Pebble Counts

Pebble Count Overview

Representative Reach Pebble Count Form

Riffle Pebble Count and Largest Particle on Bar Count Form

Pebble Counts

Two types of pebble counts are required in the morphological description. A *representative pebble count* characterizes the channel and bed material present through a given study reach to classify the stream type (e.g., C3 *vs*. C4); an *active bed riffle pebble count* is used for hydraulic calculations (R/D_{84}) to estimate velocity (on riffle bed) and to calculate sediment competence.

Representative Pebble Count

The representative pebble count procedure is a stratified, systematic method to proportionally sample all the bed features present within the bankfull channel through a designated reach and is used to determine the stream type. The designated reach is divided into two categories: pools and non-pools. Non-pools include riffles, runs and glides. The total distance of the reach is divided into total pool length and total non-pool length (**Figure 17**).

For example, assume the total reach length is 1,000 ft. To stratify the sample, collect a minimum of 100 observations proportionally based on bed features. If 300 ft (30%) of the reach is composed of pools and the other 700 ft (70%) is composed of riffles, runs and glides, then 30 particles (or 30%) are measured within pools and 70 particles (or 70%) are measured within the non-pool features.

To complete a systematic sample, 10 particles across three different pool cross-sections and 10 particles across 7 different non-pool cross-sections would be sampled. Non-pool data is entered separately from pool data on the pebble count form (**Table 6**). This allows a separate analysis of riffle data for specific biological and sedimentological purposes.

Particles are collected at evenly-spaced intervals across the entire bankfull channel at each of the selected cross-sections. The sampling interval will vary based on the bankfull width. The intermediate axis (B-axis) of each particle is measured with a ruler in the field (**Figure 18**) and is generally recorded in millimeters. However, in the case of long, linear-shaped particles, the "intermediate axis" data point is calculated from the average of the A-, B-, and C-axes.

The observer must determine the surface area of the streambanks compared to the streambed to obtain a proportional bankfull area sample. To prevent over-sampling bank material, if 10 observations per transect are obtained, generally only one bank sample every other transect is taken. This gives a 5% representative sample.

Active Bed Riffle Pebble Count

The active bed riffle pebble count characterizes the bed material at the ***surveyed*** riffle cross-section. One hundred particles are measured at evenly-spaced intervals across the active bed of the surveyed riffle cross-section. If the stream width is small, then more than one transect may be taken to obtain 100 observations as long as the values represent the bed of the surveyed riffle cross-section. The active bed riffle pebble count data is used for hydraulic calculations (R/D_{84}) to estimate velocity and for sediment competence calculations.

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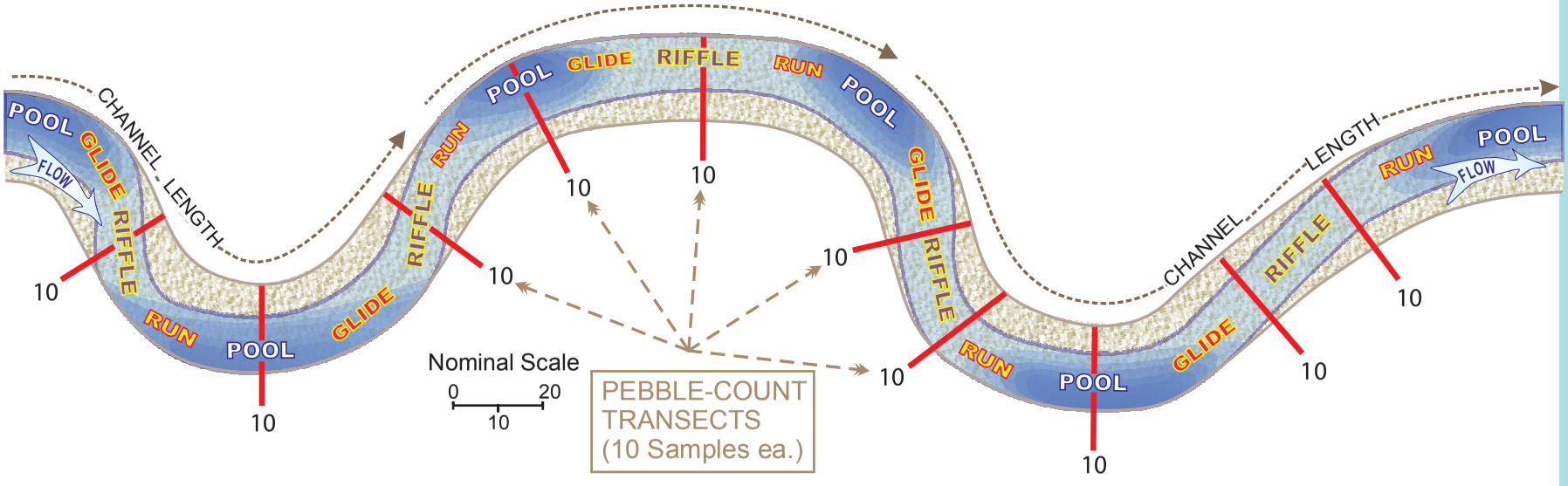
1. Locate a reach for sampling through two riffle/pool sequences of a channel reach that is approximately 20 to 30 "channel widths" in length.
2. Determine the percentage of the reach length configured as riffles and pools. Riffle data may also be analyzed separately.
3. Adjust the pebble-count transects or sampling locations so that riffles and pools are sampled on a proportional basis, where the percentage of samples taken in riffles is equal to the percentage of channel reach length configured as riffles, etc.
4. Sample the total bankfull channel cross-section surface. The bank materials are only sampled proportional to their contributed area.
5. Specific locations of individual transects should represent typical riffles and pools.



This reach is approximately 23 "channel widths" in length. The channel width is approximately 20ft. Total channel length: +/- 460 ft.

Example: Reach configured as:	Pool	Riffle
	140 ft	320 ft
Percentage:	30%	70%

Samples for Pebble Count:
30% in Pools and 70% in Riffles

Figure 17. Representative pebble count procedure (adapted from Rosgen, 1996).

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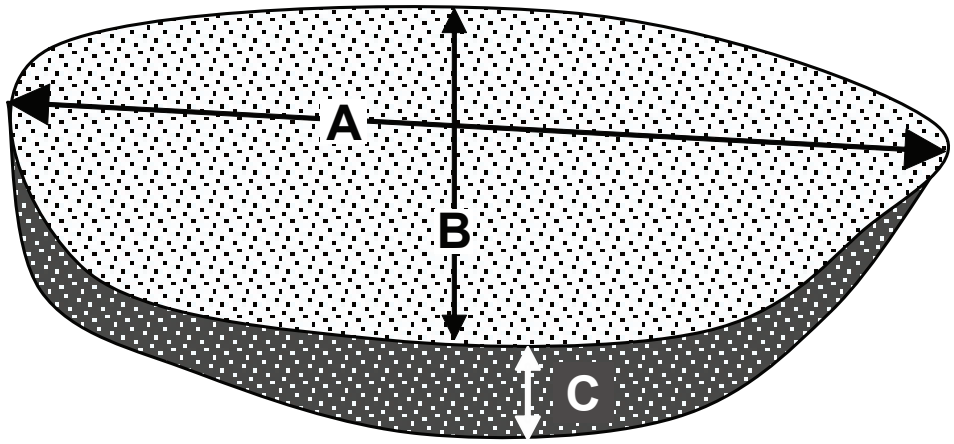

Figure 18. Comparing the three axes of a particle. The B-axis, or intermediate axis, is selected for data entry (the narrowest portion that may fit through or be retained on a sieve tray of a given size), unless the particle shape is long and linear – then the average of the A-, B-, and C-axes is recorded.

Representative Pebble Count Instructions

1. Pace the entire study reach; record pool lengths and non-pool lengths using the pebble count form (see **Table 6** for an example).
2. Calculate the percent of the reach composed of pool and non-pool bed features.
3. Determine the number of pool cross-sections and non-pool cross-sections needed (to simplify the calculations, measure 10 particles at 10 total cross-sections).
4. Identify bankfull on both sides of the channel at your first cross-section location and determine the sampling interval (sample at equal increments across the entire bankfull channel).
5. Begin the pebble count below the bankfull elevation. To avoid bias of selecting larger particles, the observer should look away from the channel bed and select the first particle touched by the tip of index finger at observer's toe. Often, a 5% bank sample is taken (one sample every other transect) to avoid skewing the particles that make up the boundary of the channel.
6. Measure the length of the B-axis in millimeters and mark a dot in the correct column and row as in **Table 6**. If the particle is linear-shaped, average the A-, B-, and C-axes (**Figure 18**).
7. Continue until 10 particles at 10 different cross-sections have been measured in proportion to the bed features of the reach.
8. Follow the example calculations in **Table 6**.
9. Plot the ***upper limit*** of each size class and the corresponding cumulative percent finer than values on the x-axis and primary y-axis respectively for pool, non-pool, and total (**Figure 19**).
10. Plot the ***upper limit*** of each size class and the corresponding value from the total # column on the x-axis and the secondary y-axis for the combined non-pool and pool total (**Figure 19**).
11. Record the D_{16}, D_{35}, D_{50}, D_{84}, D_{95}, and D_{100} on the appropriate forms.

Active Bed Riffle Pebble Count Instructions

1. Repeat Steps 6–11, only sampling on the active bed of the riffle cross-section (100 particle counts).

REPRESENTATIVE REACH PEBBLE COUNT

STREAM:	DATE:
REACH:	CREW:

PARTICLE TALLY COUNTS BY TRANSECT

ft	PARTICLE	mm		1	2	3	4	5	6	7	8	9	10	Tot Pool	Tot Riff	Comb Tot	%CUM
	Silt/Clay	< .062	S/C														
	Very Fine	.062 - .125	S														
	Fine	.125 - .25	A														
	Medium	.25 - .50	N														
	Coarse	.50 - 1.0	D														
	Vry Coarse	1.0 - 2	S														
	Very Fine	2 - 4															
	Fine	4 - 6	G														
	Fine	6 - 8	R														
	Medium	8 - 12	A														
	Medium	12 - 16	V														
	Coarse	16 - 24	E														
	Coarse	24 - 32	L														
	Vry Coarse	32 - 48	S														
	Vry Coarse	48 - 64															
0.21-0.31	Small	64 - 96	C														
0.31-0.42	Small	96 - 128	O														
0.42-0.63	Large	128 - 192	B														
0.63-0.84	Large	192 - 256	L														
0.84-1.26	Small	256 - 384	B														
1.26-1.68	Small	384 - 512	L														
1.68-3.36	Medium	512 - 1024	D														
3.36-6.72	Lrg	1024 - 2048	R														
6.72-13.43	Vry Lrg	2048-4096															
	Bedrock	>4096	BDRK														
		FEATURE SAMPLED															

	Length	Proportion	No. Units	Sampled
REACH				
POOL				
RIFFLE				
RUN				

Transect	Feature	Length	Width
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

REPRESENTATIVE REACH PEBBLE COUNT

STREAM:	DATE:
REACH:	CREW:

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ft	PARTICLE	mm		1	2	3	4	5	6	7	8	9	10	Tot Pool	Tot Riff	Comb Tot	%CUM
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	Length	Proportion	No. Units	Sampled
REACH				
POOL				
RIFFLE				
RUN				

Transect	Feature	Length	Width
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

RIFFLE PEBBLE COUNT AND LARGEST PARTICLE ON BAR COUNT

STREAM:	**DATE:**
REACH:	**CREW:**
XS No.:	**Riffle Location (also mark on reach sketch):**

				Particle Count										TOTALS	
ft	**PARTICLE**	**mm**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Tot #**	**% Cum**
	Silt/Clay	< .062	S/C												
	Very Fine	.062 - .125	S												
	Fine	.125 - .25	A												
	Medium	.25 - .50	N												
	Coarse	.50 - 1.0	D												
	Vry Coarse	1.0 - 2	S												
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6.72-13.43	Vry Lrg	2048-4096													
	Bedrock	>4096	BDRK												

LARGEST PARTICLES ON BAR

Bar Location (also mark on reach sketch):

Bar Length:
Bar Width (Thalweg - BF):
Sketch bar profile (Thalweg - BF)

Part. #	mm	Part. #	mm	Part. #	mm
1		6		11	
2		7		12	
3		8		13	
4		9		14	
5		10		15	

RIFFLE PEBBLE COUNT AND LARGEST PARTICLE ON BAR COUNT

STREAM:	**DATE:**
REACH:	**CREW:**
XS No.:	**Riffle Location (also mark on reach sketch):**

				Particle Count										TOTALS	
ft	**PARTICLE**	**mm**		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Tot #**	**% Cum**
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2		7		12	
3		8		13	
4		9		14	
5		10		15	