Road Mat Options

Mats can be incredibly useful for road access.

These are timber mats 16’ long and 4’ wide.

These particular mats have been used for crossings and for access across a swamp for a summer sale.
Road Mat Options

Tamarack mats are the best if available.
Storage is key to longevity of mats. Have to be stacked with plenty of air flow around them.
A Grade mats offer the best bang for the buck.
Pricing ranges $400-$500/mat depending on species. Can buy used and some places rent them.

Road Mat Options

Mat Producers

Ashland Mat
• Ashland, WI
• 715-682-9366

Spartan Mats
• 503-970-3575
• 888-959-9366
Forest Roads: Key Ideas Discussion

Guideline Monitoring

- 179 sites monitored in 2016 and 2017
- Harvested late summer 2014 – summer 2016
- 6 sample watershed units
Presence of Waterbodies: Guideline Monitoring Results

- Over 87% of all monitoring sites had at least one waterbody or wetland on or adjacent or along the logging road accessing the site.
- Non-open water wetlands (NOWW) most common.

Mean Percent Infrastructure: Guideline Monitoring Results

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Total road and landing area should not exceed the following amounts:

<table>
<thead>
<tr>
<th>For harvest areas</th>
<th>Road and landing area should be less than</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 acres</td>
<td>1 acre</td>
</tr>
<tr>
<td>20–30 acres</td>
<td>5% of harvest area</td>
</tr>
<tr>
<td>&gt;30 acres</td>
<td>3% of harvest area</td>
</tr>
</tbody>
</table>

Total percent infrastructure:

- 2000-02: 3.0%
- 2004-06: 3.8%
- 2009: 4.2%
- 2011: 3.8%
- 2014-15: 2.6%
- 2016-17: 2.9%
Crossings and Approaches: Guideline Monitoring Results

- 335 crossings
  - 34% roads, 2% landings, 64% skid trails
  - 92% NOWW, 6% streams, 2% dry washes
  - 28% could have been avoided

Crossings and Approaches: Guideline Monitoring Results

- Approach – portion of a skid trail or road immediately leading into a wetland or waterbody
Crossings and Approaches: Guideline Monitoring Results

• Approach – portion of a skid trail or road immediately leading into a wetland or waterbody

Utilize the following general guidelines when installing crossings:

- Design approaches to divert water away from streams and wetlands.
  
  Field guide page 37

Install erosion control devices when the following conditions exist:

  Field guide page 29

- At all approaches to stream and wetland crossings.

Crossings and Approaches: Guideline Monitoring Results

- 659 approaches
  - 95% in stable condition (no erosion control needed)
- Of the 32 approaches where erosion control was deemed necessary, only eight (25%) had those practices installed
- Erosion observed 75% of time (18/24) when practices were needed but not installed
- In 72% of instances when erosion was occurring on approaches, contractors found evidence of sediment reaching the waterbody
Three Approaches to Reduce Soil and Water Impacts

• Avoid water and soil exposure wherever possible
• Address momentum (mass x velocity) [Reduce/divert volume and/or velocity of water flow]
• Apply Modified USLE concepts: \( A = R_w KLSCP \)
  - \( A \) = Average annual soil loss
  - \( R_w \) = Rainfall/runoff factor (considers watershed area, volume of runoff, and peak flow rate)
  - \( K \) = Soil erodibility factor (*)
  - \( L \) = Slope length (*)
  - \( S \) = Percent slope (*)
  - \( C \) = Vegetative cover factor (*)
  - \( P \) = Conservation practice factor (*)

* = Factor which can be incorporated into road design

Controlling water speed and volume on the top one-third of the exposed surface can reduce erosion by more than 65%
Discussion Question
The preexisting route you plan to reuse has a segment which is incised where the road is below the surrounding topography and erosion is occurring. How would you manage water in that area?
Soil Suitability for Roads

LiDAR

Light Detection and Ranging

- Remote sensing method
  - Inputs: Pulsed laser light & sensor used to image objects
  - Outputs: 3-D representation of target

Autonomous vehicles
What do you use LiDAR for? Where do you go to obtain LiDAR images?

**Road Cross Sections**

*Typical Road Profiles for Drainage and Stability*

- Crowned fill section for low ground use
- Outslope section for use on moderate slopes for low volume roads and stable soils
- Immep with ditch section for use on steep hills and areas with fine textured soils
- Crowned and ditched section for high volume roads on steep side hills

*Ratio = run/rise*

Source: Sustaining Minnesota Forest Resources: Voluntary Site-level FMGs
According to our field guide, what is the recommended minimum slope where you should install water bars?

1. 0%
2. 2% ←
3. 5%
4. 7%
5. 10%
6. Don’t know

Field guide page 31
Water Bars

Water bars
- Useful for closed roads, skid trails, and landings.
- Construct out of soil, logs, or other material.
- Install at appropriate spacing depending on slope.

<table>
<thead>
<tr>
<th>Slope</th>
<th>Spacing between water bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>250 feet</td>
</tr>
<tr>
<td>5%</td>
<td>130 feet</td>
</tr>
<tr>
<td>10%</td>
<td>80 feet</td>
</tr>
<tr>
<td>15%</td>
<td>50 feet</td>
</tr>
<tr>
<td>25%+</td>
<td>40 feet</td>
</tr>
</tbody>
</table>

Construct a shallow trench (approximately 6 inches deep) on the upslope side of the bar to funnel runoff.

Field guide page 31

Worn down by traffic
Difficult to maintain when trafficked
How many 18-inch culverts will carry the same volume of water as one 36-inch culvert?

1. 1
2. 2
3. 3
4. 4
5. 5
6. Don’t know

According to our forest management guidelines, what is the recommended minimum fill depth over a 36-inch culvert?

1. 10 inches
2. 12 inches
3. 18 inches
4. 24 inches
5. 36 inches
6. Don’t know

12 inches or half the culvert diameter, whichever is more
General Criteria for Designing a Culvert to Allow for Fish Passage and Maintain Stream Stability (MESBOAC Culvert Design Approach)

- Match culvert width to bankfull stream width.
- Extend culvert length through the toe of the side slope.
- Set the culvert at the same slope as the stream slope.
- Bury the culvert 4 to 12 inches into the stream bottom. For culverts 2 to 6 feet in diameter, dig 10 to 18 inches below the stream bottom.
- Offset multiple culverts, with culvert in the deepest part of the channel cross section buried according to permit requirements and centered on that deepest part. Set offset culvert(s) one foot higher.
- Align the culvert with the stream channel.
- Consider head cuts and cut offs.

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Match the Culvert Width to Bankfull Stream Width

- Measure at the narrowest point on the channel away from the crossing
Extend Culvert Length Through the Side Slope Toe of the Road

Set the Culvert at the Same Slope as the Stream Slope
**Bury the Culvert into the Stream Bottom**

- Normally bury 4 to 12 inches into the stream bottom
- For culverts 2 to 6 feet in diameter, bury 10 to 18 inches into the stream bottom

**Off-set Culverts**

- One large diameter culvert is generally preferred but may not be the best choice on a stream with a wide range of stream flows

Why not?
Off-set Culverts

- Lower culvert is set into the stream bottom. Upper culvert is one foot higher. Two culverts together should equal bankfull channel width.

Align the Culvert with the Stream Channel

- Minimize changes in flow direction to minimize need for armoring
- Straightening a stream causes water to fall the same height over a shorter distance, increasing velocity faster
Consider Head Cuts and Cut Offs

- Used to protect culvert foundation from scour, to anchor it in place, and to reach a firmer foundation

True or False -- For a ford crossing, no permit is required if a) the graded finished slope is no steeper than 5:1 AND b) the graded banks are seeded or mulched.

1. True
2. False

See Appendix H
True or False -- The purpose of the Landowner Statement and Contractor and Responsibility Form is to communicate and ensure that any wetlands or public water concerns/permitting are completed prior to equipment activity occurring.

1. True
2. False

See Landowner Statement and Contractor and Responsibility Form