Office of Bridges and Structures

Preliminary Design

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HEC-23 Bridge Scour Countermeasures

- Pier Scour Countermeasures?
- NHI Course – Countermeasure Matrix
- Riprap – Depth to Contraction Scour
- Possible/Secondary Uses

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Countermeasure Group	Local Scour		Contraction Scour	Stream Instability	
	Abutments	Piers	Floodplain and Channel	Vertical	Lateral
TRANSVERSE STRUCTURES					
npermeable spurs (jetties, groins, wing dams)	◗	◗	○	○	●
ermeable spurs (fences, netting)	◗	◗	○	○	●
ransverse dikes	○	○	○	○	●
endway weirs/Stream barbs[1]	◗	◗	○	○	●
ardpoints	○	○	○	○	●
rop structures (check dams, grade control)	◗	◗	◗	●	○
mbankment Spurs	◗	○	◗	○	○
ONGITUDINAL STRUCTURES					
ongitudinal dikes (crib/rock toe/embankments)	◗	○	○	○	●
etards	◗	○	○	○	●
ulkheads	●	○	○	○	●
uide banks	●	◗	◗	○	◗
REAL STRUCTURES/TREATMENTS					

REVETMENTS AND BED ARMOR					
Rigid					
Soil cement	●	◗	◗	◗	●
Concrete pavement	●	◗	●	◗	●
Rigid grout filled mattress/concrete fabric mat	●	◗	◗	◗	●
Grouted riprap	◗	○	○	○	◗
Flexible/articulating					
Riprap	●	◗	◗	◗	●
Self launching riprap (windrow)	○	○	○	○	◗
Riprap fill-trench	◗	○	○	○	●
Gabions/gabion mattress[2]	●	◗	◗	◗	●
Wire enclosed riprap mattress (rail bank/sausage)	●	○	○	○	●
Articulated blocks (interlocking and/or cable tied)	●	◗	◗	◗	●
Concrete/grout mattress (fabric-formed)	●	◗	◗	◗	●
LOCAL SCOUR ARMORING					
Riprap (fill/apron)	●	◗	N/A	N/A	N/A
Grouted riprap	◗	○	N/A	N/A	N/A
Concrete armor units (Toskanes, tetrapods, etc.)[3]	◗	◗	N/A	N/A	N/A
Grout filled bags/sand cement bags	●	◗	N/A	N/A	N/A
Gabions	●	◗	N/A	N/A	N/A
Articulated blocks (interlocking and/or cable tied)	●	◗	N/A	N/A	N/A
Sheet pile/cofferdam	◗	◗	N/A	N/A	N/A

Iowa's Use of Articulated Fabric Formed Mattresses

- Vertical/High Abutment Bridges
- Permanent Countermeasure -Piers
- Bridge Berm Protection
- Overflow Bridges

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Iowa's Reasons For Use

- Resist Displacement
- Installation
- Cost

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Scour Critical – Vertical Abutment Bridge

- Two Span Bridge w/Conc. Sheet Pile Abutment/Pier
- Collar Design For Pier/Abutment Protection
- Provides Permanent Concrete Bottom

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Three Span Bridge – Pier Protection

- Excessive Scour At Piers – Angle of Attack
- 52’ x 32’ Mats – Significant Armoring
- Minimal Contraction Scour

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Berm Protection

- FIS Location
- Limited Waterway Encroachment – High Velocities
- Less Excavation – Better Survivability

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Overflow Bridges

- Emergency Repair Project
- Berm and Streambed Protection
- Deep Scour Hole/Embankment Failure

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Conclusions

- Articulating Fabric Formed Mattresses:

- Easy to Install
- Cost Effective
- More Durable than Riprap
- Can Be Considered Permanent Countermeasure

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