DESCHUTES COUNTY ROAD DEPARTMENT

OTTA SEAL

GRAVEL ROAD CONVERSION PILOT PROJECTS

DECEMBER 7, 2018
PINEWOOD COUNTRY ESTATES

EXISTING GRAVEL ROAD MAINTENANCE PROGRAM

- System Data:
  - 200 miles of gravel road
  - Maintenance demand/service levels:

Activity/Data	High	Medium	Low
Grading frequency	2 or 3 times per year	Annually or every other year	Infrequent/upon request
Dust palliative	Annual	None	None
Material add	8+/- years	12+/- years	>20 years
$/Mile/Year	$5,000/$7,500	$2,500/$3,500	<$1,500
# of miles +/-	50	70	80

Local/Residential road annual surface maintenance (paved): $6,000/$8,000/mi/yr.

ROAD TREATED WITH MAGNESIUM CHLORIDE FREEZE/THAW

ROAD TREATED WITH MAGNESIUM CHLORIDE
TREE KILL

ROAD TREATED WITH MAGNESIUM CHLORIDE POTHOLING

TYPICAL GRAVEL ROAD WASHBOARDING

THE GOAL

Find an improved low-cost surface treatment with annual surface maintenance costs that are at or near that of a high maintenance gravel road ($5,000/$7,500/mi/yr.)

- Target low-volume Local/Residential facilities.
- Evaluate/estimate long-term maintenance costs and strategies.
- Potentially develop/evaluate partnership opportunities with adjacent property owners (ie, a “maintenance LID”) to fund the upgrade.

PILOT PROJECT TREATMENT: OTTA SEAL

Otta Seal

- Developed in Norway (Otta Valley) in 1960s. Relatively new to USA.
- Not an "Auto Seal"
- Aggregate (1"-minus) rolled into a layer of high-float liquid asphalt.
- Life Expectancy: 8-12 yrs.
- A poor-man's oil mat.

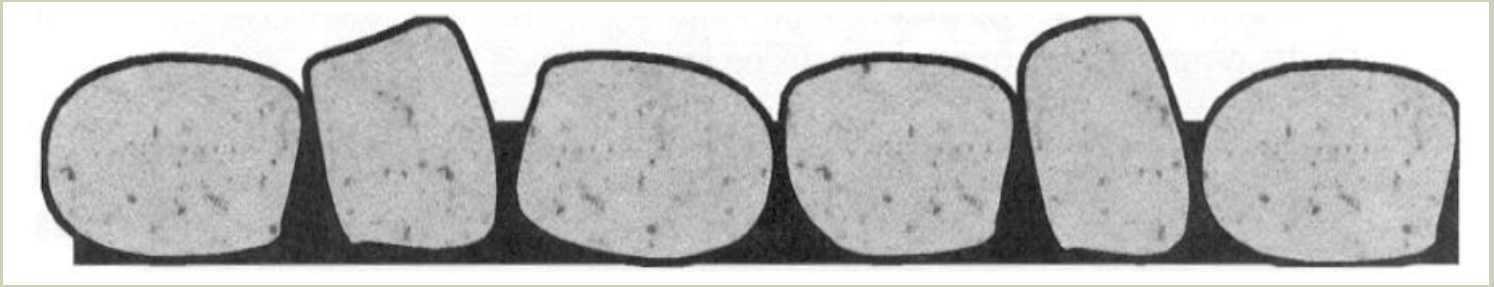
OTTA SEAL MATERIALS

- Binder: High Float Medium Set Oil: HFMS-2
- Aggregate: Gradation varies based on traffic loading
  - Low quality, non-paving spec rock
  - 0.5” to 1” Max
  - Up to 10% fines
  - Dirty!
- Again…..A Poor Mans Oil Mat

SINGLE OTTA SEAL
No Prime
1 Binder
2 Graded aggregate

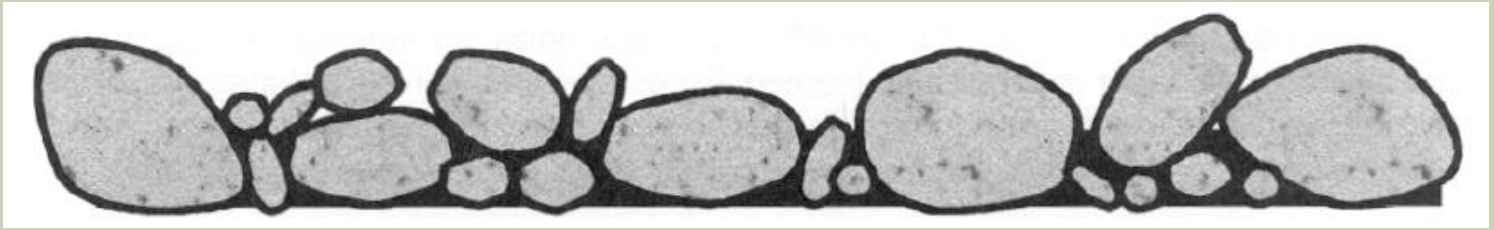
CHIP SEAL VS OTTA SEAL

- Chip Seal



  - Asphalt glues down the chips
  - Chip seal = surface treatment

- Otta Seal



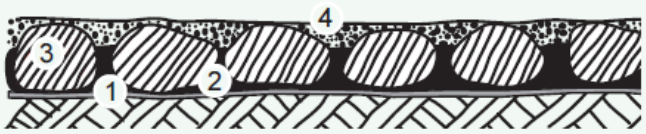
  - Rock interlock for strength
  - Asphalt fills voids and surrounds rocks like hotmix
  - Strength from interlock and glue

SAND SEAL
1 Prime
2 Binder
3 Sand

SINGLE CHIP SEAL
1 Prime
2 Binder

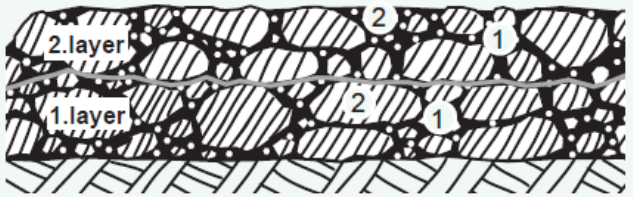
DOUBLE CHIP SEAL
1 Prime
2 Binder
3 Large stone
4 Binder

CAPE SEAL
1 Prime
2 Binder
3 Stone
4 Slurry

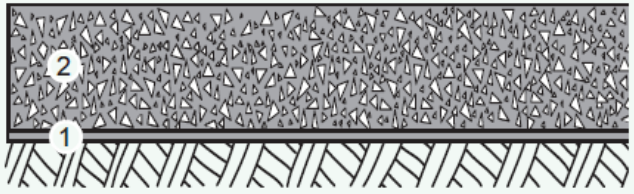


SINGLE OTTA SEAL
No Prime
1 Binder
2 Graded aggregate

DOUBLE OTTA SEAL
No Prime
1 Binder
2 Graded aggregate



ASPHALT CONCRETE
1 Prime
2 Asphalt Premix



RECOMMENDED TYPE OF OTTA SEAL IN RELATION TO TRAFFIC LEVELS

Traffic levels and type of work	Type of Otta seal
Temporary seal (diversions, haul roads, temporary accesses, etc.)	Single Otta seal
Maintenance resealing (all traffic classes to which conventional Chip seals are applicable)	Single Otta seal
AADT less than 500	Single Otta seal + sand cover seal
AADT more than 500	Double Otta seal

OTTA SEAL: RESEARCH

- Various webinars, conferences and seminars introduced concept.
- Various publications:
  - Minnesota DOT
  - Norwegian Public Road Admin.
- Internet searches, etc.
- E. Washington Agencies
- Vendor experience with similar seals
  - Bituminous surface treated (BST)

Otta Seal Surfacing of Aggregate Roads
2008 M&RR
Author: Greg Johnson, John Pantelis 2003, 2008

Description: An Otta seal is an asphalt surface treatment constructed by placing a graded aggregate on top of a thick application of relatively soft bituminous binding agent. Minnesota has used emulsified asphalt exclusively (HFMS-2s); it could be constructed with cutback asphalt if desired. The binder works its way into the aggregate with rolling and traffic. In comparison to other surface treatments, material and construction specifications are not as strict. Local aggregates that would not meet the requirements for high quality paving aggregate are often used in Otta seals.

Traffic Range: Very Low to High (AADT < 2000) for a double Otta seal.

Base/Subbase Requirements: Otta seals are constructed over an aggregate base course. Since Otta seals do not add structural capacity to the roadway, the base/subbase must be designed to support the anticipated traffic loading. Subgrade and base materials should be compacted and graded to provide a stable working surface prior to Otta seal placement. A prime coat is usually not used above the aggregate base prior to Otta seal application.

Materials: An Otta seal is constructed of a graded aggregate on top of a thick application of relatively soft bituminous binding agent. The bituminous binding is typically an emulsified asphalt (e.g. HFMS-2s). Bituminous binder application rates vary from about 1.9 liter/m^2 (0.45 gal/yd^2) to 2.4 liter/m^2 (0.56 gal/yd^2) for emulsified asphalt, depending on aggregate gradation and type. In comparison to other surface treatments, material and construction specifications are not as strict. Local aggregates that would not meet the requirements for high quality paving aggregate are often used in Otta seals. Natural gravels are acceptable. The maximum aggregate size in the graded aggregate is generally 13 to 25 mm (0.50 to 1 in.). The graded aggregate can be crushed or uncrushed and contain up to 10% fines. Quantities of aggregate are usually around 50 lb/yd2. Otta seal design is empirical in nature and trial sections are recommended to determine the appropriate material application rates.

Otta Seal Const. 2007, Olmsted County CR58

OTTA SEAL EQUIPMENT

- Asphalt Distributor
- Chip Spreader
- Pneumatic-tired roller
- Broom
- Water Truck

SOME GRADATION SPEC EXAMPLES

Washington vendor presentation

WSDOT "crushed Cover Stone" 9-03.4(2)

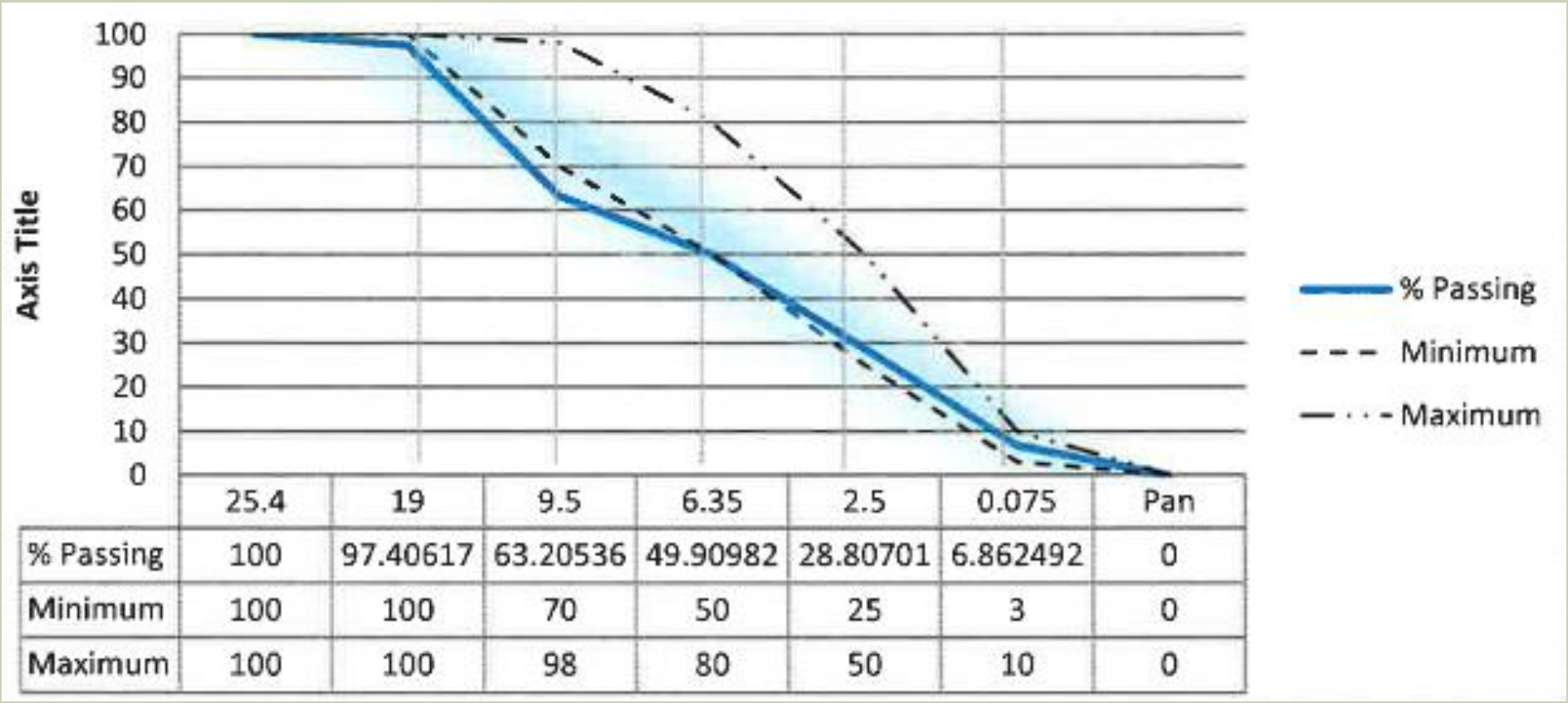
¾" square	100 % passing
5/8" square	95-100
U.S. No. 4	20-45
U.S. No. 200	0-7.5
% fracture by wt., min. 75	
Sand Equivalent min.	40
Static Stripping test	Pass

International Focus Group

Sieve (mm)	Dense grading	Medium grading	Coarse grading
	Percentage passing[1]		
19.0	100	100	100
16.0	93 - 100	84 - 100	80 - 100
13.2	84 - 100	68 - 94	52 - 82
9.5	70 - 98	44 - 73	36 - 58
6.7	54 - 80	29 - 54	20 - 40
4.75	44 - 70	19 - 42	10 - 30
2.00	20 - 48	3 - 18	0 - 8
1.180	15 - 38	1 - 14	0 - 5
0.425	7 - 25	0 - 6	0 - 2
0.075	3 - 10	0 - 2	0 - 1

Dense = Higher than 100 ADT

DESCHUTES COUNTY OTTA SEAL ROCK



	25.4	19	9.5	6.35	2.5	0.075	Pan
% Passing	100	97.40617	63.20536	49.90982	28.80701	6.862492	0
Minimum	100	100	70	50	25	3	0
Maximum	100	100	98	80	50	10	0

Dense Specification: (19 mm = ¾” and 0.075mm = #200 sieve)

PRE-INSTALLATION

(TYPICAL OF POST GRADING, PLAINVIEW ROAD)

HFMS-2 APPLICATION (0.48-50 GAL/SY)

(ROAD PRE-WET, 1-HOUR PRIOR, PLAINVIEW ROAD)

SINGLE PASS WITH CHIP SPREADER

(1”–MINUS “DIRTY” MATERIAL, WARD ROAD)

IMMEDIATE POST AGG APPLICATION

READY TO ROLL (AND ROLL AND ROLL AND ROLL)

SURFACE INTEGRITY

(VERY DIRTY APPEARANCE)

PLAINVIEW ROAD: 1-MONTH

(INCLUDED SAND SEAL)

WARD ROAD: 2 MONTHS
(SOME SHOVING ON GRADES AND INTERSECTION APPROACH)

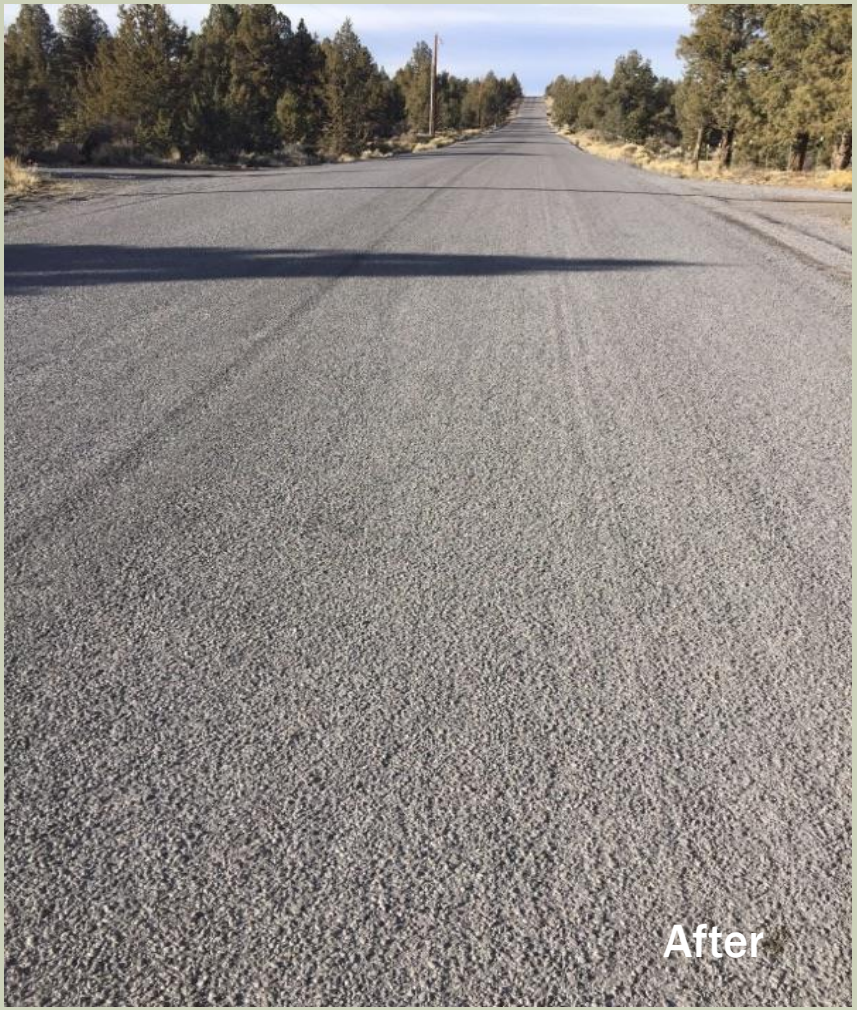
PLAINVIEW ROAD: 7 MONTHS

SOME FLAWS

(PLAINVIEW ROAD)

CHIP SEAL FINISHED PRODUCT

(WARD ROAD – EMULSION, UNCOATED ROCK)



OTTA SEAL INSTALLATION COST

Otta Seal - Ward/Groff	Amount	Unit	Unit $	Total
Labor	1	days		$ 16,355.00
Equipment	1	days		$ 4,181.00
Aggregate (1"-minus, dirty)	600	ton	$ 5.70	$ 3,420.00
High float oil (HFMS-2)	65	ton	$ 450.00	$ 29,244.00
		Total		**$ 53,200.00**
Surface Area	28,160	SY		
OTTA: Total $/SY				$ 1.89
2nd Lift: Chip Seal (uncoated, CRS-2P)				$ 1.65
Total (Otta plus Chip, $/SY):				**$ 3.54**

Hypothetical break-even point: 6.7 years

Notes:

- Personnel Rate Multiplier: 3.15 (fully loaded, with overhead)
- Equipment rates include depreciation.

OTTA SEAL: LESSONS LEARNED IN APPLICATION

- Segregation in chip spreader – especially in center.
  - Will seal one lane at a time to narrow width of spread.
- Lighter rollers preferred.
  - Will not use 10-ton double-drum roller again.
  - Too much vibe or weight promoted "sticking" to drums.
- Smooth base surface – not necessarily a good thing.
  - A little texture to promote adhesion, interlocking.
- Wet the base to promote some infiltration of the high-float oil.
- No need to wet the finished surface when rolling.

OTTA SEAL: LESSONS LEARNED IN DESIGN

- Consider grades and intersections.
  - Deceleration leads to shoving
  - Apply two-layers of Otta Seal on initial installation.
- Extended construction speed zone: 25 mph
- Gravel Road Conversion Issues:
  - Signage
  - Drainage
  - Other design issues that are overlooked with gravel roads.
- Is it a good chip seal alternative?
  - Use care in selecting roads – customer expectation issues.