## 6.0 Construction Costs

For price estimation and budgeting, JMT has made some assumptions and generalizations to provide an across the board similar cost comparison. The intent is provide guidance to the City in determination of the best course of action with financial consideration taken into account. The cost estimation provided below accounts for a "bid price" cost and does not consider other costs to the City, such as loss of use of a lane of traffic.

The construction phasing has also been assumed to be typical for all options. It is assumed the contractor will mobilize to the site and work on one full block of Murray Blvd. at a time to allow for closures as needed. This creates seven phases of wall repair phasing ranging from 500 feet to 860 feet, as shown in the sketch below. The work area would have to be blocked off to public access. This closure will be for the southern lane, or wall, side of Murray Blvd. only. This would permit the contractor to perform the contracted work using an OSHA approved excavation without extensive shoring. The contractor would be responsible for any impacts to the median and the cost of complete resurfacing of the waterside lane is included in all estimates.


For estimation purposes the concept estimates are based on a minimum section of wall replacement of 500 linear feet. This was to provide a realistic yet conservative cost for materials based on discount purchase of bulk quantities. It also factors in the "learning curve" of labor; as repetitious tasks are performed over and over, the time of the task is reduced.

The barrier rail, post, and curbing has been estimated based on the replacement costs of that installed recently at "the turn". The previous design was an 8 ½" square concrete post with stainless steel reinforcing and a three rail, 1-1/2" diameter vinyl coated pipe barrier. The sidewalk is considered to be completely replaced for the full 4,800+ linear feet. The face repair would involve water blasting to remove marine growth, deleterious materials, and loose or weak concrete. The spall repairs would require chipping to sound concrete, installation of adhesive anchors, application of a bonding agent and then installation of a structural repair mortar/grout approved for vertical surfaces and also approved for wet applications.

Some of the options considered may not require the full closure of the southern lane of Murray Blvd. At the contractor's option, it may be possible to only occupy the parking lane to effect the work. This is provided the contractor installs suitable shoring to support traffic loading and complies with South Carolina Department of Transportation (SCDOT) requirements as the owner of the road. The assumption of the following estimates is that the cost of temporary shoring exceeds the cost of the lane closure. This is based on the fact that the contractor will be required to establish a similar closure for the sidewalk and parking lanes regardless of the option undertaken. Therefore extending the barricades an additional 12 feet is a minimal additional cost.

The option of full demolition and replacement of the wall is derived from actual costs associated with the construction at "the turn". The previous repair replaced a 116.68 foot section of the high battery, from Station 49+40 to Station 48+23. The contract price was $2,665,000.00 which equates to approximately $22,840.25 per foot of wall. A major cost component of the full replacement option would be the installation of the steel sheet pile cofferdam to create a dewatered work area. By employing an underpinning option, this cost could be eliminated.

The underpinning options are broken out to a subset of options. These options are all very similar in construction processes and installation. The options all have individual merits that should be balanced by the City's needs and the impacts to the local residents. For instance, the micropiles can be installed using equipment with a much smaller foot print and could possibly be a quieter installation. The steel H piles may be more economical, but will be installed with a vibratory hammer which may or may not affect the structures nearby, but will certainly be a very visible and very noisy process. Because of the unknown cost premium factor associated with renovation work, JMT has added a contingency for unknowns that could affect the overall price of the contract.

Using the Option 1 (see Appendix A for underpinning options) conceptual drawing from Schnabel, the cost for a 500' section of wall renovation with double micropile underpinning would be approximately $3,599,000. Adding a 20% contingency increases this amount to $4,318,000, or approximately $8,637 per foot of wall. The cost difference for Option 1 versus Option 2, which eliminates the expense of one core through the existing concrete, but add the expense of forming and material to expand the cap, is not significant enough to exceed the margin of error within the estimation.

Option 3 is a more intrusive design involving excavation of the median and installing a micropile supported deadman. The benefit from option 3 is the change from a battered micropile to an easier and more economical (for installation) vertical micropile. It does create some possible utility issues, and could potentially affect the roadway because the pile supported strut would maintain its elevation if the road around it settled. This could cause an increase in the maintenance cost for the sidewalk and road. A 500' section of wall renovation would be approximately $3,370,000 for the deadman option. Adding a 20% contingency increases this amount to $4,045,000, or approximately $8,090 per foot of wall. The option 3 alternate, as noted on the base of the sketch, eliminates the deadman and adjusts the pile spacing. This option is more costly, however there is less potential for conflicts. Due to the additional length of Micropiles added, the estimate for 500 feet is approximately $4,777,000. Adding the 20% contingency increases the amount to $4,732,758 or approximately $11,465 per linear foot of wall.

The auger cast option, labeled as Option 4 in the sketches, includes a single batter micropile and a single plumb auger cast pile. The base cost would be approximately $2,915,000. The cost increases to $3,498,000, or approximately $6,997 per foot of wall with the contingency added.

Option 5, using a steel HP section as the vertical component of the underpinning, results in a base cost of approximately $2,797,000 for a 500' section. With the contingency factor added, the amount increases to $3,356,000, or approximately $6,712 per foot of wall. The steel will be coated with a coal tar epoxy for the top 20'. This is to provide a level of protection against corrosion or any corrosivity that may be encountered within the soils.

| Description | | | Cost per wall foot |
|---|---|---|---|
| Complete demolition and rebuilding new seawall | | | $ 22,840.00 |
| Underpinning options | | | |
| | Option 1 | 1 batter and 1 plumb Micropile @ 6' spacing cored through existing concrete | $ 8,637.00 |
| | Option 2 | 1 batter and 1 plumb Micropile @ 6' spacing with added concrete pile cap | $ 8,637.00 |
| | Option 3 | 3 Vertical Micropiles with a deadman installed in the median | $ 8,090.00 |
| | Option 3 alternate | 2 plumb micropiles cored through the concrete spaced @ 4'-0" | $ 11,465.00 |
| | Option 4 | 1 batter micropile with 1 plumb auger cast pile | $ 6,997.00 |
| | Option 5 | 1 batter micropile with 1 plumb steel HP | $ 6,712.00 |

## 6.1 Construction Schedule

The construction schedule is somewhat more difficult to estimate. The contractor will be required to work around the tidal cycles, but will be restricted from working off hours, nights and weekends, due to the proximity of local residences. The assumed work schedule can be derived from efforts at the turn as well as from past performance. The project at the turn was allotted 9 months from notice to proceed to close out. Based on the contractor schedule 156 working days were planned for the actual work on the wall. This equates to approximately 1.3 days per foot of wall. For a 500' section, this would be about 650 working days.

The underpinning options can vary depending on contractor means, methods and equipment used. Based on the construction procedure used to estimate construction costs, it is reasonable to assume underpinning a 500 foot section could be completed in approximately 200 working days, or 0.4 days per foot. This reduction of work effort for underpinning, along with removing the need for a cofferdam, results in a considerable time savings.

The schedule estimate is for work effort only and should not be used as the allowance for contract time.