Wisconsin County Highway Association

Shouldering

Best Management Practices

This document and appendix have been developed to serve as a guide to Wisconsin county highway departments when considering performing shoulder material placement or maintenance of shoulders on paved highways. This Best Management Practice (BMP) document is the product of the Wisconsin County Highway Association Level of Service (LOS) Committee.

The LOS Committee polled all 30 counties involved in shouldering performance based maintenance contracts in 2014. Fifteen counties responded with a great deal of detail on their experiences, the good and the bad as well as what they would do differently on future shouldering projects. The information received was the basis used to develop the matrix which serves as our draft BMP for shouldering.

This matrix along with the attached appendix should serve as a guide for County highway maintenance Managers when scoping, bidding and performing shouldering operations on paved highways. This information may also be helpful when planning future equipment purchases.

One of the key elements to being efficient when shouldering is scheduling the correct number of trucks to keep the shouldering operation moving and to not have too many trucks in queue waiting to unload into the shouldering machine. A sample material hauling analysis worksheet has been included with this information to assist managers with calculating the number of trucks needed based on truck size and haul distance.

County Managers must determine the hourly production capability (in tons) of their shouldering machine or road widener. This rate sets the pace for trucking requirements and crew size as well as the number of mobilizations necessary for a given project.

Another challenge with estimating shoulder maintenance projects is calculating a volume of material needed to restore a shoulder section to its designed profile. Please refer to the attached Excel spreadsheet which can be used for calculating asphalt, basecourse and shouldering materials. To use this spreadsheet simply edit the variables shown in red and refer to the corresponding blue values as calculated on this spreadsheet. Feel free to download this spreadsheet to your desktop and use it to estimate quantities for future projects. A sample of the spreadsheet is attached for your reference.

The LOS Committee members consider this BMP a work in progress and expect to review and amend it as new information is obtained.

Attachment Number 1, Shouldering BMP

		Equipment							
Road Type	*Crew Size	Grader: to cut (notch if required) shoulder material	Shouldering Machine: to place new gravel with left side delivery for 4 lane	Water Truck: to water gravel for compaction if necessary	Pneumatic Tire Roller: for compaction	Broom: sweep gravel off of pavement	Finish Grader: to finish outside edge slope	**Spotter	***Lead Man or Patrol Superintendent
2 Lane	5-7								
4 Lane	5-7							Energy attenuator:	

*Does not include employees for trucking

**Spotter if necessary w/a county's shouldering machine operation

*** Lead person not part of shouldering train to deal with on or off -site issues

Recommend two way radio communications between all operators.

Recommend combination units i.e. water truck with broom attachment be used if possible.

Recommend shouldering exit and entrance ramps separate from main line on 4 lane section.

Attachment Number 2, Shouldering BMP Appendix

Purpose:

The purpose of having and maintaining aggregate shoulders is to provide support for the edge of the pavement protecting it from excessive loading and side deflection as well as providing a safety area for drivers that may deviate from the paved surface. For shoulders to perform as designed the finished shoulder material should be flush with the paved surface at their juncture. If the shoulder is too low, an edge rut exists which is a hazard and fails to support the pavement. Shoulder material left higher than the pavement impedes drainage and causes ponding of surface run off on the paved surface and saturated road base.

These items are maintenance functions that should be considered when scoping, bidding and performing highway maintenance shouldering operations.

A. **Shoulder area preparation**: It may be necessary to "prep" the existing shoulder to allow for uniform new material thickness and adequate compaction of the new material. It is recommended to prep the shoulder area if there is uneven edge rutting and a deficiency of 1.5 inches or less in some areas. It is difficult to achieve adequate compaction of new material if the depth is less than 1.5 inches. Typically this prep work is done with a grader performing a uniform cut against the pavement edge and as wide as desired for re-shouldering. The cut material either remains as part of the outer shoulder top or is sloughed down the slope as dictated by individual existing conditions and desired final shoulder width. Crews should only prep as much shoulder as they can finish in a shift, it is not a good practice to leave prepped cut shoulders exposed to traffic overnight. Several Counties have developed modified grader mold board cutting edge attachments to assist with this prep work. Photos of these attachments will be made available if we receive them.

B. **Equipment scheduling**: Establishing the production rate of the placement equipment is key to sizing crews and scheduling the appropriate number of trucks. The best way to determine this information is by performing a 2-3 day shouldering project and carefully monitoring your crews daily average tons placed with enough trucks assigned to ensure the placement equipment did not sit idle waiting for trucks. Calculating rates by the ton is much more reliable than stations per hour or per shift. Material depth and shoulder width vary too much to accurately bid this work by the station.

C. **Watering material**: It may be necessary to water material to achieve maximum compaction of new material. This is an important factor for providing solid long lasting shoulders. Several variables need to be considered; i.e. moisture content of material being hauled from the source. Weather conditions etc. it is also suggested that the County Manager consult with their WIDOT inspector for input on desired moisture content for these operations.

D. Compaction: Compaction of new shoulder material should be performed with pneumatic rolling equipment either self-propelled or tow behind. Steel drum rollers are not recommended. Extreme care should be taken to ensure operators are trained to safely operate compaction equipment in these areas to prevent accidental rollovers on steep shoulder slopes.

E. Sweeping/Flushing: It is recommended that a broom or flusher be utilized to remove dust and loose material from the pavement. Some Counties have combined a broom with their water truck or compaction equipment. Photos of these combinations will be shared if they become available.

F. Finish grading: Finishing the outer edge of a new shoulder installation is recommended and typically done with a grader to remove any roller ridges or uneven sloping. Finish work at intersections, driveways and mailboxes can also be addressed during this step. Many times the same grader that preformed the prep work can also do the finish grading.

G. Hauling: Scheduling the correct number of trucks is a key element to a successful shouldering operation. The goal is to have enough trucks assigned to keep the installation equipment moving with one – two trucks in queue waiting to dump. Please refer to attachment 3 for an example of a material hauling analysis. Attention to detail while calculating the trucking component is important.

Attachment 3

Material Hauling Analysis

EXAMPLE

Shouldering machine production capacity = 150 tons/hr.

Tri-axle dump truck capacity = 15 tons/load

Loaded travel time from material source to center of job site = 23 minutes

Load and scale time = 6 minutes

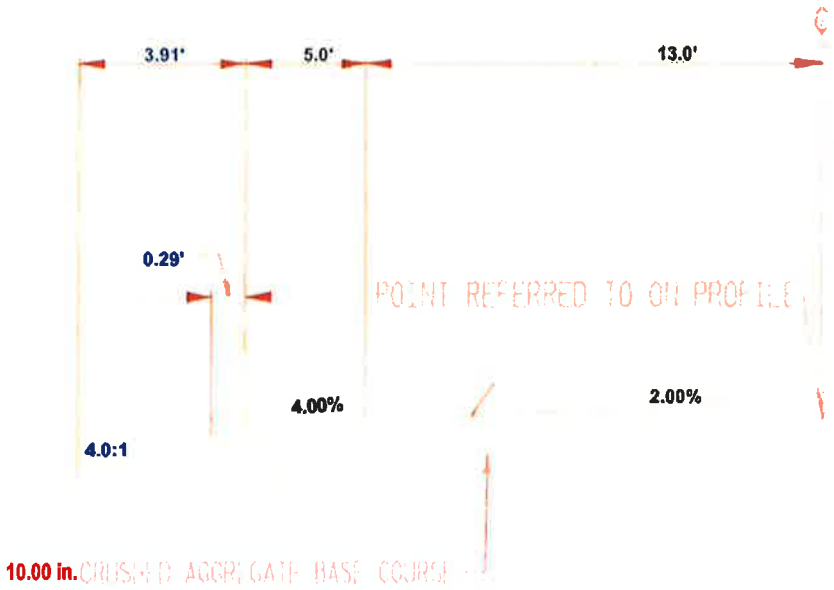
Unload into shouldering machine time = 6 minutes

Load and scale	6min.
Haul	23 min.
Unload	6min.
Return trip	23min.
Total round trip time =	58 min./round trip

60min./hr. ÷ 58min./trip = 1.03 trips/hr.

15 ton/trip x 1.03 trips/hr. =	15.45 tons/hr./truck
150tons/hr. ÷ 15.45tons/hr./truck =	9.7 trucks or 10 in reality
10 trucks + one on deck =	11 trucks ideally scheduled for this haul

- Considerations need to be made for traffic volume changes and other items that could affect the haul times.



Shoulder Width	Pavement Width	Asphalt Thickness (in.)	Shoulder Slope	Ditch Fore Slope	Subgrade Cross Slope	Crushed Agg. Base (in.)
5.0'	13.0'	2.00 in.	4.00%	25.00%	2.00%	10.00 in.

*Edit variables in **red** to match your design.
* **Blue** variables are calculated

Bituminous Concrete Pavement

31.8 Ton/Sta.

Bituminous Material for Surface Course **6.00% AC**

1.91 Ton/Sta. AC

Crushed Aggregate Base Course (cu. yd.)

Area of Shoulder = 1.23 S.F.

Area of Base = 33.50 S.F.

Volume of Shoulder = 7.62 cu. yd. / Sta.

Volume of Base = 165.44 cu. yd. / Sta.

Crushed Aggregate Base Course (ton)

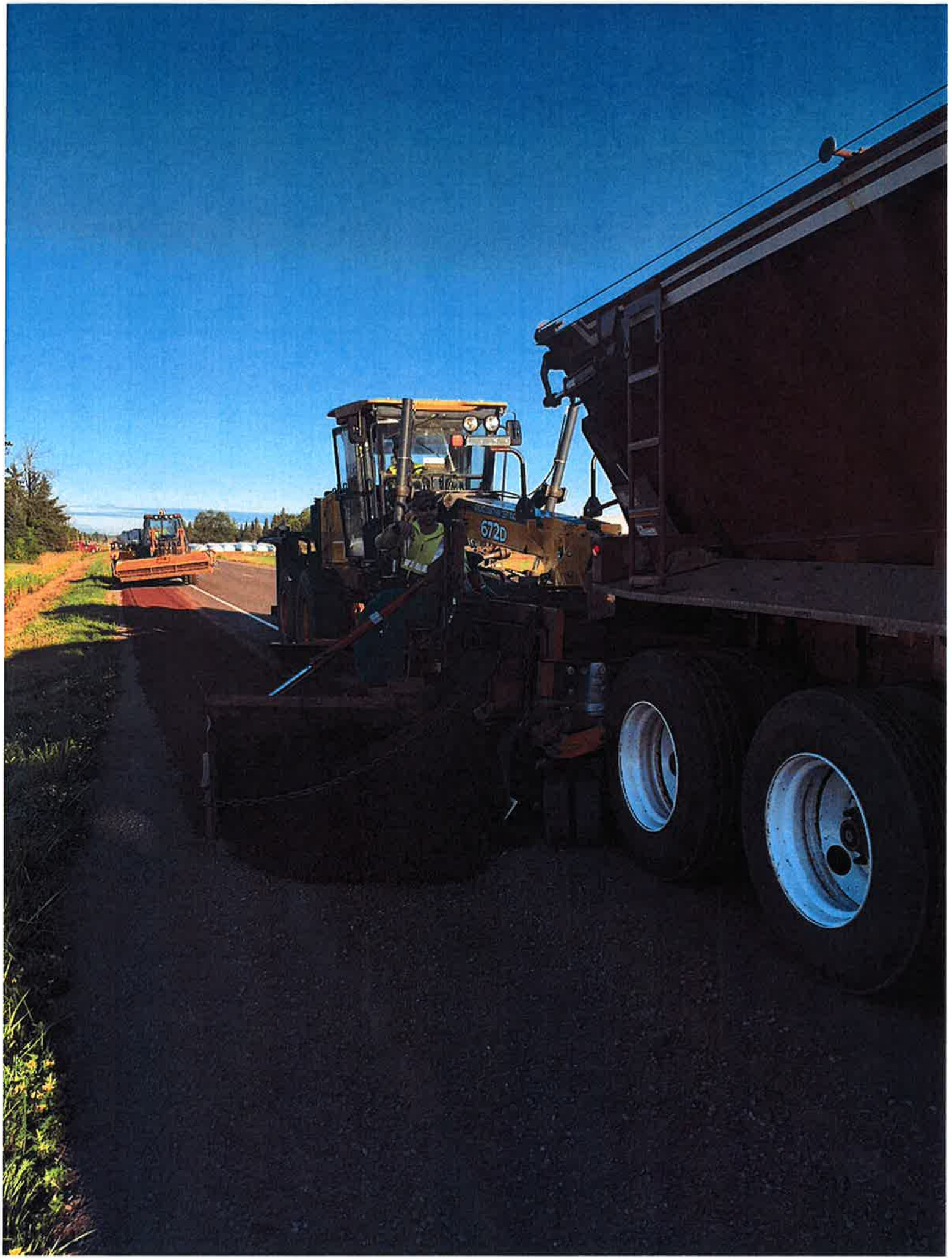
Volume of Base = 248.17 Ton/Sta.

Volume of Shoulder = 9.14 Ton/Sta.

Ashland County Equipment


ASHLAND COUNTY
HWY DEPT #343
DEERE
672D


CASE
551
718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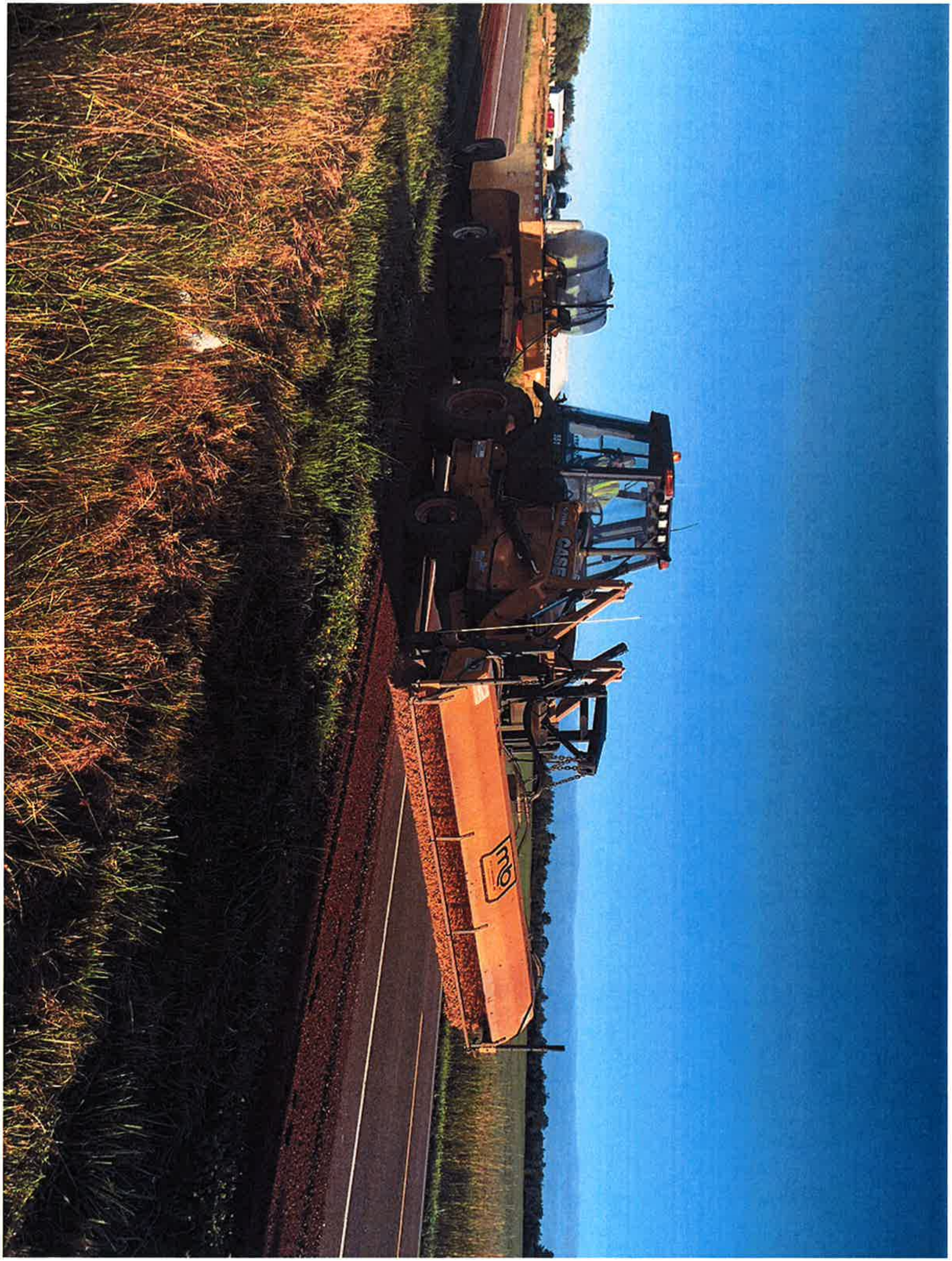
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