Breaking strengths of cordelette anchors tied with overhands versus figure-8s.

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Cordelette anchors use a long loop of cordage, usually 7 or 8 mm accessory cord, attached to several anchors with the resultant loops tied together to make a load sharing anchor system. They have traditionally been tied with overhand knots. There is some question to whether a figure-8 knot may give greater strength.

Testing was done at CMC industries in Goleta, CA using a hydraulic ram and a load cell. A length of 8 mm cord was triple looped around a 4 inch bollard then tied with a double fisherman. The three resulting loops were then equalized and the ends were tied together with either an overhand or a figure-8. The resultant loop was then attached to a carabiner and the anchor system pulled to destruction. Failure modes were noted.

Average failure in the overhand group was at 9500 lbf ± 596 (MBS 7712) versus 11,123 lbf ±595 (MBS 9338) for the figure-8 group (P=0.0026). Failure mode was very variable.

Using a figure-8 knot in the cordelette anchor does increase strength, but at least in with 8 mm cord, the strength of either anchor is more than adequate for most applications. Either knot is acceptable and might be chosen to improve positioning of the carabiner.

A few speculations can be made about failure modes. On the bollard side, the loop with the joining bend was the least likely to fail. Dressing the knot made a difference. When any of the loops on the load side were shorter they broke first. When loop length was closer to identical, overall strength increased, but the anchor was more likely to fail catastrophically rather than sequentially. Either knot deforms a lot before failure happens.

This study is limited by a lack of standardization of the cordage. The samples were left over ends and were not guaranteed to have come from the same spool or to have had identical treatment. Internal angles of the anchors were not the same. Cord length was chosen to have the minimum length of anchor to fit into the machine but still allowing the knot to be tied. After loading 1 kN, the arm lengths were 14 inches in the overhand group and 19 inches in the figure-8 groups, giving similar and safe, but not identical angles. It was impossible to dress either of the knots in any standard way.

Results of breaking cordellete anchors		
14' of 8mm cord done as a cordelette anchor over a 4" bollard. Carabiner on load side. Overhand.		
1	8730	First break at shackle, 2&3 at knot on load side
3	9572	Separate breaks on bollard side, knot side won
5	9196	First break at carabiner on a trapped loop. Second failure in bollard side loop. Third failure of remaining two loops simultaneously
7	10340	Two loops on carabiner followed by 3rd loop on carabiner
9	9661	3 sequential failures on load side
Sum	47499	
Average	9499.8	
SD	596	
MBS	7711.8	
18' of 8mm cord done as a cordelette anchor over a 4" bollard. Carabiner on load side. Figure-8.		
2	11626	Double failure on bollard side, one was a double break. Knot leg won.
4	11375	Simultaneous failure x 3 at carabiner
6	10379	Double failure on bollard side, knot leg won
8	10594	Double failure on load side, followed by last loop on load side
10	11641	Double failure on load side, followed by last loop on load side (a double failure)
Sum	55615	
Average	11123	
SD	595	
MBS	9338	
		P=0.0026