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The Short Story

Wire Rope (Steel Cable) Selection for Floating Dock Anchoring Applications

Galvanized vs. Stainless Steel wire rope types and different IWRC constructions, Averaged Costs, and Lifespan Expectancy Observations - Specifically for the White River Lakes System (Arkansas & Missouri) including Beaver, Table Rock, and Bull Shoals Lakes.

DISCLAIMER: Providers of wire rope are cautious not to publish life expectancy data due to countless variables that influence performance of steel cables for any environment, which is why it is extremely difficult to find specific information about cable life expectancy on the internet. For the same reason, Boaters Lifeline cannot promise or guarantee specific results for your particular application. However, for the specific lakes identified above, we will share our observations and the experience of others regarding dock anchoring cable performance. Life expectancy figures are represented as ***averages*** with a reasonable degree of confidence (85% +/- 10%). Likewise, your experience is valuable and we hope you will contribute to our knowledge base.

The #1 Question:

When the need arises to replace dock anchor cables, the most common question dock owners have by far is, "What's the difference between galvanized and stainless steel cable?" Sounds easy enough, but the answer is far from simple. "A lot" would be the appropriate initial response, but not a very satisfying one. To help answer this question (and appeal to the varying degrees of the individual's quest for knowledge), we have divided this into two sections, ***The Short Story*** and ***The Long Story*** of Cable Selection.

Figure 1 – Stainless Steel Wire Rope

The Short Story:

For those less concerned about the technical explanation and the science behind the different wire ropes (steel cables) and applications, ***The Short Story*** limits discussion to the most common floating dock anchor cable selections. We will likewise skip over most of the wire rope size and construction science and jump right into a brief description of ***cable types*** along with their pros and cons. followed by a summary of the ***labor costs, cable lifespan limiting factors, expected lifespan***, and ***annualized costs*** of replacement.

We strongly encourage you to contact Boaters Lifeline or seek other professional consultation regarding the correct cable specifications for use with your dock, current equipment, topography, and so on. Moreover, have your current anchoring setup evaluated now to help prevent costly emergency services and potential dock damage due to unexpected cable breaks.

Wire Rope (Steel Cable) Types:

Wire rope ***type*** classification begins with identifying the quality of steel being used. The vast majority of wire rope used in dock anchoring applications and all wire rope examples analyzed here are made from ***IPS*** wire (Improved Plow Steel). Different wire rope *types* are created by applying different corrosion treatments or by using corrosion resistant metal alloys. Among these, and probably the most common, is ***galvanized*** wire rope which uses a coating high in zinc (93% minimum) to enhance the wire's resistance to corrosion. Galvanized wire rope is typically about

10% weaker than stainless steel. Moreover, the galvanized coating is susceptible to abrasion, leading to degradation of the protective layer and corrosion, causing the strength of galvanized wire rope to decline consistently over its service life.

Another common wire rope type is ***stainless steel*** *(Figure 1)*. Highly desirable in the marine industry due to its superior resistance to corrosion, stainless steel alloy has "self-healing" properties thanks to the addition of chromium and other metals like nickel. Of the different stainless steel alloys, the most common is type 304 marine stainless steel.

For our analysis, three types of wire rope are commonly offered for dock anchoring applications:

1. ***Standard Galvanized*** – Corrosion resistant steel wire rope.
2. ***Premium Galvanized*** – Technically still a galvanized type, this cable differs in internal wire count construction and variable diameters of individual steel wires.
3. ***304 Marine Stainless Steel*** – A strong & high corrosion resistant alloy for marine use.

Figure 2 represents the most common offerings from area suppliers, separated by wire type. Wire rope sizes smaller than 1/4" are never used for dock anchoring applications and even still, 1/4" wire rope is uncommon. The vast majority of anchoring applications utilize 5/16", 3/8", and 1/2" wire rope. Only 1/4" and larger wire rope is covered on the cost and lifespan charts.

Wire Rope Comparison of Different Types & Construction		IPS Grade – IWRC (Independent Wire Rope Core)					
		Galvanized Wire Rope		Stainless Steel Wire Rope		Premium Galvanized Wire Rope	
Class Type	Size (Diameter)	Weight per Foot in lbs.	Breaking Strength*	Weight per Foot in lbs.	Breaking Strength*	Weight per Foot in lbs.	Breaking Strength*
7 x 19	1/8"	0.030	1.00	0.030	0.88	-	-
7 x 19	3/16"	0.070	2.10	0.070	1.85	-	-
7 x 19	1/4"	0.110	3.50	0.110	3.20	-	-
7 x 19	5/16"	0.170	4.90	0.173	4.90	-	-
7 x 19	3/8"	0.243	7.20	0.243	6.00	-	-
6 x 19	1/2"	0.460	10.30	0.460	11.40	-	-
6 x 19	5/8"	0.720	16.10	0.720	17.50	-	-
6 x 19	3/4"	1.040	23.00	1.040	23.80	-	-
6 x 26	1/2"	-	-	-	-	0.460	11.50
6 x 26	5/8"	-	-	-	-	0.720	17.90

* Breaking Strength in Short Tons (2,000 lbs). Individual results may vary.

Figure 2 – Comparison of Common Dock Anchor Wire Rope

Labor Cost Component:

There is a significant ***Labor Cost Component*** associated with anchor cable replacement, especially with submerged anchor drops. Even with shore anchor ***rodes*** (a single dock-to-anchor cable run), what may seem like insignificant installation costs can greatly impact annualized costs. The labor cost is generally the same regardless of cable *type* so you can simply divide the labor cost by the average years of expected life for the particular cable type. For a common 8-10 slip dock configured with 4 cable rodes (2 land anchors and 2 submerged), cable type selection could easily mean the difference of spending $200 or more per year in average labor costs alone and in the thousands over the life of the type cable used. Costs would increase proportionately for larger docks with more submerged anchor points and more cable rodes.

What Limits the Lifespan of Wire Rope?

The biggest contributors to wire rope corrosion, loss of strength, and limiting service life are:

1. Abrasion over rocks, debris, and poor cable routing (winch towers, dock framework).
2. Over-tightening, shearing, kinks, and bends which break individual wires and coatings.
3. Back-and-forth exposure to submerged and dry conditions (largely unavoidable).
4. Poor maintenance practices, improper loading and/or winding on winch drums.
5. Manufacturing quality varies among suppliers, affecting all performance characteristics.

Lifespan Observations (averages):

The following observations are based on our experience as well as the feedback from dock owners and area professionals. Regardless of what some providers may have told you, among the products commonly sold in our geographic area, ***galvanized wire rope is NOT stronger than Stainless Steel*** rope of the same wire grade, construction, and finished diameter. Always ask for proof before accepting such claims as fact. Boaters Lifeline uses only ***certified*** South Korean manufactured wire rope in most diameters, constructions and types, and provide the ***Certification Documents*** for the actual wire used in your installation. Moreover, for quality assurance and performance tracking, Boaters Lifeline catalogs and stores sample sections from each spool of the installed wire, for the entire duration of use. We even provide a wire set for the customer upon request.

1. **Standard Galvanized:** 3 years minimum - 5 years maximum. Standard galvanized is very appealing to dock owners because it is the least expensive in cost per foot of the 3 cable types identified here. However, the annualized *Labor Cost Component* (as defined above) is often overlooked due to the attractiveness of lower price (or underestimated due to lack of information). Additionally, due to noticeable decreases in quality from Chinese manufacturers, standard China galvanized wire rope is no longer recommended for anchoring applications by Boaters Lifeline (and the more reputable area providers). Routine maintenance including cleaning and lubrication will maximize service life. Have this cable inspected by a professional annually.
2. **Premium Galvanized:** 4 years minimum – 6 to 7 years maximum. The higher internal wire per strand count (6x25 or 6x26), adds flexibility and improves performance compared to standard 6x19 galvanized. Better resistance to abrasion from scraping against rocks (and other physical factors) reduces degradation of the galvanized coating and service life is subsequently increased. Strength can near that of stainless steel in the same diameter however, the galvanized coating will still degrade over time, as will its strength. Routine inspection, cleaning, and lubrication will extend service life.
3. **304 Marine Stainless Steel:** 10 years minimum, 11 years average, 12 or more years for Korean manufactured wire. A superior product and preferred choice for long life and added strength, 304 Stainless Steel has a *Self Healing* ability that prevents corrosion thanks largely to high chromium content and other metals like nickel. Unlike the other cable types, it does not rely on a coating for protection. 100% of the wire, inside and out, has this resistance to corrosion and much longer life expectancy are the result. On the average, it is stronger than galvanized products, especially over its service life where its counterparts weaken over time. This adds more security against breaks and adds integrity to the entire dock anchoring system. Stainless Steel cable however is still susceptible to damage and can experience breaks in the individual wires, mostly by stress from high winds or storms, incorrect rigging components, improper winding on winches, and over tightening cables. In addition to inspection, it is also recommended to have periodic maintenance performed, like a mild cleaning and lubrication, to achieve the greatest life expectancy.

Lifespan and Average Annualized Cost Charts:

The following annualized costs are based on pricing dated April 15, 2022, the observed average lifespan data from above, separated into 3 different charts.

1. ***Annualized Cost Per Foot of 500' Cable with No Labor Component*** (*Figure 3*) which is typical of x2 anchor rodes of 250' each.

2. ***Annualized Cost Per <u>Installed</u> x2, 250 Shore Anchor Rodes*** (*Figure 4*). This combines a labor component of $200 installation per shore anchor rode.
3. ***Annualized Cost Per <u>Installed</u> x2, 250' Anchor Rodes and x2 Submerged Anchors*** (*Figure 5*). Combines a materials and labor component of $1,000/submerged anchor.

Annualized Cost of Different Wire Rope Types – 500' (x2 250' rodes)		Annualized Cost Per Foot of 500' Cable Length Only – No Labor Component								
		Galvanized IWRC Wire Rope			Stainless Steel IWRC Wire Rope			Premium Galvanized IWRC Wire Rope		
Class Type	Size (Diameter)	Cost Per Foot*	Average Lifespan**	Annual Cost [1]	Cost Per Foot	Average Lifespan**	Annual Cost [1]	Cost Per Foot	Average Lifespan**	Annual Cost [1]
7 x 19	1/4"	$0.37	4.0	$46.25	-	-	-	-	-	-
7 x 19	5/16"	$0.57	4.0	$71.25	-	-	-	-	-	-
7 x 19	3/8"	$0.72	4.0	$90.00	$1.68	10.0	$84.00	-	-	-
6 x 19	1/2"	$1.20	4.0	$150.00	$3.04	10.0	$152.00	-	-	-
6 x 19	5/8"	$1.76	4.0	$220.00	$4.65	10.0	$232.50	-	-	-
6 x 26	1/2"	-	-	-	-	-	-	$1.65	6.0	$137.50
6 x 26	5/8"	-	-	-	-	-	-	$2.36	6.0	$196.67

* Based on 500 Foot lengths as of April 15, 2022. Common length of x2 shore anchor rodes. 250' reel is typical supplier price point.

** Average Life as observed and user reported feedback. Individual results will vary. Always have cable inspected by qualified professional.

[1] Annual Cost per Cable Only – This Chart: Annualized Cost Per Foot of 500' Cable Length Only – No Labor Component

Figure 3 – Comparison of Selected Wire Rope Costs With <u>No</u> Installation Labor

As you can see in *Figure 3*, the low cost of standard galvanized wire rope looses its appeal when cost averaging over the expected lifespan. The most important factor here is the omission of any labor cost. Even if the dock owner was to perform the installation themselves, it becomes a question of how often do you want to do this? Anyone who has handled and installed 250' of 1/2" cable can tell you it's no easy task. Weighing in at close to 1/2 pound per foot makes handling a challenge, as well as selecting the correct hardware & properly securing everything.

Annualized Cost of Different Wire Rope Types – 500' (x2 250' rodes)		Annualized Cost Per Installed x2, 250' Shore Anchor Rodes @ $200/rode								
		Galvanized IWRC Wire Rope			Stainless Steel IWRC Wire Rope			Premium Galvanized IWRC Wire Rope		
Class Type	Size (Diameter)	Cable Cost/yr [1]	Average Lifespan**	Annual Cost*	Cable Cost/yr [1]	Average Lifespan**	Annual Cost*	Cable Cost/yr [1]	Average Lifespan**	Annual Cost*
7 x 19	1/4"	$46.25	4.0	$146.25	-	-	-	-	-	-
7 x 19	5/16"	$71.25	4.0	$171.25	-	-	-	-	-	-
7 x 19	3/8"	$90.00	4.0	$190.00	$84.00	10.0	$124.00	-	-	-
6 x 19	1/2"	$150.00	4.0	$250.00	$152.00	10.0	$192.00	-	-	-
6 x 19	5/8"	$220.00	4.0	$320.00	$232.50	10.0	$272.50	-	-	-
6 x 26	1/2"	-	-	-	-	-	-	$137.50	6.0	$204.17
6 x 26	5/8"	-	-	-	-	-	-	$196.67	6.0	$263.33

* Based on Installation Cost of X2, 250' ***Shore Anchor*** Rode Sections @ $200/rode. Includes all additional hardware, transport, labor and taxes.

** Average Life as observed and user reported feedback. Individual results will vary. Always have cable inspected by qualified professional.

[1] Cable Cost Per/yr from Chart: *<u>Annualized Cost Per Foot of 500' Cable Length Only – No Labor Component</u>*

Figure 4 – Comparison of Selected Wire Rope Costs With Installation Labor @ x2 Shore Anchors

Adding in a mere $400 in total labor component for x2 shore anchor rode replacement really illustrates the differences in annualized cost among the three cable types (*Figure 4*). If this is beginning to look like we are making the case for using stainless steel, you would be correct, but this is not intentional. Stainless clearly has the advantage simply because the longer lifespan equates to lower annual costs and overall better value.

Figure 5 is a perfect example of the submerged anchor configuration of a typical 8-slip floating dock on our area lakes, with 1/2" cable or larger comprising nearly 100% of the installations. Here the difference between standard galvanized and stainless steel is clearly in favor of stainless. At $300 per year these cost differences should not be ignored. This equates to $3,000 or more over the life of stainless steel compared to standard galvanized and $380 or more compared to premium galvanized. Moreover, this installation is well beyond the Do-It-Yourself dock owner's capability.

Annualized Cost of Different Wire Rope Types – 500' (x2 250' rodes)		Annualized Cost Per Installed x2, 250' Submerged Anchor Drops @ $1,000/rode								
		Galvanized IWRC Wire Rope			Stainless Steel IWRC Wire Rope			Premium Galvanized IWRC Wire Rope		
Class Type	Size (Diameter)	Cable Cost/yr [1]	Average Lifespan**	Annual Cost*	Cable Cost/yr [1]	Average Lifespan**	Annual Cost*	Cable Cost/yr [1]	Average Lifespan**	Annual Cost*
7 x 19	1/4"	$46.25	4.0	$546.25	-	-	-	-	-	-
7 x 19	5/16"	$71.25	4.0	$571.25	-	-	-	-	-	-
7 x 19	3/8"	$90.00	4.0	$590.00	$84.00	10.0	$284.00	-	-	-
6 x 19	1/2"	$150.00	4.0	$650.00	$152.00	10.0	$352.00	-	-	-
6 x 19	5/8"	$220.00	4.0	$720.00	$232.50	10.0	$432.50	-	-	-
6 x 26	1/2"	-	-	-	-	-	-	$137.50	6.0	$470.83
6 x 26	5/8"	-	-	-	-	-	-	$196.67	6.0	$530.00

* Based on ***Installation Cost*** of *X2 Submerged Anchors and 250' Rode Sections @ $1,100/rode*. Includes all hardware, transport, labor,taxes.

** Average Life as observed and user reported feedback. Individual results will vary. Always have cable inspected by qualified professional.

[1] Cable Cost Per/yr from Chart: *Annualized Cost Per Foot of 500' Cable Length Only – No Labor Component*

Figure 5 – Comparison of Selected Wire Rope Costs Costs With Installation Labor @ x2 Submerged Anchors

Conclusion:

During its usable life, every dock will require replacing worn/degraded anchor cables numerous times. Just like the many different variables that affect how often this occurs, ***budgeting*** is equally unique, one dock to the next. Commercial dock applications aside, dock ownership consists of two types, *Private Docks* (1-8 slips with a single owner or family), and *Community Docks* (typically 6+ slips with multiple owners, all belonging to a *dock association*). Private Dock ownership greatly simplifies budgeting maintenance expenses simply by the limited number of parties involved in the decision making process. Community Docks pose a different set of considerations as the total maintenance cost is divided up equally among the number of slips in the dock, with each association member being required to cover that cost for each slip they own. For example, a 20-slip dock may have as many as 20 different slip owners, each with a different expectation of maintenance costs and budget. When maintenance is required, quotes are requested from service providers and shared with all members, with final expenditure approval determined by a vote (each slip counts as one vote, so members that own multiple slips get multiple votes). As you may expect, this does not always set well with every member. Unexpected maintenance costs or emergency repairs are never well received and cost justification is largely dependent on individual budgets. A calendar of anticipated maintenance costs presented upfront can help smooth over cost justifications and the scheduling of cable replacement in advance can potentially eliminate unexpected failures and in some cases, even lead to a reduction in insurance costs. While there may not be a single magical answer to the question of anchor cable replacement frequency and cost, we hope this information narrows down the choices for selection and helps determine the best approach and overall ***value*** for your application.