

# PUBLIC WORKS STANDARDS, INC. – GREENBOOK COMMITTEE

## MEETING MINUTES

April 16, 2020

**Presiding:** Lance Grindle, Co-Chair

1. **Called to Order:** 9:34 am

2. **Self-Introduction:**

### Voting Members & Alternates

1	Datuin, Elmer	T	Riverside County
2	Dungca, Catherine	T	City of San Diego
3	Fahey, Keegan	T	Los Angeles County Public Works
4	Fernandez, Birger (Dickie)	T	Orange County Sanitation District
5	Galvez, Temo	T	City of Fountain Valley
6	Gilley, Curt	T	Terrain Engineering Inc.
7	Grindle, Lance	T	Los Angeles County Public Works
8	Howard, Anthony	T	Los Angeles County Sanitation District
9	MacFarlane, Randall	T	City of Los Angeles BCA
10	Patricelli, Richard	T	Orange County Public Works
11	Peterson, Dan	T	DJP Co.
12	Ramirez, Onofre	T	City of Long Beach
13	Vivant, Don	T	Sully-Miller Contracting Corp.

### Other Participants

1	Alvarez, Veronica	T	RedZone Robotics
2	Bandzuilis, Ruta	T	Tencate Geosynthetics
3	Bustamante, Ramses	T	City of San Diego
4	Hilton, Kyle (Alt.)	T	City of Fountain Valley
5	Khamanian, Bijan	T	Hobas Pipe
6	LaRue, Thomas (Tom)	T	ADS
7	McCarter, Colin	T	Los Angeles County Public Works
8	McManus, Michael	T	AGC San Diego
9	Na, Gean	T	ACPA
10	Oien, Brad	T	Thompson Pipe Group
11	Womack, Keith	T	Press Seal
12	Woolsey, Rory	T	BNi Building News

(\*\* denotes Member with proxy, <sup>T</sup> denotes attendance via Teleconference)

**3. Establish a Quorum:**

Self-introductions were made, and a quorum was established at the beginning of the meeting with **13** voting members present.

**4. Approval of Minutes from previous Meetings:**

The October 2019, the November 2019, the January 2020, February 2020, and the March 2020 Greenbook Committee meetings were voted on and approved.

**5. Correspondence:**

- a) Gean Na proposed a change to 207.2.8 will be sent to the Underground Subcommittee.
- b) Dickie Fernandez proposed a change to 210-2 will be sent to the Underground Subcommittee.

**6. Old Business:**

Supplement Changes:

- a) A vote to approve Change No. **272SM** "Stone for Riprap" was held. Change No. **272SM** was approved.

**7. New Business:**

- a) Co-Chairman's Report: *No report.*

Meetings will continue to be held via Teleconference only.

- b) Secretary's Report: *No report.*

- c) Vice Chair Communication Report: *No report.*

- d) Vice Chair Editorial Report:

- e) Surface Materials and Methods Subcommittee Report: *No meeting/report.*

- f) Underground Materials and Methods Subcommittee Report: *Manhole landings were discussed. This will be discussed with the Standard Plans Committee. The Committee is working hard to complete the Part 5 reorganization in time for a 2021 Edition SSPWC.*

- g) Standard Plans Subcommittee Report: *No Report, Subcommittee is making progress.*

- h) General Provisions Subcommittee Report: *No Report*

- i) Editorial Standards Subcommittee Report: *No Report. Will provide update to date Change Log for inclusion in the meeting minutes.*

- j) Other New Business:

**8. General Discussion:** *The focus of the Part 5 revisions currently underway in the Underground Subcommittee was discussed. It was proposed to exercise caution in making changes and to focus on the introduction of new content that makes a substantial improvement to the Book; the UV Cured Liners for example.*

*The general focus of the Greenbook itself was discussed. A refocus on reducing the number of special amendments required by local agencies was suggested. Also, an increased effort to remove old products that are no longer used, make updates where needed, and introduce new products and techniques to keep the Book relevant. A change in the publishing cycle from 3 years to 4 years was proposed that will be discussed with BNi.*

*The Roster posted to the website is still out of date. BNi would like an updated roster to be voted on at the next Board meeting. The Secretary will forward the most recent approved September 2019 Roster to this Committee.*

**9. Next Meeting:** May 21, 2020

**10. Adjourned:** 10:27 am

Submitted by; Greenbook Committee Secretary

*Colin McCarter, Associate Civil Engineer  
Construction Division  
Los Angeles County Public Works  
900 South Fremont Avenue Alhambra, CA 91803  
Office: (626) 458-3116 | Email: [cmccarter@pw.lacounty.gov](mailto:cmccarter@pw.lacounty.gov)*

PUBLIC WORKS STANDARDS, INC. - GREENBOOK COMMITTEE

ACTIVE CHANGE SUBMITTAL LOG

LATEST REVISION: 04-16-2020

Change No.	Subsection(s) or Std Plan(s)	Date Proposal Received	Subject	Submitted by Name/ Agency	Subcommittee			Editorial Standards Review			Greenbook Committee			
					Assigned to	Action		Date Submitted	Date Returned	Date	ACTION		Date	GB Edition
						A	R				A	R		
246 SM			Alkali-Silica reactions testing		CA-SM									
270 SM	201-1	6/13/2014	Shrinkage compensating cement		CA-SM	X		1/17/2017						
272 SM	300-11	7/17/2014	RIP RAP	Durand Long, OC Public Works	CA-SM	X		9/17/2019	10/16/2019					2/20/2020
273 SP	SP 100-2, 600-4	8/13/2015	Provide additional details to subject plans	Temo Galvez Fountain Valley	SP	X		8/7/2015						
274 SM	500-3	5/45/2015	Annular space-grouting		UM									
285 SM	200	11/10/2016	Add permeable aggregate gradations		CA-SM									
286 SM	201-1.2.5.4	11/10/2016	Update requirements for Special Exposure		CA-SM									
287 SM	203-16, 301-7		Add Engineered Emulsion –Stabilized Pulverized Base	Stabilized Base Task Force	SM			On hold pending Agency trials/usage						
288 SP	100-2	11/29/2016	Abbreviations, lines, and symbols	Alex Salazar, Fountain Valley	SP									
289 UM	215	2/23/2017	Maintenance Holes		UM				8/14/2019	9/16/2019			X	10/17/2019
290 UM	306-2,3	3/14/2017	Jacking/tunneling		UM	X		6/13/2017	6/14/2017	6/14/2017				
291 SP	STD Plans Part 1	12/5/2017	STD Plans Part 1	Temo Galvez, Fountain Valley	SP				8/14/2019	9/16/2019			X	10/17/2019





PUBLIC WORKS STANDARDS, INC. - GREENBOOK COMMITTEE

ACTIVE CHANGE SUBMITTAL LOG

LATEST REVISION: 04-16-2020

Subcommittee	Change No. Group	Assigned to Abbr.	Chair	Agency	Phone Number	email address
Editorial Standards	ES	ES	Keegan Fahey	LA County Public Works	(626) 458-3190	<a href="mailto:kfahey@pw.lacounty.gov">kfahey@pw.lacounty.gov</a>
General Provisions	GP	GP	David Yanez	Metropolitan Water District	(909) 392-5429	<a href="mailto:dyanez@mwtdh2o.com">dyanez@mwtdh2o.com</a>
Landscaping and Irrigation	LI	LI	Dan Phelps	AGCC	(526) 234-1705	<a href="mailto:dan@phelbssw.com">dan@phelbssw.com</a>
Materials & Methods - Surface	SM	SM	Richard Patricelli	OC Public Works	(714) 667-8826	<a href="mailto:Richard.Patricelli@ocpw.ocgov.com">Richard.Patricelli@ocpw.ocgov.com</a>
Asphalt Task Force	AT	AT-SM	Tom Williams	LaBelle Marvin, Inc	(714) 546-3468	<a href="mailto:twilliams@labellemarvin.com">twilliams@labellemarvin.com</a>
Concrete Ad-Hoc	CA	CA-SM	Nathan Forrest	CNCA	(520) 235-0480	<a href="mailto:Nathan.Forrest@cnccement.org">Nathan.Forrest@cnccement.org</a>
Geotextiles and Geogrids Task Force	GT	GT-SM	Vinh Tran	OC Public Works	(714) 955-0210	<a href="mailto:Vinh.Tran@ocpw.ocgov.com">Vinh.Tran@ocpw.ocgov.com</a>
Standard Plans	SP	SP	Temo Galvez	Fountain Valley	(714) 593-4517	<a href="mailto:Temo.galvez@fountainvalley.org">Temo.galvez@fountainvalley.org</a>
Traffic Signals and Street Lighting	TS	TS	--	--	--	--
Materials & Methods - Underground	UM	UM	Curt Gilley Gean Na	AGCC ACPA	(916) 952-0704 (714) 932-1663	<a href="mailto:cgilley@terrainengineeringinc.com">cgilley@terrainengineeringinc.com</a> <a href="mailto:GNa@concretepipe.org">GNa@concretepipe.org</a>

Proposed Revision To: <input checked="" type="checkbox"/> <b>Standard Specifications For Public Works Construction</b> <input type="checkbox"/> <b>Standard Plans For Public Works Construction</b>	<b>Change No. 272NS</b>  <small>(ASSIGNED BY GREENBOOK COMMITTEE)</small>
Public Works Standards, Inc. c/o Associated General Contractors of California Los Angeles District Office 1906 West Garvey Avenue, Suite No. 100 West Covina, California 91760	<b>Date Proposal Received</b>  <small>(ASSIGNED BY GREENBOOK COMMITTEE)</small>
<b>Subsection or Standard Plan to be revised:</b> _____ <b>On page(s):</b> _____	
<b>Warning:</b> Public Contract Code §3400 prohibits any local agency specification that limits bidding, directly or indirectly, to any one specific concern or product. If this revision describes a proprietary or patented product, it must identify other products which equally perform the functions of the proprietary or patented product.	
<b>Revision:</b> Change to Section 200-1.6 Stone for Ripap and Section 300-11 Stonework for Erosion Control. See attached.	
<b>Reason For Revision:</b> Revision is need for removal of subjective language and addition of larger rock gradations.	
Submitted By: <u>Concrete Ad-Hoc / Durand Long</u> Phone No: <u>714-667-4959</u> Agency: <u>OC Public Works</u> Address: <u>1152 E. Fruit, Santa Ana, CA 92701</u>	
<b>Instructions:</b> Use a separate form for each revision. Attach plain paper if more space is needed. For minor changes, copy present wording striking out words to be deleted and <u>underlining</u> new text. For major changes, rewrite or add paragraph or sections. All proposed revisions must include the reason(s) for the revision.	
<b>Subcommittee Action:</b> On _____ (Date) <input type="checkbox"/> Recommended For _____ Supplement/Edition <input type="checkbox"/> Rejected <input type="checkbox"/> As Modified	<b>Editorial Standards Subcommittee Review:</b> On _____ (Date) <input type="checkbox"/> Reviewed For Surf/Und/Spec/Plans Subcommittee <input type="checkbox"/> NO Modifications <input type="checkbox"/> As Modified
<b>Greenbook Committee Action:</b>  On _____ (Date) <input type="checkbox"/> Approved For _____ Supplement/Edition <input type="checkbox"/> As Modified <input type="checkbox"/> Rejected	



**200-1.6 ~~Stone for Riprap.~~ Rock for Slope and Erosion Protection (Riprap).**

**200-1.6.1 General.** ~~Stone for riprap shall be quarystone or cobblestone. Quarystone shall be angular and cobblestone shall be rounded. Flat or elongated shapes will not be accepted unless the thickness of the individual pieces is at least 1/3 of the length. The Contractor shall notify the Engineer in writing of the intended source of rock at least 60 Days prior to use. Rock for slope and erosion protection shall be placed in accordance with 300-11.~~

~~Stone shall be sound, durable, hard, resistant to abrasion and free from laminations, weak cleavage planes, and the undesirable effects of weathering. It shall be of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. All material shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings.~~

**200-1.6.2 Grading Requirements.** ~~Stone~~ Rock for riprap slope and erosion protection shall be designated by class and conform to the following ~~gradations:~~ dimension grading requirements:

**TABLE 200-1.6.2**

Rock Size	Percent Larger Than			
	500 lb. (225 kg) Class	375 lb. (170 kg) Class	Light (90 kg) Class	Facing (35 kg) Class
4,000 lbs (450 kg)	0-5	-	-	-
700 lbs (320 kg)	-	0-10	-	-
500 lbs (225 kg)	50-100	10-50	0-5	-
200 lbs (90 kg)	-	85-100	50-100	0-5
75 lbs (35 kg)	90-100	95-100	90-100	50-100
25 lbs (10 kg)	95-100	-	95-100	90-100
2.2 lbs (1 kg)	-	-	-	95-100

~~Note: The amount of material smaller than the smallest size shown in the table for any class shall not exceed the percentage limit as determined on a weight basis. Compliance with the percentage limits shown in the table for all other sizes of the individual pieces of any class of rock slope protection shall be determined by the ratio of the number of individual pieces larger than the specified size compared to the total number of individual pieces larger than the smallest size listed in the table for that class.~~

**TABLE 200-1.6.2**

<b>Nominal Class by Median Particle Diameter<sup>1</sup></b>		<b>Nominal Median Particle Weight W<sub>50</sub><sup>3,4</sup> pounds (kg)</b>	<b>Dimension Grading Requirements</b>				
			<b>d<sub>15</sub><sup>2</sup> inches (mm)</b>		<b>d<sub>50</sub><sup>2</sup> inches (mm)</b>		<b>d<sub>100</sub><sup>2</sup> inches (mm)</b>
<b>Class</b>	<b>Diameter inches (mm)</b>		<b>Min</b>	<b>Max</b>	<b>Min</b>	<b>Max</b>	<b>Max</b>
I	6 (150)	20 (9)	3.7 (94)	5.2 (132)	5.7 (145)	6.9 (175)	12.0 (300)
II	9 (225)	60 (27)	5.5 (140)	7.8 (198)	8.5 (216)	10.5 (267)	18.0 (450)
III	12 (300)	150 (68)	7.3 (185)	10.5 (267)	11.5 (292)	14.0 (356)	24.0 (600)
IV	15 (375)	300 (135)	9.2 (234)	13.0 (330)	14.5 (368)	17.5 (445)	30.0 (750)
V	18 (450)	500 (225)	11.0 (279)	15.5 (394)	17.0 (432)	20.5 (521)	36.0 (900)
VI	21 (525)	750 (340)	13.0 (330)	18.5 (470)	20.0 (508)	24.0 (610)	42.0 (1,050)
VII	24 (600)	1,000 (450)	14.5 (368)	21.0 (533)	23.0 (584)	27.5 (699)	48.0 (1,200)
VIII	30 (750)	2,000 (900)	18.5 (470)	26.0 (660)	28.5 (724)	34.5 (876)	48.0 (1,200)
IX	36 (900)	4,000 (1,800)	22.0 (559)	31.5 (800)	34.0 (864)	41.5 (1,054)	52.8 (1,320)
X	42 (1,050)	6,000 (2,700)	25.5 (648)	36.5 (927)	40.0 (1,016)	48.5 (1,232)	60.5 (1,512)
XI	46 (1,150)	8,000 (3,600)	28.0 (711)	39.4 (1,000)	43.7 (1,110)	53.1 (1,350)	66.6 (1,665)

1) Intermediate or B dimension (i.e., width) where A dimension is length and C dimension is thickness.

2) d%, where % denotes the percentage of the total weight of the graded material.

3) Values shown are based on the minimum and maximum particle diameters shown and an average specific gravity of 2.65. Weight will vary based on specific gravity of rock available.

4) W%, where % denotes the percentage of the total weight of the graded material.

**200-1.6.3 Quality Requirements.** ~~Visual evaluation of the quarry, including examination of blast samples and diamond drill core samples, suitable tests and service records may be used to determine the acceptability of the stone. The Contractor shall notify the Agency in writing of the intended source of stone at least 60 days prior to use. To ensure the required quality, stone may be subject to petrographic analysis or X-ray diffraction.~~

Flat or elongated shapes will not be accepted. A flat rock is defined as having a width at least 3 times greater than its thickness. An elongated rock is defined as having a length at least 3 times greater than its width. Rock shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings.

Stone Rock for riprap slope and erosion protection shall conform to the following requirements:

**TABLE 200-1.6.3**

<b>Tests</b>	<b>Test Method No.</b>	<b>Requirements</b>
Apparent Specific Gravity	ASTM C127-California 206	2.50 Minimum
Absorption <sup>1</sup>	California 206	4.20 Maximum
Durability Index <sup>1</sup>	California 229	52 Minimum
Abrasion (500 revolutions)	ASTM C134-California 211	45 Maximum
Percentage Wear (%)		

1. Based on the formula below, absorption may exceed 4.2 percent if the Durability Absorption Ratio (DAR) is greater than 10. Durability Index may be less than 52 if DAR is greater than 24.  $DAR = \frac{\text{Coarse Durability Index}}{\% \text{ Absorption} + 1}$

The structural integrity of each individual rock shall be such that it passes a "drop test" when requested by the Engineer. The drop test shall consist of dropping a single rock once from a height of half the average diameter of the rock onto a rigid concrete surface, or onto a half-buried rock of comparable size, in the presence of the Engineer. Prior to testing, the rock shall be measured and have all cracks examined, marked, and measured. Immediately after the drop, the rock will be examined. A rock will pass the drop test provided the following criteria are met:

- a) new cracks have not developed,
- b) existing cracks have not widened, and
- c) the greatest dimension decreases in size by less than 5 percent.

**300-11 STONEMWORK FOR EROSION CONTROL ROCK SLOPE AND EROSION PROTECTION (RIPRAP).**

**300-11.1 General.** ~~Stone for erosion control shall be in conformance with 200-1.6 and the following provisions. When shown on the Plans, stonework shall be concreted as specified herein.~~ Rock for rock slope and erosion protection shall conform to 200-1.6. Rock slope and erosion protection shall be concreted in accordance with 300-11.3 when shown on the Plans.

**300-11.2 Placing Stone. Rock Placement.** ~~Stone for erosion control~~ Rock slope and erosion protection shall be placed in accordance with the following method:

A footing trench shall be excavated along the toe of the slope, as shown on the Plans. The larger ~~stones~~ rocks shall be placed in the footing trench. The voids in the footing trench shall be filled with uncompacted excavated material after the rock is placed. Stones Rocks on the slope shall be placed with their longitudinal axis normal to the embankment face, and arranged so that each ~~stone~~ rock above the foundation course has a 3-point bearing on the underlying ~~stones~~ rocks. The foundation course is the course placed on the slope in contact with the ground surface.

Rocks shall be placed by a grapple or other mechanical equipment in a tight interlocking configuration which results in rock to rock contact, without slipping, to form a stable layer. Smaller rocks used between layers shall be evenly distributed and sized to fill voids after 3-point bearing on the underlying course is established.

Class VII or smaller rock may be placed by dumping provided the following criteria are met:

- a) rock is spread in layers by bulldozers, excavators, or other suitable equipment,
- b) larger rocks are in the toe course and on the outside surface of the slope protection, and
- c) voids larger than the diameter of the smallest rock size are filled.

~~Bearing on smaller stones which may be used for chinking voids will not be acceptable. Nesting of the smaller stones used for chinking voids will not be permitted. Placing of stones rocks by dumping will not be permitted.~~

Local surface irregularities of the slope and erosion protection shall not vary from the planned slope by more than 1 foot (0.3m) measured at right angles to the slope. Rounded rocks shall not be used on slopes steeper than 1 vertical to 2 horizontal.

**300-11.3 Concreted Stone Rock Slope and Erosion Protection.** ~~Stone for concreted stone slope protection shall be placed in accordance with 300-11.2.~~

**300-11.3.1 General.** Rock for concreted rock slope and erosion protection shall be Class I – VII conforming to 200-1.6 and shall be placed in accordance with 300-11.2.

**300-11.3.1~~2~~ Concrete.** Concrete for concreted ~~stone~~ rock slope and erosion protection shall be 520-C-2500P (310-C-17P) and conform to the requirements of 201-1, except that the slump of the concrete shall be adjusted to provide the minimum penetration shown in Table 300-11.3.1~~2~~.

**TABLE 300-11.3.1**

<b>Class</b>	<b>500 lb (225 kg)</b>	<b>375 lb (170 kg)</b>	<b>Light (90 kg)</b>	<b>Facing (35 kg)</b>
Minimum Penetration in inches (mm)	14 (350)	12 (300)	10 (250)	8 (200)

**TABLE 300-11.3.2**

<b>Class</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>	<b>VII</b>
Penetration in inches (mm)	6 (150)	8 (200)	10 (250)	12 (300)	14 (350)	16 (400)	18 (450)

**300-11.3.23 ~~Placing~~ Concrete Placement.** The surfaces of the ~~stone~~ rock to be concreted shall be cleaned of adhering dirt and clay and then moistened. The concrete shall be placed in a continuous operation for any day's run at one location. Concrete shall be brought to the place of final deposit by buckets or pump. Other placement methods shall be approved by the Engineer prior to use.

In no case shall concrete be permitted to flow on the slope and erosion protection a distance greater than 10 feet (3m).

Immediately after depositing, the concrete shall be spaded and rodded into place with suitable tools until the minimum penetration is that shown in Table 300-11.3.42.

After the concrete has been placed, the ~~stones~~ rocks shall be thoroughly brushed so that their top surfaces are exposed. The outer ~~stones~~ rocks shall project 1/3 to 1/4 their diameter above the concrete surface. After completion of any 10 foot (3m) strip, no person or load shall be permitted on the surface for a period of at least 24 hours, or longer if so ordered by the Engineer.

Concreted ~~stone~~ rock slope and erosion protection shall be cured as provided in 303-1.10.

**300-11.4 Measurement and Payment.** ~~Stone and stonework for riprap and erosion control~~ Rock for rock slope and erosion protection will be measured and paid for per ton (tonne) of ~~stone~~ rock in place.

Concrete and concrete placement will be measured and paid for per cubic yard (cubic meter) in place.

**200-1.6 Rock for Slope and Erosion Protection (Riprap).**

**200-1.6.1 General.** The Contractor shall notify the Engineer in writing of the intended source of rock at least 60 Days prior to use. Rock for slope and erosion protection shall be placed in accordance with 300-11.

**200-1.6.2 Grading Requirements.** Rock for slope and erosion protection shall be designated by class and conform to the following dimension grading requirements:

**TABLE 200-1.6.2**

Nominal Class by Median Particle Diameter <sup>1</sup>		Nominal Median Particle Weight $W_{50}^{3,4}$ pounds (kg)	Dimension Grading Requirements				
			$d_{15}^2$ inches (mm)		$d_{50}^2$ inches (mm)		$d_{100}^2$ inches (mm)
Class	Diameter inches (mm)		Min	Max	Min	Max	Max
I	6 (150)	20 (9)	3.7 (94)	5.2 (132)	5.7 (145)	6.9 (175)	12.0 (300)
II	9 (225)	60 (27)	5.5 (140)	7.8 (198)	8.5 (216)	10.5 (267)	18.0 (450)
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IV	15 (375)	300 (135)	9.2 (234)	13.0 (330)	14.5 (368)	17.5 (445)	30.0 (750)
V	18 (450)	500 (225)	11.0 (279)	15.5 (394)	17.0 (432)	20.5 (521)	36.0 (900)
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VII	24 (600)	1,000 (450)	14.5 (368)	21.0 (533)	23.0 (584)	27.5 (699)	48.0 (1,200)
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X	42 (1,050)	6,000 (2,700)	25.5 (648)	36.5 (927)	40.0 (1,016)	48.5 (1,232)	60.5 (1,512)
XI	46 (1,150)	8,000 (3,600)	28.0 (711)	39.4 (1,000)	43.7 (1,110)	53.1 (1,350)	66.6 (1,665)

- 1) Intermediate or B dimension (i.e., width) where A dimension is length and C dimension is thickness.
- 2)  $d\%$ , where % denotes the percentage of the total weight of the graded material.
- 3) Values shown are based on the minimum and maximum particle diameters shown and an average specific gravity of 2.65. Weight will vary based on specific gravity of rock available.
- 4)  $W\%$ , where % denotes the percentage of the total weight of the graded material.

**200-1.6.3 Quality Requirements.** Flat or elongated shapes will not be accepted. A flat rock is defined as having a width at least 3 times greater than its thickness. An elongated rock is defined as having a length at least 3 times greater than its width. Rock shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings.

Rock for slope and erosion protection shall conform to the following requirements:

**TABLE 200-1.6.3**

<b>Tests</b>	<b>Test Method No.</b>	<b>Requirements</b>
Apparent Specific Gravity	California 206	2.50 Minimum
Absorption <sup>1</sup>	California 206	4.20 Maximum
Durability Index <sup>1</sup>	California 229	52 Minimum
Abrasion (500 revolutions)	California 211	45 Maximum

1. Based on the formula below, absorption may exceed 4.2 percent if the Durability Absorption Ratio (DAR) is greater than 10. Durability Index may be less than 52 if DAR is greater than 24.  $DAR = \frac{\text{Coarse Durability Index}}{\% \text{ Absorption} + 1}$

The structural integrity of each individual rock shall be such that it passes a "drop test" when requested by the Engineer. The drop test shall consist of dropping a single rock once from a height of half the average diameter of the rock onto a rigid concrete surface, or onto a half-buried rock of comparable size, in the presence of the Engineer. Prior to testing, the rock shall be measured and have all cracks examined, marked, and measured. Immediately after the drop, the rock will be examined. A rock will pass the drop test provided the following criteria are met:

- a) new cracks have not developed,
- b) existing cracks have not widened, and
- c) the greatest dimension decreases in size by less than 5 percent.

### 300-11 ROCK SLOPE AND EROSION PROTECTION (RIPRAP).

**300-11.1 General.** Rock for rock slope and erosion protection shall conform to 200-1.6. Rock slope and erosion protection shall be concreted in accordance with 300-11.3 when shown on the Plans.

**300-11.2 Rock Placement.** Rock slope and erosion protection shall be placed in accordance with the following method:

A footing trench shall be excavated along the toe of the slope, as shown on the Plans. The larger rocks shall be placed in the footing trench. The voids in the footing trench shall be filled with uncompacted excavated material after the rock is placed. Rocks on the slope shall be placed with their longitudinal axis normal to the embankment face, and arranged so that each rock above the foundation course has a 3-point bearing on the underlying rocks. The foundation course is the course placed on the slope in contact with the ground surface.

Rocks shall be placed by a grapple or other mechanical equipment in a tight interlocking configuration which results in rock to rock contact, without slipping, to form a stable layer. Smaller rocks used between layers shall be evenly distributed and sized to fill voids after 3-point bearing on the underlying course is established.

Class VII or smaller rock may be placed by dumping provided the following criteria are met:

- a) rock is spread in layers by bulldozers, excavators, or other suitable equipment,
- b) larger rocks are in the toe course and on the outside surface of the slope protection, and
- c) voids larger than the diameter of the smallest rock size are filled.

Local surface irregularities of the slope and erosion protection shall not vary from the planned slope by more than 1 foot (0.3m) measured at right angles to the slope. Rounded rocks shall not be used on slopes steeper than 1 vertical to 2 horizontal.

### 300-11.3 Concreted Rock Slope and Erosion Protection.

**300-11.3.1 General.** Rock for concreted rock slope and erosion protection shall be Class I – VII conforming to 200-1.6 and shall be placed in accordance with 300-11.2.

**300-11.3.2 Concrete.** Concrete for concreted rock slope and erosion protection shall be 520-C-2500P (310-C-17P) and conform to the requirements of 201-1, except that the slump of the concrete shall be adjusted to provide the minimum penetration shown in Table 300-11.3.2.

**TABLE 300-11.3.2**

Class	I	II	III	IV	V	VI	VII
Penetration in inches (mm)	6 (150)	8 (200)	10 (250)	12 (300)	14 (350)	16 (400)	18 (450)



**300-11.3.3 Concrete Placement.** The surfaces of the rock to be concreted shall be cleaned of adhering dirt and clay and then moistened. The concrete shall be placed in a continuous operation for any day's run at one location. Concrete shall be brought to the place of final deposit by buckets or pump. Other placement methods shall be approved by the Engineer prior to use.

In no case shall concrete be permitted to flow on the slope and erosion protection a distance greater than 10 feet (3m).

Immediately after depositing, the concrete shall be spaded and rodded into place with suitable tools until the minimum penetration is that shown in Table 300-11.3.2.

After the concrete has been placed, the rocks shall be thoroughly brushed so that their top surfaces are exposed. The outer rocks shall project 1/3 to 1/4 their diameter above the concrete surface. After completion of any 10 foot (3m) strip, no person or load shall be permitted on the surface for a period of at least 24 hours, or longer if so ordered by the Engineer.

Concreted rock slope and erosion protection shall be cured as provided in 303-1.10.

**300-11.4 Measurement and Payment.** Rock for rock slope and erosion protection will be measured and paid for per ton (tonne) of rock in place.

Concrete and concrete placement will be measured and paid for per cubic yard (cubic meter) in place.