2020
Metro State Aid Grading and Base

Outline

- Responsibilities of Unit
- Compaction around Culverts
- Aggregate Resources
- Changes from Oldest to Newest
- Repair typical section in the Plan
- Base One

Responsibilities of Unit

Specs, Manual, Aggregate Unit, SMC, & Technical Training,

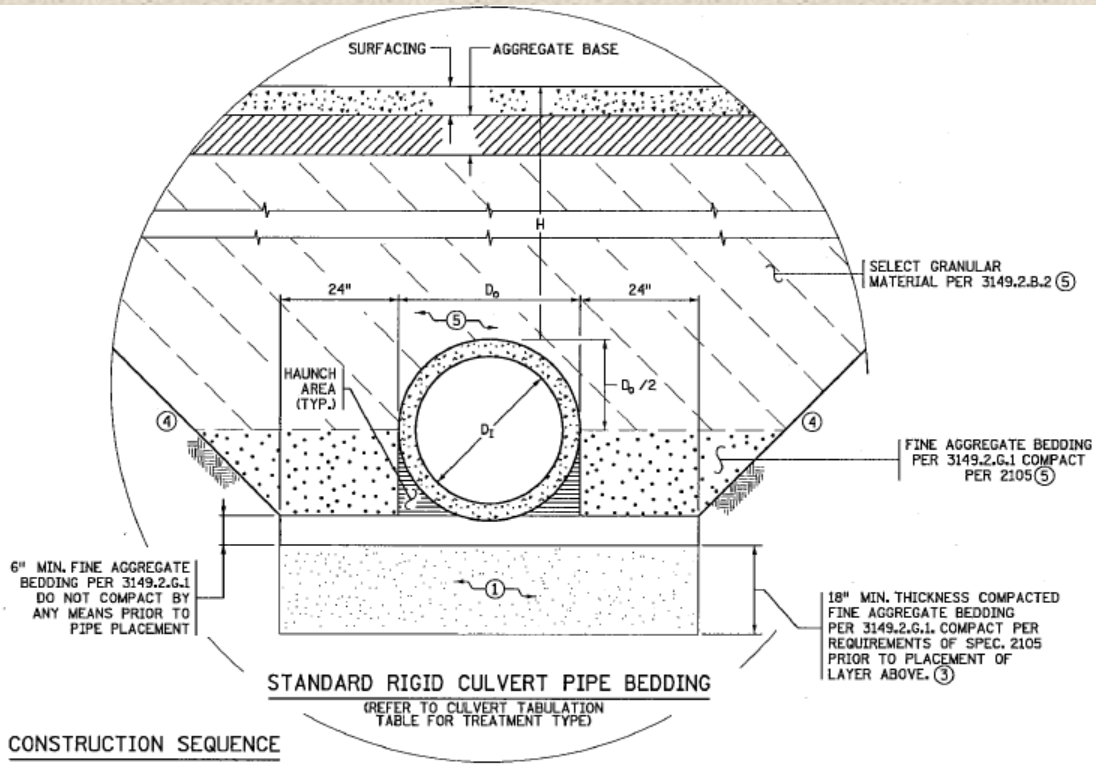
Includes:

- Aggregate Unit
- Subgrade
- Subbase, Base, & Surfacing
- Reclamation CIR & (S)FDR
- Geotextiles
- Compaction around Structures

Culvert compaction with 6” uncompacted under pipes

- Change to 6” uncompacted bedding requirements.
- Requiring this compaction method, because our concrete pipe designs are based upon it
- Some districts have been employing method for some time – template w/o compaction
- Some districts had some difficulty
- Please contact during construction if issues arise
- Additionally, Limestone and recycled concrete not allowed around aluminized Pipe.

Compaction around Culverts



STANDARD RIGID CULVERT PIPE BEDDING

(REFER TO CULVERT TABULATION TABLE FOR TREATMENT TYPE)

CONSTRUCTION SEQUENCE

1. PLACE AND COMPACT 18" OF FINE AGGREGATE BEDDING TO THE REQUIREMENTS OF SPEC. 2105.
2. LOOSELY PLACE 6" OF FINE AGGREGATE BEDDING MATERIAL TO GRADE. DO NOT COMPACT PRIOR TO PIPE PLACEMENT.
3. FOR PIPES WITH BELL, REMOVE MATERIAL IN BELL AREA PRIOR TO PLACEMENT.
4. FURNISH AND INSTALL PIPE TO GRADE.
5. AFTER PLACEMENT OF THE PIPE, PLACE ADDITIONAL BEDDING AND COMPACT THE FULL LENGTH ON BOTH SIDES OF THE PIPE UNDERNEATH THE HAUNCH AREA BY FIRST SHOVEL SLICING (MANUALLY SHOVE THE BLADE END OF A SHOVEL AT AN ANGLE DOWN THE ENTIRE LENGTH OF THE HAUNCH UNDER THE PIPE) THEN COMPACT THE HAUNCH AT AN ANGLE USING A POWERED MECHANICAL OR PNEUMATIC DEVICE (I.E. POLE TAMPER, JUMPING JACK, OR SIMILAR). COMPACT THE REMAINING MATERIAL OUTSIDE THE HAUNCH AREA TO THE REQUIREMENTS OF THE APPLICABLE MATERIAL TYPE ENSURING THAT THE ENTIRE LENGTH OF PIPE IS SUPPORTED UNIFORMLY BY BEDDING.
6. PLACE AND COMPACT BACKFILL EVENLY AND SIMULTANEOUSLY IN 6" LIFTS ON EACH SIDE OF THE PIPE UP TO THE MID-HEIGHT WHEN COMPACTED.
7. COMPLETE REMAINING BACKFILL PER THE APPROPRIATE TREATMENT REQUIREMENTS.

NOTES

EXCAVATE & CONSTRUCT ALL TRENCHES AND SLOPES PER OSHA REQUIREMENTS.

ALL SLOPES SHOWN AS (V) : (H)

PIPE SIZE IS BASED ON THE NOMINAL INSIDE DIAMETER.

(1) IF APPROVED BY THE ENGINEER IN WET CONDITIONS THE CONTRACTOR MAY SUBSTITUTE 18" OF COARSE FILTER AGGREGATE PER 3149.2.H COMPACTED TO THE QUALITY COMPACTION REQUIREMENTS OF SPEC. 2105. WRAP WITH GEOTEXTILE FABRIC TYPE IV PER SPEC 3733. SEAM ALL FABRIC SIDES AND ENDS PER SPEC TABLE 3733-1 INCLUDING FOOTNOTE (e) OR OVERLAP A MINIMUM OF 3 FT. ALL AT NO ADDITIONAL COST.

(2) ~~FOR FILL HEIGHTS (H) LESS THAN 3 FT., OMIT 1:1½ TAPER.~~

(3) FOR INSTALLATIONS ON INTACT BEDROCK, OMIT THIS LAYER.

(4) OVER EXCAVATION BENEATH TAPERS IS NOT PERMITTED UNLESS REQUIRED BY OSHA. (TYP.)

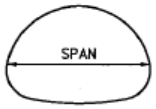
(5) MAXIMUM EMBANKMENT PARTICLE SIZE WITHIN 2 FT. OF PIPE IS 3" PER SPEC. TABLE 2105-4.

PROTECT ALL PIPE DURING CONSTRUCTION PER SPEC. 2501 OR 2503.

PLACE MULTIPLE PIPE CULVERTS WITH A MIN. CLEARANCE OF 24 INCHES OR GREATER BETWEEN STRINGS OF PIPE.

-LEGEND-

D_I = NOMINAL INSIDE DIAMETER OR SPAN OF PIPE
D_o = OUTSIDE DIAMETER OF ROUND PIPE, OR OUTSIDE SPAN OF PIPE-ARCH.
H = FILL COVER HEIGHT OVER PIPE (FEET)
= UNDISTURBED SOIL



Aggregates

- All Aggregate Sources need a pit number
- We Do the Pit Numbers

Design Manual Considerations In-Place Recycling

- Know the thickness and quality
- Do not over mill or go into gravel too deep
- Be cautious of 50/50 designs
- Specs for both a Mix Design agency or Contractor
- Beware of Base Gravel Pounded into subgrade

SFDR Oil Demand Variability Illustration

RAP oil demand 1.5% Agg oil demand 4.5%

9” RAP & 1” Agg: (9x1.5% + 1x4.5%)/10 = **1.8% oil needed**

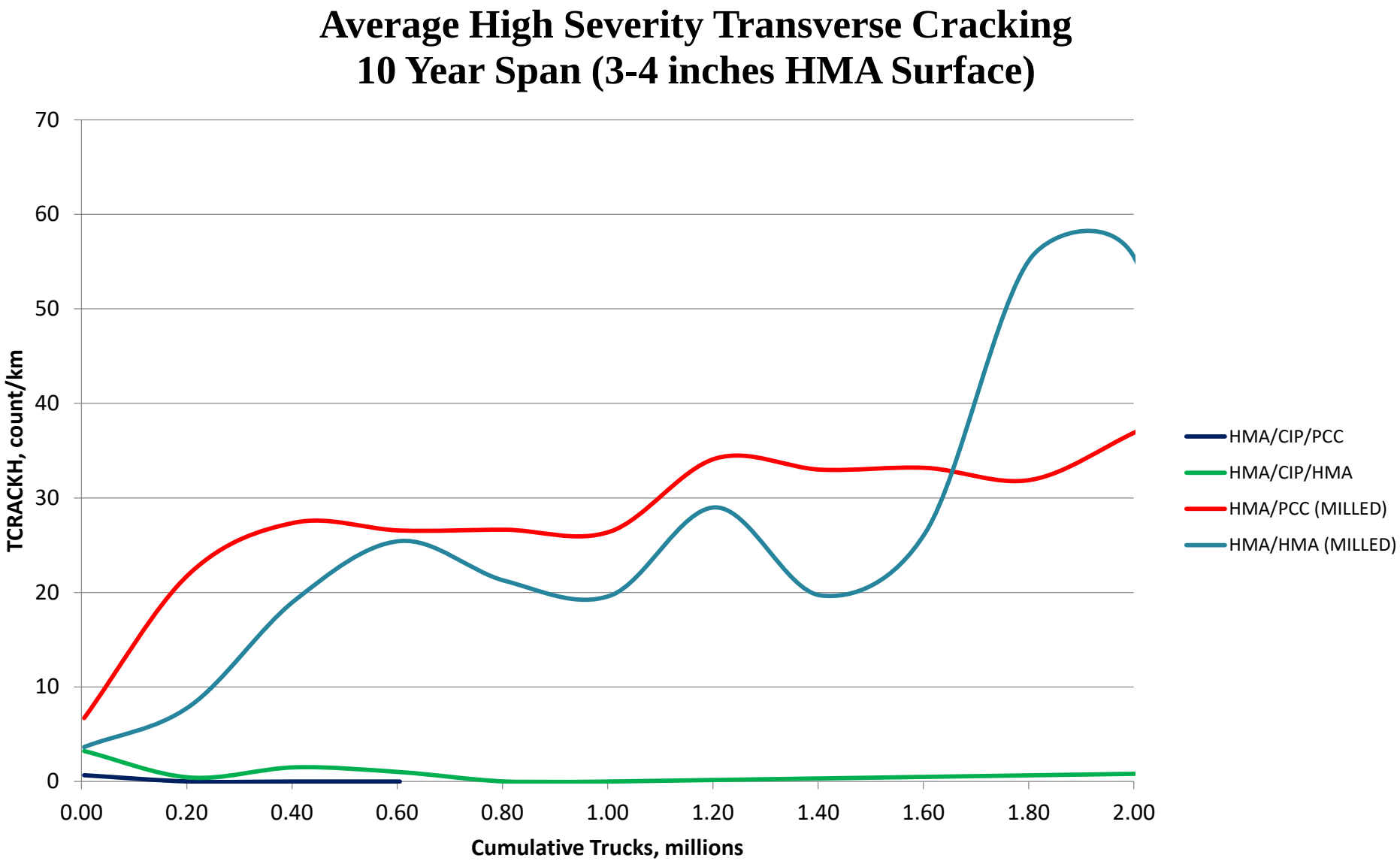
5” RAP and 5” Aggregate: **3.0%**

1” RAP and 9” Aggregate: **4.2%**


S.P. 1704-27
R.P. 2.328

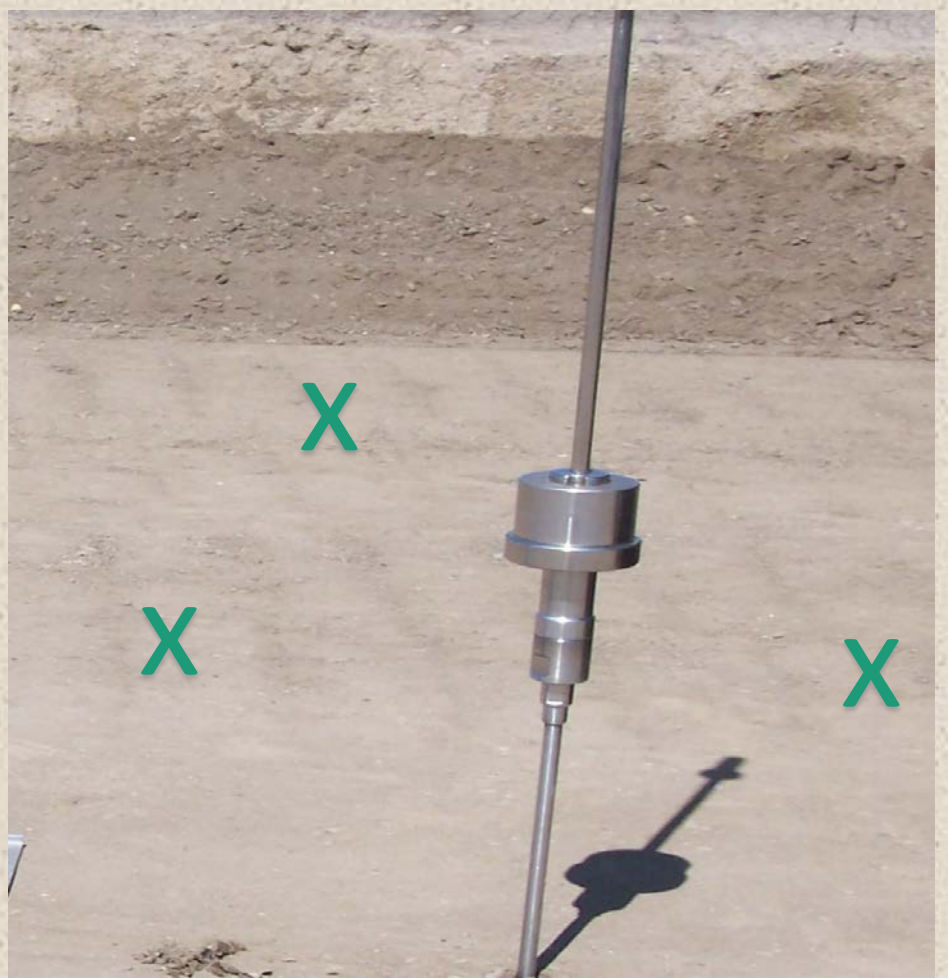

S.P. 1704-27
R.P. 19.697

Iowa Field Performance



Older Change
Target Value for DCP

- Procedure in Grading and Base Manual



Test Rolling Schedule of Materials Control

SMC (2018):

- Base (2211),
- FDR (2215), and
- Dirty Granular

Minimum 12’ x 300’ length.


05/24/2005

Criteria for Which Test Roller

In G&B Manual, defaulted in spec to TR 10 test roller

2018 MCS

- Engineer choose to divide lots sizes into smaller volumes/weights of non-equal sizes.
  - For example, Engineer may designate one or more turn or passing lanes as individual lots, or a lot as one or more a day(s) production.

Test at Engineer's Discretion

- Bit content, clay content, concrete content, objectionable materials.

2018
3138 Surfacing Aggregate

Minimum clay 3% and Plasticity Index of 5 – 12.

Requirements met for recycled or quarry stone.

Test at the Engineer’s Discretion

2018 MCS
Random Sampling

≥ 250 yd^3 (CV) to ≤ 2,000 yd^3 (CV) or ≥ 500 tons to ≤ 4,000 tons

Material is a minimum of one lot.

Test two random samples from each lot and average.

> 2,000 yd^3 (CV) or 4,000 tons

Divide into lots with lot size no greater than 2,000 yd^3 (CV) or 4,000 tons

Test two random samples from each lot and average

2018
2106 & 2211

Contractor meets:

- Quality compaction,
- Specified density,
- LWD, and
- DCP (Granular Only)

- **Agency Tests:**
  - Quality compaction and
    - Specified density, LWD, or DCP.

2018
2215 – Reclamation

- No more lifts > 6” allowed

2018 Spec. Book
2211 – Aggregate Base

Too Coarse Gradations:

The Engineer may elect to accept the material w/o a $ adjustment, if the material meets the engineering intent of the spec.

Sampling Criteria for Base

- Change from after spreading before compaction to before spreading
  - Inconsistent
  - Taking sample over dozer tracks
  - Too short a window to gather sample
  - Making changes to Grading and Base Manual

Crushing Test Changes
2020 Spec. Book

- Changing the current protocol to same as HMA
- Crushing test discretionary to the Engineer

2020 Spec. Book and New Guidance 2108 & 3733

- New Geotextile Specification 2108
- 3733 also includes grids

2020 G&B Manual
Sand Cone Sand

- MnDOT requires #20 - #30 Sand, whilst ASTM D1556 (1990) requires #10 - #60 sand
- G&B Manual now allows ASTM D1556 sand
- 1/3 the price

2020
2105 Removed from Spec Book

- Standard Special Provision

2020
5Q Removed from Spec Book

- Standard Special Provision
- Use it where quarried rock or recycled concrete available.
- Substitution for class 5 or 6
- Look for revised gradation in Special Provision

2020
Monetary Price Adjustments
Removed from Spec Book

- New guide lines will be posted on the Grading and Base web page

Supersand/Structural Backfill Specification

- Met Super Sand and Structural Backfill specifications
- Passing #200 = 8%, 5% clay and 3% Silt.
- Picture is > 24 hours after a rain
- Changed per Boiler Plate &

  2020 Spec:

  5% #200 & 1.5% Clay

Repair Typical Section

- Consider having a typical repair section in the Plan with a bid item and quantity for repair of subgrade and base.

Geotextiles Used in 2018

- Geotextiles Used:

Item	SY	Occurrences
Type 1 Fabric	752	2
Type 3 Fabric	2,159	4
Type 4 Fabric	1,323	1
Type 5 Fabric	289,261	35
Type 6 Fabric	1,466	1

AASHTO M 288 – Geosynthetic Specification for Highway Applications

AASHTO Subsurface Drainage Requirements:

- 8.2.1. *Description*—This specification is applicable to placing a geotextile against a soil to allow for long-term passage of water into a subsurface drain system retaining the *in situ* soil. The primary function of the geotextile in subsurface drainage applications is filtration. Geotextile filtration properties are a function of the *in situ* soil gradation, plasticity, and hydraulic conditions.
- 8.2.2. *Geotextile Requirements*—The geotextile shall meet the requirements of Table 2. Woven slit film geotextiles (i.e., geotextiles made from yarns of a flat, tape-like character) will not be allowed. ***I.E. MnDOT Type 5 fabrics*.**

Geotextile Rules of Thumb

For the top of a subgrade & assuming 6 - 8” of gravel minimum, & 4 - 6” HMA minimum, in lieu of using a type 5 fabric, which has been our standard in the past use the following: Note this is a draft

R_{value} Soil	CBR Soil	Perpetually wet subgrade	Geotextile
10 - 15	2 - 3	No	Enhance Type 5 with the permittivity close to a type 4
< 10	< 2	No	AASHTO M288: Class 1A
Any	Any	yes	A geotextile with lateral capacity to wick water

Also note that, especially for R_{value} less than 15, recommend that these be designed, prior to use.

Base one on Gravel Roads

Gravel Roads Treated With Base One

Wilkin County, Mn

Last grading 1 month ago

Polk County, Mn

Last grading 2 months ago

Base One cost savings

Gravel Roads

1/10 Grading Cost

1/2 Gravel Cost

2/3 CaCl Cost

Add in Base One cost $0.12/SY inch

Total maintenance savings from 35-50%

Roads applied were up to 15 years old, still functioning as when first applied.

The end

Charles Mingus quotes “Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity.” Charles Mingus quotes (American jazz bassist and Composer, 1922 - 1979)