ARMORTEC HARD ARMOR SOLUTIONS.

A LEGACY OF SUCCESS

Doing the seemingly impossible is an everyday job. With erosion control systems for any need in any application, Contech Engineered Solutions delivers a range of effective, efficient solutions. Our engineered systems provide performance-tested solutions for a wide variety of applications including channel lining, shoreline protection, dam crests and spillways, energy dissipation, pipeline and cable protection, bridge and abutment protection, boat ramps, low water crossings, outfall protection, wave attack protection and more.

1978 – ArmorFlex® Articulating Concrete Block Mats developed
1980
1983 – Delft Hydraulics Wave Attack Testing for ArmorFlex®
1986 – ArmorLoc® introduced
1988/89 – ArmorFlex® FHWA Research Study
1990
1991 – A-Jacks® Concrete Armor Units introduced
1996 – ArmorFlex® and A-Jacks® inclusion in FHWA HEC 23
1999 – ArmorRoad®
2000 – ArmorFlex® L’ Block and Tapered Block Hydraulic Stability and Overtopping Testing
2000 – Ongoing Hydraulic & Structural Testing A-Jacks®
2002 – Infield Development of ArmorRoad®
2003 – Manly Hydraulics A-Jacks® Wave Flume Testing Phase I
2006 – ArmorFlex® Block and a Half developed
2009 – Manly Hydraulics A-Jacks Wave Flume Testing Phase II
2010 – ArmorFlex® ASTM Hydraulic Testing
2013 – ArmorFlex® Erosion Control Solutions

BUILDING CONFIDENCE EVERY STEP OF THE WAY

<table>
<thead>
<tr>
<th>ARMORTEC SOLUTIONS</th>
<th>VS.</th>
<th>TRADITIONAL RIP-RAP</th>
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<tr>
<td><strong>RESEARCH &amp; DEVELOPMENT</strong></td>
<td>ASTM TESTING PROTOCOL COMPLIANT FULL-SCALE TESTING</td>
<td>SCALE MODEL TESTING</td>
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<tr>
<td><strong>DESIGN</strong></td>
<td>CONSISTENT &amp; CONSERVATIVE INDUSTRY DESIGN GUIDELINES</td>
<td>RECOMMENDED GRADATION VARIES WITH METHODOLOGY</td>
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<td><strong>QUALITY CONTROL</strong></td>
<td>MANUFACTURED UNDER CONTROLLED CONDITIONS IN COMPLIANCE WITH ASTM ESTABLISHED STANDARDS</td>
<td>RANDOM QUARRIED MATERIAL WITH LIMITED QUALITY CONTROL</td>
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<td>CONFIDENT &amp; SELF-EVIDENT PLACEMENT QUALITY</td>
<td>VARIABLE PARTICLE DISTRIBUTION</td>
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INCREASE YOUR CONFIDENCE WITH ARMORTEC
PROCESS – DESIGN, PREFABRICATION, INSTALL.

<table>
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<tr>
<th>ARMORFLEX®</th>
<th>HAND-PLACED</th>
<th>A-JACKS®</th>
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<tr>
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<td>COMPLETION</td>
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ARMORFLEX® ARTICULATING CONCRETE BLOCKS

OPEN CELL BLOCK DESIGN ALLOWS FOR REVEGETATION

CLOSED CELL BLOCK DESIGN ALLOWS FOR HEAVY LOADING

BOTH BLOCKS READILY ADAPT TO COMPLEX SITE GEOMETRIES

BLOCK OPTIONS

Open-Cell Block

Closed-Cell Block

Tapered Open-Cell Block

Block and a Half®

ARMORFLEX UNIT SPECIFICATION

<table>
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<tr>
<th>Block Class</th>
<th>Nominal Thickness (in)</th>
<th>Length (in)</th>
<th>Width (in)</th>
<th>Gross Area (sf)</th>
<th>Minimum Weight (lbs)</th>
<th>Open Area %</th>
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<th>D° slope (psf)</th>
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ARMORFLEX® ARTICULATING CONCRETE BLOCKS

APPLICATIONS

- Channel Lining
- Shoreline Protection
- Scour Protection
- Slope Protection
- Outfall Protection
- Pipeline & Cable Protection
- Weirs
- Spillways
- Dam Overtopping
- Emergency Overflows
- Grade Transitions
- Intracoastal Waterways
- Bays
- Lakes
- Reservoirs
- Low Water Crossings
- Boat Ramps
- Down Chutes

MATTED SOLUTIONS

SCOUR PROTECTION

SHORELINE PROTECTION

VEGETATED SLOPE

CHANNEL LINING

SUBMERGED ARMORING

Dam Overtopping
ARMORFLEX® DESIGN CONSIDERATIONS

SIZING

ArmorFlex® ACB vs Traditional Riprap*

<table>
<thead>
<tr>
<th>VELOCITY (FPS)</th>
<th>ArmorFlex Non-Tapered ACB</th>
<th>ArmorFlex Tapered ACB</th>
<th>USACE D30 Riprap (Maynord)</th>
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<td>19 fps</td>
<td>64&quot;</td>
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<td>21 fps</td>
<td>169&quot;</td>
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* Assume 4H:1V sideslopes, 2% bedslope, 15ft. bed width, 3ft. flow depth, FS = 1.5

TYPICAL CROSS SECTIONS (not to scale)

Standard Cross Section

Tapered Series - Cross Section

REFERENCES AND STANDARDS

- ASTM D 7276 – Standard Guide for Analysis and Interpretation of Test Data for ACB Revetment Systems in Open Channel Flow
- ASTM D 6684 – Standard Specification for Materials and Manufacture of Articulating Concrete Block (ACB) Revetment Systems
- ASTM D 6884 – Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems
ARMORFLEX® INSTALLATION

THE ARMORTEC® HARD ARMOR ADVANTAGE

PROCESS

Step 1: ArmorFlex arrives on-site as a system of factory-assembled mats. ArmorFlex is placed on a site specific geotextile which has been placed on a prepared subgrade using conventional construction equipment.

Step 2: Mats are supplied on flat bed trailers. Mats can be handled with a spreader bar which can be rented from Contech.

Step 3: ArmorFlex Mats are placed according to the site plans with appropriately sized equipment. Above normal waterline mats may be topsoiled and seeded to give a vegetated effect.

Step 4: Proper toe trench requires a minimum of two rows of block buried below predicated soil depth. Tapered series block or mats subject to wave attack are required to have a bedding layer of crushed stone or gravel.

ARMORROAD® CONCRETE UNITS

APPLICATIONS

- Industrial Yards
- Durable Driving Surface
- Temporary Road
- Lay Down Yard
- Heaving and Expanding Subgrades

ARMORROAD UNIT SPECIFICATION

<table>
<thead>
<tr>
<th>Block</th>
<th>L</th>
<th>W</th>
<th>H</th>
<th>Minimum Weight (lbs / sf)</th>
<th>SF per Truck load</th>
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<tr>
<td>Mat</td>
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<td>15.60</td>
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* See ArmorFlex Installation Guide for additional information.
A-JACKS® CONCRETE ARMORING UNITS (CAU)

APPLICATIONS

- Bridge/Pier Scour
- Energy Dissipation
- Streambank/Toe Stabilization
- Shoreline
- Drop Structure
- Weirs
- Coastal Breakwater (Jetty)
- Habitat Creation

INSTALLATION

- Hand-placed and Bundled Unit Methods
- Field Technicians Available for Pre-con and Installation
- Construction Versatility
A-JACKS® DESIGN CONSIDERATIONS

DESIGN

- A-Jacks® are recommended in FHWA HEC 23 with further guidance in Design Guideline 19.

STANDARD DETAILS

A-Jacks Placement Profile

<table>
<thead>
<tr>
<th>A-JACKS UNIT SPECIFICATION</th>
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<tbody>
<tr>
<td>A-Jacks</td>
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<td>AJ-96</td>
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<td>AJ-120</td>
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</table>

A-Jacks Energy Dissipation Detail

A-Jacks Toe Stabilization Detail
ADDitional Hand-Placed Acb Solutions

ArmorfLEX®

- Dam Overtopping
- Auxiliary Spillways
- Emergency Overflow
- Grade Transitions
- Retention Basins
- Shoreline Protection
- Drainage Ditch Lining
- Outfall Protection
- Bridge Abutment Protection

ArmorfLOC®

- Auxiliary Spillways
- Emergency Overflow
- Grade Transitions
- Retention Basins
- Shoreline Protection
- Drainage Ditch Lining
- Outfall Protection
- Bridge Abutment Protection
- Walking Paths
- Auxiliary Parking
- Slope Paving

ArmorfWEDGE®

- Dam Overtopping
- High Velocity Channels
- Primary and Secondary Spillways
- Down Chutes
CONSIDERATIONS FOR ENGINEER OF RECORD

- Site Design
- Soil Borings
- Hydraulic Analysis
- Scour Analysis
- Scour Countermeasures
- Permitting
- Inspections

SOLUTION DEVELOPMENT & DESIGN SUPPORT

- Limit Assessment
- Hydraulic Analysis
- HEC RAS Review
- Factor of Safety Analysis
- Block Selection
- Engineer's Estimate
- Proposal Drawings
- Contract Drawings
- Specifications
- Approval Assistance
- Staging and Layout
- Fabrication Drawings

INSTALLATION SUPPORT

- Preconstruction Meeting
- Logistics Coordination
- Onsite Installation Assistance

HEC RAS REVIEW

DRAWINGS & TECHNICAL SUPPORT

STAGING & LAYOUT
ENGINEERED SOLUTIONS

PIPE SOLUTIONS
Meeting project needs for durability, hydraulics, corrosion resistance, and stiffness
• Corrugated Metal Pipe (CMP)
• Steel Reinforced Polyethylene (SRPE)
• High Density Polyethylene (HDPE)
• Polyvinyl Chloride (PVC)

STORMWATER SOLUTIONS
Helping to satisfy stormwater management requirements on land development projects
• Stormwater Treatment
• Detention/Infiltration
• Rainwater Harvesting
• Biofiltration/Bioretenion

STRUCTURES SOLUTIONS
Providing innovative options and support for crossings, culverts, and bridges
• Plate, Precast & Truss bridges
• Hard Armor
• Retaining Walls
• Tunnel Liner Plate

COMPLETE SITE SOLUTIONS

ADDITIONAL SPECIALTY PRODUCTS

TURF REINFORCEMENT MATS
BIN WALL
LIGHT GAGE METRIC SHEETING

For more information, call one of Contech’s Regional Offices located in the following cities:

Corporate Office - Ohio (Cincinnati)  513-645-7000
California (Roseville)  800-548-4667
Colorado (Denver)  720-587-2700
Florida (Orlando)  321-348-3520
Maine (Scarborough)  207-885-9830
Maryland (Baltimore)  410-740-8490
Oregon (Portland)  503-258-3180
Texas (Dallas)  972-590-2000

www.ContechES.com 800-338-1122

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