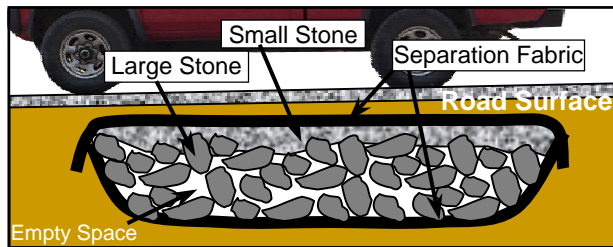


FRENCH MATTRESS –A structure under a road consisting of coarse rock wrapped in fabric through which water can freely pass. A *French mattress* is basically a French drain that is used similar to a culvert to allow water passage through the roadbed.



Side view cut-away diagram of a French mattress.



Side view of an actual French mattress.

PURPOSES: The primary function of a *French mattress* is to provide load support and to establish, maintain, or equalize the subsurface water on both sides of the road. The use of *French mattresses* in road maintenance is a relatively new concept. Please contact the Center for Dirt & Gravel Road Studies with any questions or concerns.

HOW THEY WORK:

Support strength is provided by large rocks in the lower portions and by spreading the weight load with layers of progressively smaller rock near the top. Water moves into the *French mattress* from any direction through the protective geo-textile fabric, which functions to prevent migration of fine material. The water collects in the voids provided by the larger rock and moves by gravity either into the soil or subsurface drainpipes, if provided, or exits as a gentle seep on the downhill end of the structure.

BENEFITS OF A FRENCH MATTRESS:

- Corrects road support problems in areas where the road base has been weakened by water saturation caused when the road acts as a dam to natural water flow.
- Allows for natural equalization of subsurface water on both sides of a road.
- Requires little, if any, maintenance compared to cross-drainage culverts.
- Eliminates the need for additional cross pipes in some instances.
- Allows a gentle, non-erosive water discharge rather than concentrated flow.
- Provides an indefinite service life if not compromised by heavy flows of sediment.

WHERE TO USE A FRENCH MATTRESS:

- Areas where concentrated outlet flow through a pipe may be undesirable, impractical, or regulated.
- Low-lying areas near streams or wetlands where installing cross drains would be difficult.
- Areas where a road is acting as an impoundment or dam to the natural water flow by isolating subsurface water on one side of the road from the other.
- Areas where placement of a pipe at the depth necessary to provide structural cover would lower the natural water table of the area and require long term maintenance.

IMPORTANT CONSIDERATIONS

- **Materials:** The core material for the mattress should be large clean stone, typically referred to as R4¹. A general rule is that the depth of the mattress needs to be at least three times the diameter of the largest stone used. Smaller stone, such as #3's¹ should be placed on top of the large stone. Progressively smaller stone should be placed on top to prevent tearing of the fabric. The structure should be wrapped in heavy-duty, non-woven separation fabric.
- **Dimensions:** The length of the mattress must, at a minimum, equal the width of the road, but can extend out of the road area to equalize drainage. Mattress width and stone size depend on the amount of water that needs to pass through. In wetland settings, the mattress should be as wide as possible to allow slow lateral flow and avoid concentrating the outlet drainage. Mattress depth depends on stone size, depth available, and desired drainage patterns.
- **Equipment:** Most mattresses can be installed easily with a backhoe and a truck to haul stone.

CONSTRUCTION: Refer to numbered pictures on right.

1. Excavate the section of the road where the mattress will be located to desired depth. Lay heavy-duty separation fabric in the bottom of the area after excavation and leveling. Use bedding material if necessary to protect fabric. Leave enough fabric on the ends to wrap around and overlap with top fabric later.

2. Place large stone, typically R4¹, on top of the fabric and spread out into a uniform bed.

3. Place a layer of smaller stone such as #3's¹ on top of the R4¹. Be careful not to intermix the two stone sizes. The empty space between the large stones, and therefore flow capacity, will be reduced if the small stone is intermixed. Spread increasingly smaller stone on top to create layer that will not puncture fabric.

4. Wrap ends of lower fabric up on top of structure. Place a piece of fabric on the top if existing fabric does not completely cover mattress. All fabric "joints" should overlap by at least 18".

5. Place bedding material and fill over the mattress if necessary. Place driving surface aggregate (DSA) over the structure according to normal program specifications and procedures.

TYPICAL REQUIREMENTS:

While these figures will vary with the size of structure and individual site conditions, here is what was required for the 20' x 12' x 1.5' mattress illustrated on the right:

- 3 Hours of work with a Case 580 Backhoe
- 20 tons of clean R4¹ rock (large rock)
- 8 tons of clean #3¹ rock (small rock on top)
- 85 Square yards of heavy-duty geo-textile (fabric)
- Sufficient fill and driving surface aggregate over fabric (minimum of 6 inches recommended after compaction)

¹ R4 and #3 size rock refer to PA Department of Transportation Section 408 Specifications. #3 rock ranges from 1" to 2 1/2". R4 rock ranges from 3" to 18".

