refurbishment of this truck was \$121,642 (approximately 60% of the cost of a new WMT). This does not include any additional items that are found once the work starts or transportation of the unit from its current location to the refurbishment location and back.

IX. Data Analysis

MDOT performed an analysis on all WMT auctions from calendar year 2011 through calendar year 2018 (see chart below). A total of 93 WMTs (70 single axle trucks and 23 tandem axle trucks) sold for a total of \$738,544.11 (equivalent to the purchase of approximately four new WMTs over a seven-year period). This was an average cost of \$7,941.33 per truck. That equates to \$12,358.17 for tandem axle trucks and \$6,490.09 for single axle trucks. Costs are prior to the Department of Technology, Management, and Budget (DTMB)-Surplus invoking an average of a 21 percent service/administrative charge per truck. The funds accrued from WMT sales are returned to MDOT's Road and Bridge State Trunkline Fund and not necessarily directly reinvested in purchasing new equipment or repairing existing items. The average age of the both the tandem and single axle trucks that were sold/disposed were approximately 17 years (17.8 years for single axle trucks and 14.6 years for tandem axle trucks).

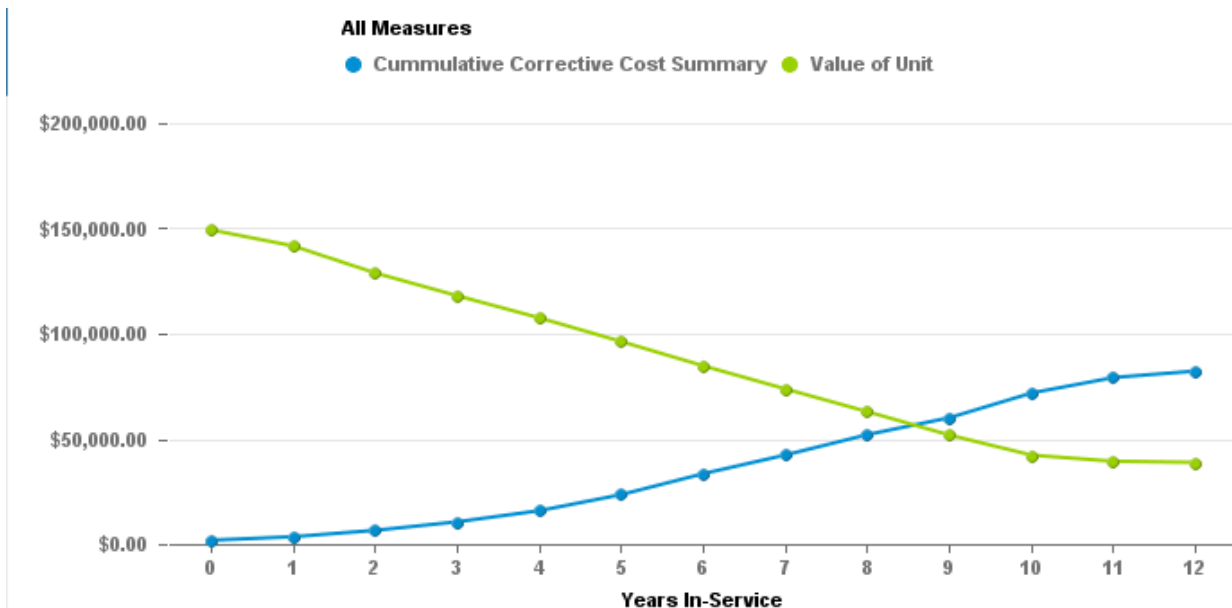
TRUCK SNOW REMOVAL SINGLE & TANDEM AXLE

Calendar Year	Average Selling Price	Sum of Selling Prices	Quantity Sold	Average Age at Sale
2011	\$6,056.48	\$163,525.00	27	16.3
2012	\$5,725.71	\$40,080.00	7	19.3
2013	\$12,706.76	\$216,015.00	17	17.3
2014	\$11,399.36	\$159,591.00	14	15.7
2015	\$5,639.50	\$56,395.00	10	16.4
2016	\$7,702.64	\$61,621.11	8	16.7
2017	\$2,044.50	\$12,267.00	6	19.0
2018	\$7,262.50	\$29,050.00	4	20.9
Grand Total	\$7,941.33	\$738,544.11	93	17.0

From FYs 2012 through 2018, MDOT has purchased 131 WMTs (approximately \$27 million or \$3.86 million per year – approximately 42% of the \$9.1 million spent per year on average during the same time frame for new vehicles/equipment) at an average cost of approximately \$206,106.87 per WMT. There was a total of 125 tandem units purchased at a cost of approximately \$206,269.38. There were six single axle units purchased at a cost of approximately \$175,857.32.

Based upon MDOT's current life/retention cycle, 30 WMTs should be replaced annually. That would equate to 210 WMTs versus 131 (another 79) being replaced from 2012 to 2018 at a cost of an additional \$16.3 million, contingent on available funding. Current break-even analysis for WMT repairs typically exceed truck value at approximately 8.5 years which is slightly below the current life cycle/retention period for replacement (see charts below).

Years In-Service	Unit Value	Cumulative Corrective Costs	Annual Corrective Costs
0	\$149,259.36	1,833.28	\$1,833.28
1	\$141,635.86	3,493.91	\$1,660.64
2	\$128,775.84	6,525.66	\$3,031.75
3	\$117,966.30	10,588.22	\$4,062.56
4	\$107,474.37	15,867.54	\$5,279.31
5	\$96,198.80	23,519.54	\$7,652.00
6	\$84,642.26	33,476.64	\$9,957.10
7	\$73,689.51	42,348.86	\$8,872.22
8	\$62,863.27	52,025.1	\$9,676.24
9	\$51,757.11	60,071.69	\$8,046.59
10	\$42,248.24	71,802.45	\$11,730.76
11	\$39,332.19	79,151.52	\$7,349.07
12	\$38,834.39	82,222.09	\$3,070.58



Refurbishment, depending on cost per truck, could potentially help offset repairs while extending WMT life if funding is not available to replace the units past retention. Since every WMT refurbishment would be different in terms of scope and cost, a comparison between purchasing new WMTs and refurbishing existing units for MDOT, based solely on a single quote/estimate provided by the vendor will not necessarily be an accurate representation for making decisions to only refurbish. MDOT expects refurbishment costs

would vary substantially from truck to truck. The vendor also stated in their response that “vehicle needs and requirements are different for each truck.”

Depreciated value of the 183 WMTs that are past retention (permanent and contingency) is approximately \$6.09 million, with corrective repairs for these units exceeding \$13.6 million. MDOT has spent approximately \$7.51 million over the current value of these units, which is on average 121.6% over the current value per truck spent on corrective repairs.

In November 2017, MDOT surveyed other State DOTs regarding WMT refurbishment and received twenty-three responses. Except for one DOT, none of the other DOTs refurbished WMTs. DOTs did not consider refurbishment cost effective due to corrosion issues, engine/emissions issues, evolving technology, parts obsolescence, personnel resources/vendor availability to perform refurbishment, and return on investment. Based on follow-up at the August 2018 National Equipment Managers’ Conference and the April 2019 Midwest/Northeast Equipment Manager’s Conference, the responses received regarding WMT refurbishment was that it remained cost prohibitive and resource limited.

For the one DOT that did consider refurbishment, the DOT indicated they have been performing in-house (vendors not geographically available) WMT refurbishment and truck build-up (“cookie cutter” trucks) for approximately the past 40 years. The central garage performs this work but does not perform basic service and repair functions. Most refurbishment is considered more minor in nature and includes replacement of frame rails, boxes/spreaders, and corrosion treatments, with a focus specifically on individual truck items identified by mechanics. Their refurbishment is not typically intended to provide technological upgrades. Their 600 trucks are not equipped with Global Positioning Systems (GPS), Automatic Vehicle Locators (AVL), and Mission Decision Support Systems (MDSS). Their depreciation schedule for WMTs is 12 years with full replacement typically occurring after accrual of 300,000+ miles. Their goal is that refurbishment will extend truck life another 5-10 years. The DOT indicated they had not captured costs for refurbishment nor determined if it is more cost effective than buying/building new WMTs.

Currently, MDOT performs certain tasks as part of WMT build-up that minimize the need for long-term refurbishment. This includes ordering and reusing stainless-steel components, which reduces potential corrosion/wear and tear. All new chassis are undercoated prior to or soon after delivery to minimize underbody corrosion. Additionally, each new truck is treated using an improved military grade paint which should improve the life span of the chassis and associated components. MDOT is also piloting an external coating designed to protect the chassis from the corrosion causing elements.

MDOT’s emphasis on seeking out, piloting, benchmarking, and implementing new technology efforts in the snow and ice arena are essential to ensure roads are clear and safe for the motoring public while improving efficiency, reliability, maintainability, and reducing costs. Examples include use of the tow plow (15 units statewide), purchase of side/mid-mount wings, conversion to stainless steel components to reduce corrosion, specific use of salt slurry generators for applicable snow routes, various salt application

technologies, green strobe lights, installation of GPS, AVL, and MDSS to enhance winter operations and save dollars, piloting of auto lubrication systems, improved corrosion control techniques, and beginning to leverage hook loader technology (chassis that can utilize multiple attachments and improve truck versatility (i.e. salters, sprayers, dumpsters, etc. -- currently there are five hook loader WMTs in service at this time with another five to be completed by the end of calendar year 2019).

X. Conclusion

MDOT needs to ensure structural, operational, and safety components of the WMT fleet and the impact on the motoring public. As stated in the commercial literature, the response from the vendor, and the above information, refurbishment, particularly complete refurbishment, is not a stand-alone strategic approach designed to replace purchasing of WMTs. A dual effort of both new WMT purchases and some form of refurbishment has been and would likely continue to prove beneficial to the department.