(Specifier Notes:
The purpose of this guide specification is to assist the specifier in correctly specifying segmental retaining walls and their installation. The specifier needs to edit this guide specification to fit the needs of each specific project.
Throughout the guide specification, there are Specifier Notes to assist in the editing of this guide specification. Brackets [ ] have been used to indicate when a selection or a decision is required. References have been made to MasterFormat Division numbers and titles and should be coordinated with other Sections.)

SECTION 32 32 23

LIMESTONE SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

(Specifier Note: DELETE "delegated engineering" in paragraph below, and throughout specification, when retaining walls will not include soil reinforcement.)

A. Delegated engineering.

(Specifier Note: RETAIN either one or both of the bracketed options in paragraph below.)

B. Limestone segmental retaining walls [with] [and] [without] soil reinforcement.

1.2 DELEGATED ENGINEERING REQUIREMENTS

(Specifier Note: DELETE this Article if Contractor will not be responsible for structural engineering of retaining walls; RETAIN if retaining walls are engineered and detailed on the Drawings.)

A. Contract Documents: Concept of work specified by this Section is expressed on Drawings and in Specifications however, they may not indicate or specify full extent of work that may be required.

B. Delegated Engineering Responsibility: Employ delegated engineering professional to provide engineering for each member and component of limestone segmental retaining walls required to meet concept expressed in Contract Documents that includes, but is not limited to, following:

1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on building structural frame.
2. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.

C. Structural Performance: Base engineering design on following loads according to NCMA's Design Manual for Segmental Retaining Walls.

1. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.

(Specifier Note: RETAIN subparagraph below if there are superimposed loads on retaining walls, such as drives and parking areas.)

2. Superimposed loads (surcharge) indicated on Drawings.

(Specifier Note: NCMA's Segmental Retaining Walls - Seismic Design Manual establishes a methodology for seismic design specific to retaining walls. Verify requirements of authorities having jurisdiction.)

D. Seismic Performance: Base engineering design on following loads and factors according to NCMA's Design Manual for Segmental Retaining Walls.

1. Gravity loads due to soil pressures resulting from grades and sloped backfill indicated.

(Specifier Note: RETAIN subparagraph below if there are superimposed loads on retaining walls, such as drives and parking areas.)

2. Superimposed loads (surcharge) indicated on Drawings.

(Specifier Note: Horizontal peak ground acceleration (A) is determined by Project's location and site classification; insert value in brackets.)

3. Horizontal Peak Ground Acceleration (A) for Project: [- insert value -].

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

B. Samples for Verification – Limestone: 12 inch square units for each limestone color and finish showing full range to be expected.

(Specifier Note: DELETE paragraph below if deleting "Delegated Engineering Requirements" Article above.)

C. Delegated Engineering Calculations: Engineering calculations sealed by delegated engineering professional; test reports not acceptable substitute for calculations.

(Specifier Note: RETAIN paragraph below if retaining "Preconstruction Testing" paragraph below under Quality Assurance Article.)

D. Preconstruction test reports.

1.4 QUALITY ASSURANCE

(Specifier Note: DELETE paragraph below if not retaining "Delegated Engineering Requirements" Article above.)

A. Delegated Engineering Professional Qualifications:

1. Professional engineer legally authorized to practice in jurisdiction where Project is located.
2. Experienced in providing engineering services of kind indicated resulting in installation of limestone segmental retaining walls similar to this Project in material, design, and extent.

B. Mockups: Before beginning work of this Section, build as many mockups as required to verify selections made under submittals and to demonstrate aesthetic effects and for work execution. Use materials and installation methods specified.

1. Build mockup of retaining wall [as shown on Drawings] [approximately 72 inches long by not less than 36 inches high above finished grade at front of wall].

(Specifier Note: RETAIN any of following subparagraphs to suit project.)

a. Include typical soil reinforcement.
b. Include typical base and cap or finished top construction.
c. Include backfill to typical finished grades at both sides of wall.
d. Include typical end construction at one end of mockup.
e. Include 36 inch return at one end of mockup, with typical corner construction.

2. Locate at locations indicated or, if not indicated, as directed by Architect; facing south.
3. Clean exposed faces.
4. Notify Architect 7 days in advance of dates and times when mockup will be constructed.
5. Protect approved mockups from elements with weather-resistant covering.
6. Maintain during construction in an undisturbed condition as a standard for judging completed work.
7. Approval is for following qualities; approval does not constitute approval of deviations from Contract Documents, unless specifically approved by Architect in writing:

   a. Color, texture, and blending of limestone units.
   b. Other aesthetic qualities as determined by Architect.

8. When directed, demolish and remove mockups from site, including foundations.

C. Pre-Installation Conference:

1. Conduct at Project site.

(Specifier Note: EDIT attendees in brackets that are appropriate to project conditions.)

2. Attendees include Owner, Contractor, Architect, Retaining Wall Installer, Company providing Earthwork, and Technical Representative of Manufacturer.
3. Review Contract Document requirements.
4. Review approved submittals.
5. Review methods and procedures related to retaining walls including, but not limited to, following:

   a. Handling, storing and protecting products and materials.
   b. Evaluation of substrates on which work will be installed.
   c. Setting limestone units.
   d. Protecting installed work, including stain prevention.
   e. Cleaning installed work.

6. Tour representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory work performed by other installers.
7. Review required inspection and testing.
8. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
9. Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

(Specifier Note: RETAIN paragraph below if soil reinforcement or backfill materials are selected by Contractor. DELETE paragraph below if soil reinforcement and backfill materials are provided by Project's engineer.)

D. Preconstruction Testing Service: Engage a qualified testing agency to perform following preconstruction testing for soil reinforcement and backfill materials:

1. Pullout Resistance: ASTM D 6706.

2. Coefficient of Friction: ASTM D 5321.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Limestone and Accessories: Store and handle according to following:

1. To prevent deterioration or damage due to contaminants, breaking, chipping, or other causes.
2. ILI's The Contractors Handbook on Indiana Limestone.

B. Geosynthetics: Store in manufacturer's original packaging with labels intact. Store and handle to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 degrees F or below 32 degrees F, and other conditions causing damage.

PART 2 - PRODUCTS

2.1 LIMESTONE

A. Material Quality Standard: ASTM C 568, Classification II or III.

2.2 SEGMENTAL RETAINING WALL UNITS

A. Basis of Design: Contract Documents are based on the Regency Wall System fabricated by Earthworks, Inc. to establish a standard of quality.

B. Unit Shapes and Finishes:

(Specifier Note: In addition to the stone named below, Pewter Mist is available but is limited in height to 9 inches.)

(Specifier Note: Sizes shown below are standard dimensions available; consult EarthWorks, Inc. for special order sizes.)

1. Wall Unit:

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

a. Basis of Design: [EW Gold] [Cottonwood].
b. Dimensions: 12 inches high by 12 inches deep by random lengths of 24 to 48 inches long.
c. Front and Back Face Finish: Split face.
d. Top and Bottom Face Finish: Sawn.

(Specifier Note: RETAIN subparagraph below for radius wall applications.)

e. Ends: Tapered at one end.

(Specifier Note: RETAIN subparagraph below for 90 degree corners.)

f. 90 Degree Corner Finish: Split face.

2. Base Unit:

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

a. Basis of Design: [EW Gold] [Cottonwood].

b. Dimensions: 12 inches high by 12 inches deep by random lengths of 24 to 48 inches long.
c. Front and Back Face Finish: Split face.
d. Top and Bottom Face Finish: Sawn.

(Specifier Note: RETAIN subparagraph below for radius wall applications.)

e. Ends: Tapered at one end.

(Specifier Note: RETAIN subparagraph below for 90 degree corners.)

f. 90 Degree Corner Finish: Split face.

3. Wall Cap Unit:

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

a. Basis of Design: [EW Gold] [Cottonwood].
b. Dimensions: 5 inches high by 14 inches deep by 36 inches long.
c. Front and Back Face Finish: Split face.
d. Top and Bottom Face Finish: Sawn.

4. Step Unit:

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

a. Basis of Design: [EW Gold] [Cottonwood].

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

b. Dimensions: 6 inches high by 16 inches deep by [36] [48] inches long.
c. Front and Back Face Finish: Split face.
d. Top and Bottom Face Finish: Sawn.

5. Column Cap Unit:

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

a. Basis of Design: [EW Gold] [Cottonwood].
b. Dimensions: 6 inches high by 28 inches square.

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

c. Four Sides Finish: [Split face] [Rockface].
d. Top and Bottom Face Finish: Sawn.

6. Column Units:

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

a. Basis of Design: [EW Gold] [Cottonwood].
b. Dimensions: 12 inches high by 24 inches square.
c. Four Sides Finish: Split face.
d. Top and Bottom Face Finish: Sawn.

2.3 INSTALLATION MATERIALS

(Specifier Note: RETAIN one of bracketed options in subparagraph below; if retaining third option, specify as recommended by geotechnical engineer.)

A. Leveling Base: [As determined by delegated engineering.] [As specified in Division 31 Earthwork Section.] [- insert information - .]

(Specifier Note: RETAIN one of bracketed options in subparagraph below; if retaining third option, specify as recommended by geotechnical engineer.)

B. Drainage Fill: [As determined by delegated engineering.] [As specified in Division 31 Earthwork Section.] [- insert information - .]

(Specifier Note: RETAIN one of bracketed option below; if retaining third option, also RETAIN subparagraphs.)

C. Geotextile Fabric: [As determined by delegated engineering.] [As specified in Division 31 Earthwork Section.] [As indicated below:

1. Description: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with
2. Elongation: Not less than 50 percent.
3. Apparent Opening Size: Not more than No. 70 to 100 sieve according to ASTM D 4751.
4. Minimum Grab Tensile Strength: 110 pounds according to ASTM D 4632.
5. Minimum Weight: 4 ounces per square yard.]

(Specifier Note: RETAIN one of bracketed options in subparagraph below; if retaining third option, specify as recommended by geotechnical engineer.)

D. Soil Fill: [Reinforced and non-reinforced as determined by delegated engineering.] [Reinforced and non-reinforced as specified in Division 31 Earthwork Section.] [- insert information - .]

E. Soil Reinforcement: One of following as determined by delegated engineering:

1. Knitted or woven geogrid made from polyester yarns with a protective coating.
2. Molded geogrid made from high-density polyethylene.
3. Woven geotextile made from polyamides, polyesters, or polyolefins.

F. Subdrainage Pipe and Filter Fabric: As specified in Division 31 Subdrainage Section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of segmental retaining walls.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:

1. ILI's Indiana Limestone Handbook.

(Specifier Note: DELETE subparagraph below if deleting "Delegated Engineering Requirements" Article above.)

2. Delegated engineering.
3. Respective manufacturer's written instructions.
4. Approved submittals.

(Specifier Note: RETAIN one of bracketed options in subparagraph below; if retaining third option, revise as recommended by geotechnical engineer.)

B. Leveling Base: [Place base material according to delegated engineering.] [Place base material as specified in Division 31 Earthwork Section.] [Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698. At Contractor's option, place unreinforced lean concrete over leveling base 1 to 2 inches thick; compact and screed to a smooth, level surface.]

C. First Course:

1. Place first course of retaining wall units for full length of wall.
2. Place units in firm contact with each other, properly aligned and level.
3. If concrete is not placed over base material, tamp units into leveling base as necessary to bring tops of units into a level plane.

(Specifier Note: RETAIN one of bracketed options in subparagraph below.)

D. Bond Pattern: [Running bond.] [Bond pattern indicated.]

E. Subsequent Courses:

1. Remove excess fill and debris from tops of units in course below.
2. Place units in firm contact, properly aligned, and directly on course below.

(Specifier Note: RETAIN one of bracketed options in subparagraph below; if retaining third option, revise as recommended by geotechnical engineer.)

F. Fill Placement: [Place fill and compact according to delegated engineering.] [Place fill and compact as specified in Division 31 Earthwork Section.] [Place fill as each course of units is set. Place, spread, and fill in uniform lifts for full width and length as wall is constructed. Place fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time; begin at wall and place and spread fills toward embankment.]

G. Back of Wall Drainage:

1. Fill 12 inch wide zone against back of wall, to 12 inches below finished grade and wrap in geotextile fabric.
2. Coordinate with subdrainage pipe with filter fabric specified in Division 31 Subdrainage Section.

H. Soil Reinforcement:

1. Place in horizontal joints of retaining wall where indicated.
2. Embed reinforcement a minimum of 8 inches into retaining wall and stretch tight over compacted fill. Anchor soil reinforcement before placing fill.
3. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
4. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
5. Do not dump fill material directly from trucks onto geosynthetics.
6. Place at least 6 inches of fill over reinforcement before compacting with tracked vehicles or 4 inches before compacting with rubber-tired vehicles.
7. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.

I. Tolerances: Horizontal variation from level not more than 1-1/4 inches in 10 feet.

3.3 ADJUSTING

A. Patching: Repair damaged surfaces according to ILI's Repairing Damage to Indiana Limestone.

3.4 CLEANING

A. Final Cleaning: Clean installed work according to following:

1. ILI's Indiana Limestone Handbook.
2. ILI's How to Avoid Small Area Stains and Blemishes.

3.5 FIELD QUALITY CONTROL

A. Testing Agency:

1. Owner will engage a qualified testing agency to perform tests and inspections.

(Specifier Note: RETAIN one of bracketed options in subparagraph below; if retaining third option, specify as recommended by geotechnical engineer.)

2. [Test as determined by delegated engineering.] [Test as specified in Division 31 Earthwork Section.] [- insert information - .]

END OF SECTION