

SAMPLE OF ESTIMATED QUANTITIES TABULATION FOR MODULAR BLOCK WALLS ③

	UNIT	QUANTITY
STRUCTURE EXCAVATION CLASS ---	CU. YD.	
STRUCTURAL BACKFILL (CV)	CU. YD.	
STRUCTURAL CONCRETE (1P42)	CU. YD.	
COARSE FILTER AGGREGATE	CU. YD.	
MODULAR BLOCK RETAINING WALL	SQ. FT.	
TYPE 1 GEOTEXTILE	SQ. YD.	

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- ① VERTICAL FACE AREA OF MODULAR BLOCK AS MEASURED FROM PLAN TOP OF WALL TO 2 FT. BELOW FINISHED GRADE AT BOTTOM OF WALL.
- ② PAY ITEM FOR MBW WALLS SHALL BE 2411.
- ③ REFER TO TABULATIONS / ESTIMATE SHEETS FOR QUANTITIES.
- ④ FOR USE AS LEVELING PAD.

DEFINITION OF TERMS

MBW = MODULAR BLOCK WALL	
C.I.P. = CAST-IN-PLACE	
H = WALL HEIGHT FROM TOP OF CAP TO BOTTOM OF LOWERMOST BLOCK UNIT	
S = VERTICAL REINFORCEMENT SPACING	
REINFORCEMENT COVERAGE RATIO = WIDTH OF SOIL REINFORCEMENTS TO HORIZONTAL SPACING (100% COVERAGE RATIO REQUIRED)	

NOTES TO CONTRACTOR:

APPROVED COMBINATIONS OF MODULAR BLOCK UNIT AND SOIL REINFORCEMENT AND APPROVED MODULAR BLOCK UNIT PRODUCTS ARE MAINTAINED BY THE FOUNDATION UNIT (GEOTECHNICAL ENGINEERING SECTION) AND ARE POSTED AT <https://www.dot.state.mn.us> ONLY APPROVED PRODUCT COMBINATIONS AND APPROVED BLOCK UNITS PRODUCED FROM APPROVED SOURCES SHALL BE USED.

PROVIDE DETAILED SHOP DRAWINGS FOR CONSTRUCTION CONTAINING:

- A COPY OF MnDOT STANDARD SHEETS FOR LOADING CASE(S) USED WITH BLOCK TYPE AND SPACING NOTED ON THE "MODULAR BLOCK WALL REINFORCEMENT LAYOUT" TABLE.
- ELEVATION VIEW WITH REINFORCEMENT PLACEMENT REQUIREMENTS, WALL FACING LAYOUT, AND GEOMETRIC INFORMATION. TOP OF WALL MAY EXTEND UP TO 4" ABOVE PLAN TOP OF WALL ELEVATION.
- PLAN VIEW WITH BOTTOM AND TOP OF WALL ALIGNMENT, AND PLAN LIMITS OF WALL ALIGNMENT.
- CROSS SECTIONS DETAILING BATTER, REINFORCEMENT, VERTICAL SPACING, REINFORCEMENT LENGTHS, SUBSURFACE DRAINAGE, SURFACE DRAINAGE, AND WATER RUNOFF COLLECTION ABOVE WALL.
- REINFORCEMENT LAYOUT: REINFORCEMENT SHALL BE PLACED AT 100% COVERAGE RATIO. REINFORCEMENT ELEVATIONS SHALL BE CONSISTENT ACROSS LENGTH OF WALL STRUCTURE.
- BLOCK, REINFORCEMENT AND FILL PLACEMENT METHODS AND REQUIREMENTS.
- DETAIL ALL WALL FILL PENETRATIONS AND WALL FACE PENETRATIONS. DETAIL REINFORCEMENT AND/OR WALL FACING UNIT PLACEMENT AROUND PENETRATIONS. VERTICAL PENETRATIONS GREATER THAN 1 FT. DIAMETER REQUIRE A STRUCTURAL GEOGRID DIVERSION SYSTEM AND/OR PREINSTALLED SLEEVES.
- DETAILS THAT ARE SPECIFIC TO VENDOR PRODUCTS AND THEIR INTERACTION WITH OTHER PROJECT COMPONENTS.
- LIST INFORMATION ON APPROVED COMBINATION OF MBW UNIT AND GEOSYNTHETIC REINFORCEMENT, INCLUDING MnDOT CLASSIFICATION CODE, NOMINAL BLOCK WIDTH, PROPERTIES FOR FIELD IDENTIFICATION, AND INSTALLATION INSTRUCTIONS.
- DETAILS OF CAP UNITS AND INSTALLATION/FASTENING INSTRUCTIONS FOR THE CAPS. CAP UNITS SHALL BE SET IN A BED OF ADHESIVE DESIGNED TO WITHSTAND MOISTURE AND TEMPERATURE EXTREMES, REMAIN FLEXIBLE, AND SHALL BE SPECIFICALLY FORMULATED FOR BONDING MASONRY TO MASONRY.
- CERTIFICATION BY PROFESSIONAL ENGINEER EXPERIENCED IN MBW DESIGN THAT THE CONSTRUCTION LAYOUT MEETS THE REQUIREMENTS OF PLANS AND MnDOT MBW STANDARDS. DEVIATION FROM STANDARD DESIGN TABLES ARE PERMITTED BY VALUE ENGINEERING SUBMITTAL ONLY ON PROJECTS WITH OVER 5000 SQ. FT. OF WALL.
- CONTRACTOR MUST PROVIDE AN MBW SUBMITTAL THAT DETAILS EROSION PREVENTION AND PERMANENT PLANT STABILIZATION. THE SUBMITTAL MUST ALSO MEET THE REQUIREMENTS OF SPEC. 1712.2.

DESIGN CRITERIA

DESIGN CRITERIA FOLLOWS THE "AASHTO LRFD BRIDGE DESIGN SPECIFICATION" (7TH EDITION, 2014) EXCEPT FOR THE DEVIATIONS NOTED BELOW. DESIGN CRITERIA ARE IN ACCORDANCE WITH MnDOT POLICY, AS RECORDED IN THE MnDOT ROAD DESIGN MANUAL, OR FACILITY DESIGN GUIDE.

- A. THE MINIMUM REINFORCEMENT LENGTH IS 7 FT. FROM THE FRONT OF THE BLOCK OR 0.8H FOR CASE 1 AND CASE 3 AND 1.2H FOR CASE 2, WHICHEVER IS GREATER.
- B. THE REINFORCEMENT FILL FRICTION ANGLE IS 34°.
- C. THE LATERAL EARTH PRESSURE COMPUTATION FOR EXTERNAL STABILITY CALCULATIONS USES AN INTERFACE FRICTION ANGLE SET EQUAL TO THE RETAINED BACKFILL ANGLE.
- D. THE LATERAL EARTH PRESSURE COMPUTATION FOR INTERNAL STABILITY CALCULATIONS USES THE EFFECTS OF WALL FACE BATTER.

LOAD FACTORS - STRENGTH LIMIT STATE

HORIZONTAL EARTH PRESSURE (γ_{EH}) = 1.5 FOR EXTERNAL STABILITY
 HORIZONTAL EARTH PRESSURE (γ_{EH}) = 1.35 FOR INTERNAL STABILITY
 VERTICAL PRESSURE FROM DEAD LOAD OF EARTH FILL (γ_{EV}) = 1.35 FOR BEARING CAPACITY
 VERTICAL PRESSURE FROM DEAD LOAD OF EARTH FILL (γ_{EV}) = 1.0 FOR SLIDING AND PULL OUT
 EQUIVALENT EARTH PRESSURE SURCHARGE (γ) = 1.35

RESISTANCE FACTORS - STRENGTH LIMIT STATE

BEARING ϕ_{BR} = 0.65
 DIRECT SLIDING ϕ_{DS} = 1.0
 GEOGRID STRENGTH ϕ = 0.9
 GEOGRID BLOCK CONNECTION STRENGTH ϕ = 0.9
 GEOGRID PULLOUT ϕ = 0.9

SEE FOUNDATION REPORT FOR NOMINAL SOIL BEARING RESISTANCE OF FOUNDATION SOIL.

CASE 1 AND 3 - NOMINAL SOIL BEARING RESISTANCE OF 2000 PSF IS REQUIRED FOR WALLS UP TO 12 FT IN HEIGHT. FOR WALLS GREATER THAN 12 FT IN HEIGHT, THE REQUIRED NOMINAL BEARING RESISTANCE IS EQUAL TO 2000 PSF + (H-10)(1500 PSF) WHERE H IS IN FEET.

CASE 2 - NOMINAL SOIL BEARING RESISTANCE OF 2500 PSF IS REQUIRED FOR WALLS UP TO 12 FT IN HEIGHT. FOR WALLS GREATER THAN 12 FT IN HEIGHT, THE REQUIRED NOMINAL BEARING RESISTANCE IS EQUAL TO 2500 PSF + (H-10)(2200 PSF) WHERE H IS IN FEET.

REINFORCED WALL FILL CHARACTERISTICS:

- A. USE STRUCTURAL BACKFILL (SPEC. 3149.2D2)
- B. INTERNAL ANGLE OF FRICTION (ϕ_r) = 34° MINIMUM
- C. COHESION (C) = 0
- D. MOIST UNIT WEIGHT (γ_r) = 125 PCF

COARSE FILTER AGGREGATE CHARACTERISTICS:

- A. COARSE FILTER AGGREGATE TO MEET SPEC. 3149.2H.

RETAINED BACKFILL CHARACTERISTICS:

- A. INTERNAL ANGLE OF FRICTION (ϕ_b) = 30°
- B. COHESION (C) = 0
- C. MOIST UNIT WEIGHT (γ_b) = 120 PCF

FOUNDATION SOILS CHARACTERISTICS:

- A. INTERNAL ANGLE OF FRICTION (ϕ_f) = 30°
- B. COHESION (C) = 0
- C. UNIT WEIGHT (γ_f) = 120 PCF

BASIS OF DESIGN:

IN ADDITION TO THE STANDARD SHEETS, INCLUDE PLAN AND FRONT ELEVATION VIEWS OF THE MODULAR BLOCK RETAINING WALLS IN THE PLANS. THE PLAN VIEW MUST SHOW ALIGNMENT BASELINE, LIMITS OF BOTTOM OF WALL ALIGNMENT, AND LIMITS OF TOP OF WALL ALIGNMENT AS ALIGNMENTS VARY WITH BATTER OF WALL SYSTEM ACTUALLY SUPPLIED. THE FRONT ELEVATION MUST IDENTIFY BOTTOM AND TOP OF WALL ELEVATIONS, EXISTING GRADES, AND FINISHED GRADES.

IF THE WALL IS CURVED, THE RADIUS AT THE BOTTOM AND THE TOP OF EACH WALL SEGMENT AND THE P.C. AND P.T. STATION POINTS OFF OF BASELINE AND LIMITS OF BOTTOM AND TOP OF WALL ALIGNMENT MUST BE SHOWN.

REFERENCE STANDARD PLATES AND PROVIDE DETAILS FOR TRAFFIC BARRIERS, CURB AND GUTTER, HANDRAILS AND FENCING AS REQUIRED BY PROJECT CONDITIONS. SEE AASHTO MANUALS, MnDOT ROAD DESIGN MANUAL OR FACILITY DESIGN GUIDE, STANDARD PLATES AND DETAILS FOR REQUIREMENTS.

SHOW SURFACE DRAINAGE PATTERNS IN THE PLAN VIEW. PROVIDE DIMENSIONS FOR WIDTH AND DEPTH OF THE DRAINAGE SWALE AS WELL AS THE TYPE OF IMPERVIOUS LINER MATERIAL. COLLECT SURFACE WATER RUNOFF ABOVE AND DIVERT AROUND WALL FACE.

DETAIL LINES AND GRADES OF THE INTERNAL DRAINAGE COLLECTION PIPE. DETAIL OR NOTE THE DESTINATION OF INTERNAL WALL DRAINS AS WELL AS THE METHOD OF TERMINATION (DAYLIGHT END OF PIPE OR CONNECTION INTO HYDRAULIC STRUCTURE). SPACE DRAIN PIPE OUTLET NOT MORE THAN 150 FT.

SOFT SOILS AND/OR HIGH WATER CONDITIONS (DEFINED AS GROUNDWATER WITHIN A DEPTH EQUAL TO THE WALL HEIGHT (H) MAY NOT BE SUITABLE FOR APPLICATION OF STANDARD DESIGNS AND REQUIRE SPECIAL CONSIDERATION BY THE FOUNDATIONS UNIT.

STANDARD DESIGN CHARTS ARE NOT APPLICABLE TO:

- PROJECT/SITES WHERE FOUNDATION SOILS SHEAR STRENGTH AND/OR BEARING RESISTANCE DO NOT MEET OR EXCEED VALUES USED IN THE DEVELOPMENT OF STANDARD DESIGN CHARTS.
- PROJECTS WITH A LARGE QUANTITY OF FACE AREA WHERE PROJECT SPECIFIC DESIGNS ARE RECOMMENDED, AS DEFINED IN MnDOT ROAD DESIGN MANUAL OR FACILITY DESIGN GUIDE.
- WHERE SLOPES IN FRONT OF WALL ARE STEEPER THAN 1:3.
- WHERE MAXIMUM WALL HEIGHT EXCEEDS 12 FT.
- WHERE WALLS ARE TIERED.
- WALLS WITH NOISE WALLS.

IF USING CONCRETE RAILING, INCLUDE STANDARD BRIDGE DETAIL "CONCRETE RAILING (TYPE F)" IN PLAN SET.

PROVIDE PROJECT SPECIFIC AESTHETIC REQUIREMENTS INCLUDING COLOR AND FASCIA SURFACING IN THE SPECIAL PROVISIONS.

MnDOT ROAD DESIGN MANUAL OR FACILITY DESIGN GUIDE CONTAINS GUIDELINES, TRAFFIC SAFETY AND OTHER ASPECTS.

LEAD EXPERT OFFICE
 AMBER BLANCHARD
 ACTING DIRECTOR
 OFFICE OF MATERIALS
 & ROAD RESEARCH



**MODULAR BLOCK RETAINING WALL
GENERAL NOTES**

APPROVED: 03-29-2023
REVISED:

Thomas Styrbicki
 THOMAS STYRBICKI
 STATE DESIGN ENGINEER

STANDARD PLAN
 5-297.640

1 OF 2

STANDARD PLAN

STATE PROJ. NO.

SHEET NO.



TRUNK HWY.

TOTAL SHEETS

MODULAR WALL STORMWATER MANAGEMENT AND VEGETATION ESTABLISHMENT NOTES

THE FOLLOWING MUST BE ADDRESSED IN DESIGN AND INCORPORATED INTO THE PLAN SUBMITTALS:

1. STORMWATER MANAGEMENT OF OVERLAND AND SLOPE TOE FLOWS-
 INCLUDE IN WALL PACKAGE SUBMITTAL THAT DETAILS HOW OVERLAND AND TOE OF SLOPE FLOWS WILL BE MANAGED AROUND AND THROUGH DURING ALL PHASES OF WALL CONSTRUCTION.
 INCLUDE THE FOLLOWING:
 A. DESCRIBE EROSION PREVENTION BMPs, AND METHODS FOR APPROPRIATE INSTALLATION.
 B. DETAIL HOW TEMPORARY OR PERMANENT STABILIZATION WILL BE INCORPORATED INTO THE WORK.
 C. DETAIL HOW SLOPE TOE WILL BE DEFENDED FROM SEDIMENT LOSS DURING ALL PHASES OF WALL CONSTRUCTION, INCLUDING CONTINGENCY PROGRAM FOR SEDIMENT RECOVERY OUTSIDE OF CONSTRUCTION LIMITS.
2. TOP AND END WALL STABILIZATION-
 INCLUDE IN WALL PACKAGE SUBMITTAL ESTIMATED QUANTITIES, PRECISE BEST PRACTICES FOR EXPOSED SOIL STABILIZATION FOR ALL PHASES OF CONSTRUCTION. DETAIL TIME FRAMES FOR INTERIM AND CONCURRENT STABILIZATION MEASURES, ALONG WITH STANDARD INSTALLATION DETAILS THAT FOLLOW MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION (LATEST EDITION) OR NATIONWIDE GENERAL INDUSTRY PRACTICE. USE 1:4 SLOPE STEEPNESS TO DIFFERENTIATE BETWEEN RELATIVELY FLAT AND CRITICAL SLOPE STEEPNESS FOR DETERMINING APPROPRIATE SLOPE COVERS THAT PREVENT EROSION DURING THE VEGETATIVE ESTABLISHMENT PHASE INCLUDE THE FOLLOWING:
 A. DEFINE THE COHESIVE SOIL TYPES FOR MAXIMIZING EROSION STABILITY FOR SWALE AND UPGRADE AREAS.
 B. OBTAIN SOIL FERTILITY TEST RESULTS OF PROPOSED TOPSOILS. BASE FERTILIZER APPLICATION RECOMMENDATION FROM TEST RESULTS.
 C. DEFINE ADDITIONAL SOIL AMENDMENTS TO MAXIMIZE VEGETATIVE GROWTH.
 D. DEFINE THE SEED MIXTURES APPROPRIATE TO SOLAR ASPECT, REGION, ADJACENT PERENNIAL COVER TYPES, AND EXPECTED MAINTENANCE PROTOCOLS.
 E. USE CRITICAL PATH PLANNING FOR OPTIMUM SEEDING DATE INCORPORATION INTO THE WORK..
3. TOE OF WALL STABILIZATION-
 INCLUDE ITEMS ABOVE IN PACKAGE SUBMITTAL FOR EXPOSED SOIL STABILIZATION, WITH ADDITIONAL STABILIZATION PROGRAM DELIVERY IF CONVEYANCE FLOW OR SATURATED SOIL CONDITION IS ALSO PRESENT.
4. DRAIN TILE OUTLETS-
 INCLUDE IN WALL PACKAGE SUBMITTAL IMMEDIATE STABILIZATION PROGRAM INCLUDING BMPs FOR DRAIN TILE OUTLET OR WALL OPENINGS OR PENETRATIONS.
5. CONCRETE WASTE/EXCESS MATERIAL MANAGEMENT-
 INCLUDE IN WALL PACKAGE SUBMITTAL A MATERIAL MANAGEMENT PROGRAM THAT ADDRESSES CONCRETE WASTE GROUND CONTACT PREVENTION, SPILL MANAGEMENT, AND EXCESS MATERIAL DISPOSAL.
6. VEGETATION MANAGEMENT PROGRAM-
 A. PREVENT EROSION. SUBMIT A CONTINGENCY PLAN FOR EXTREME WEATHER GREATER THAN A 2 YEAR TYPE STORM AND EROSION CONDITIONS. IMMEDIATELY IMPLEMENT THE CONTINGENCY PLAN WHEN DAMAGE IS DETECTED.
 B. ESTABLISH VEGETATION. SUBMIT A VEGETATION ESTABLISHMENT MONITORING PROGRAM THAT WEEKLY OR MORE OFTEN DETERMINES PLANT HEALTH AND DEVELOPMENT. DEVELOP A CORRECTIVE ACTION PLAN WHEN VEGETATION IS NOT DEVELOPING ADEQUATE COVER DENSITY OR SPECIES DIVERSITY BASED ON SEED MIX DEFINED IN THE WALL SUBMITTAL.
 C. PROVIDE AUTOMATED TEMPORARY IRRIGATION SYSTEM UNTIL PERENNIAL SEEDS OR SOD COMPONENTS ARE A MINIMUM OF 6 INCHES OF COVER HEIGHT. APPLY WATER AT A RATE OF 1 INCH PER WEEK, EVENLY AND UNIFORMLY APPLIED EACH DAY. IRRIGATION IS NOT NECESSARY ON RAIN DAYS. ENSURE APPROPRIATE SPECIES DENSITY HAS OCCURRED THAT MEETS CONTRACT REQUIREMENTS AND ENVIRONMENTAL COMMITMENTS.
 D. CONTROL ANNUAL WEEDS THAT LIMIT PERENNIAL VEGETATIVE COVER BY MECHANICAL METHODS.
 E. CONTROL ALL NOXIOUS STATE LISTED WEEDS BY MECHANICAL OR PRECISION HERBICIDE METHODS.
7. LIST AND PROVIDE TEMPORARY AND PERMANENT STABILIZATION ESTIMATED QUANTITY ITEMS AND TABULATIONS IN WALL SUBMITTAL PACKAGE. THE TABULATION OF ESTIMATED QUANTITIES SHOULD INCLUDE ITEMS LIKE TOPSOIL BORROW, FERTILIZER TYPES, TEMPORARY EROSION PREVENTION ITEMS, PERMANENT EROSION PREVENTION ITEMS, SEED MIXTURE TYPES, SEDIMENT CONTROL BMP TYPES, AND IRRIGATION.

<p>LEAD EXPERT OFFICE</p> <p>AMBER BLANCHARD ACTING DIRECTOR OFFICE OF MATERIALS & ROAD RESEARCH</p>		<p>MODULAR BLOCK RETAINING WALL STORMWATER MANAGEMENT AND VEGETATION NOTES</p>	<p>APPROVED: 03-29-2023 REVISED:</p>	 THOMAS STYRBICKI STATE DESIGN ENGINEER	<p>STANDARD PLAN 5-297.640</p>	<p>2 OF 2</p>
	 DEPARTMENT OF TRANSPORTATION	<p>STANDARD PLAN</p>	<p>STATE PROJ. NO. TRUNK HWY.</p>	<p>SHEET NO. TOTAL SHEETS</p>		