MARINE SPECIFICATIONS
REDUCING COST WITHOUT COMPROMISING QUALITY

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Abstract: Pick up a typical Submarine Cable System supply contract today and the chances are that, in the Marine Technical Specification section, you will find clauses that have not changed significantly from a supply contract from the mid nineties. However, tools and techniques have developed over this period so perhaps it is now time to challenge these specifications to see if there are any areas where changes can be made to allow costs to be reduced without compromising quality. Unnecessary over specification results in unwarranted additional cost.

The goal of this paper is to raise the awareness within the Submarine Cable community of areas of over specification in Cable System supply contracts so that the potential impacts can be properly considered during the tendering and contract forming phases of a new Submarine Cable System.

This paper discusses a number of Marine Technical Specifications that exist in today's supply contracts that could be challenged on the grounds of unnecessary cost.

1. SURVEY CORRIDOR WIDTH

Since the introduction of plough burial as the primary means of cable protection in shallow waters, the corridor width for the shallow water geophysical survey has traditionally been set at 1000m (shallow water is defined as <1000m water depth or to the end of burial, whichever is greater). This allowed sufficient data to be acquired for charting so that decisions could be taken to optimise the route post survey. In the early days, this optimisation was carried out 'back in the office' once the survey had finished and the report had been produced. Therefore, a reduced corridor would have carried with it a risk that insufficient survey data had been collected resulting in the need to do additional survey, an expensive prospect considering that the survey resources would have to be remobilised.

Today, partly due to time pressures and partly due to the availability of GIS software, decisions regarding route optimisation are taken offshore during the course of the survey in 'real time'. If a suitable route cannot be found with the acquired data, then route development is performed whereby the survey corridor width is increased over a specific area in order to find more suitable sea bed.

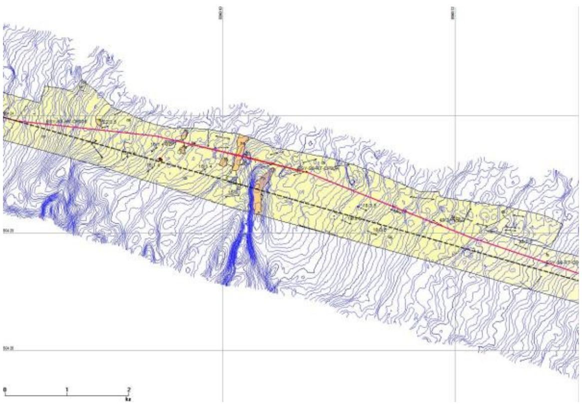

Figure 1: Example of Route Development

The ability to make such routing and route development decisions onboard the survey vessel means that the survey corridor can be reduced to 500m without the risk of having to remobilise and perform additional survey acquisition. A 500m corridor will result in less time required to perform the survey compared with a corridor width of 1000m as the survey vessel has to sail fewer line kilometres. The time saving can be in the order of 40% of the shallow water geophysical survey duration.

2. ROUTE DEVELOPMENT ALLOWANCE

Route development is used during a route survey when a suitable route across the sea bed cannot be found with the acquired survey data. Additional survey lines are run to the side of the survey corridor in order to find better sea bed across which the cable can be routed.

Nearly all Cable System contracts call for an inclusive survey route development allowance of 10% (of survey acquisition time). Of course at the time when the contract is priced, it is not possible to know how much route development will actually be required, so the full 10% will be included. Any unused allowance will be an unnecessary cost.

The amount of route development required will, to a large extent, depend on the ‘quality’ of the original routing as determined during the Cable Route Study phase of the project. A lot more data is available to the Route Engineer than was the case a decade ago which allows for better route selection pre-survey. The resulting improvement in routing ‘accuracy’ should reduce the need for route development.

An analysis of survey campaigns going back to the turn of this century shows that the amount of route development required rarely exceeded 5% of survey acquisition time, with the average around 3%. Of course, in the rare case the quantity exceeds 5%, this can be addressed as a contract variation in the normal way.

3. BURIAL ASSESSMENT SURVEY

There have been many conference papers on the subject of the need for a Burial Assessment Survey (BAS) but the Industry generally accepts that these surveys do produce useful information for the engineering and installation planning phases of a project to construct a new cable system. So the specifications we see today generally call for a BAS wherever the cable is planned to be buried. The methodology employed is commonly Cone Penetrometer Testing (CPTs) at regular intervals along the route (typically every 4 km). Methods for continuous survey are also available but these add more cost.

Figure 2: Example CPT System

In areas where the seafloor geology is not complex (sands, uncompacted clays), burial assessment may be adequately performed using the standard data acquired during the geophysical survey, namely bathymetry, side scan sonar and subbottom data, including sea bed samples. In these areas CPTs will not add any extra data.

However there may be areas (gravels, compacted clays or sub-cropping rock) where the results of the geophysical survey may be inconclusive with respect to providing a good burial assessment. It is in these types of sea bed where the benefits of CPTs will be realised. Therefore when specifying a new cable system, consideration should be given to a focused approach, only requiring a BAS where it would add value or where there exists little knowledge of the seafloor conditions, for example an area where there are no existing cables. It is worth noting here that some specifications attempt to reduce cost by increasing the spacing between CPTs but a data density of say, one every 10kms, is not sufficient to provide useful information.

How should we determine which parts of a new system should be selected for a BAS? This could be identified during the Desk Top Study (DTS) activity implying that this should be performed prior to formulating the specification and entering the tendering phase of a project.

4. CABLE BURIAL & WATER DEPTH

For many years now, the industry standard specification for burial has been from 0 to 1000m water depth mainly driven by the general understanding that this is the limit for bottom fishing. More recently we have seen this being pushed to the 1500m contour, partly due to the wish to 'future proof' systems against the inevitable expansion of fishing into deeper waters as fishing stocks continue to deplete and partly due to the fact that most cable burial ploughs used in the industry are rated to 1500m (so the additional requirement comes at no additional capital cost).

Cable burial is a relatively slow process; it is performed at, typically, one tenth of the speed of laying the cable on the surface of the sea bed. It is therefore a costly exercise to bury the cable so eliminating unnecessary burial will bring significant cost savings.

Specifications, more often than not, apply the end of burial water depth limit uniformly across the system rather than focussing burial in areas where it is needed. Take for example a system connecting Western Europe with South Africa. There is evidence of fishing extending beyond 1000m water depth off Western Europe but no evidence of this off West Africa. Therefore burial to 1500m water depth is only necessary on the European continental shelf and burial on the African shelf can be limited to 1000m (or less).

Similarly in areas where bottom trawling is not performed, it is not necessary to bury the cable to 1000m. Recent studies[1,2,3] in fault trends have shown that over 80% of all faults caused by external aggression (fishing, anchoring) occur in water depths less than 300m, with 70% in water depths less than 100m. So a specification with burial to a water depth of say 300m would adequately protect cable systems in these areas saving significant cost.

As with the focussed BAS approach, identification of threats in specific areas resulting in the need for burial is part of the DTS process.

5. POST LAY INSPECTION

Post lay inspection (PLI), usually performed by a burial ROV (remotely operated vehicle), was introduced as a means to validate that the cable has been buried and at what depth into the sea bed. A percentage of the buried cable to be inspected is specified, sometimes as much as 30% or, on occasion, 100%! Inspection rates are relatively slow; average progress would be in the order of 500m per hour so large amounts of inspection are costly.

We have to ask why is it necessary to inspect buried cable. Modern ploughs have the means to accurately measure the depth of burial either by calculation (front skid height and plough pitch) or by a specific depth measuring skid. Some ploughs have both systems to provide redundancy. Thus the plough can provide depth of burial verification without the need for post lay inspection. Of course PLI could be required if there is an indication that the plough system is not functioning but a greater reliance on the plough data will significantly reduce the cost of operations.

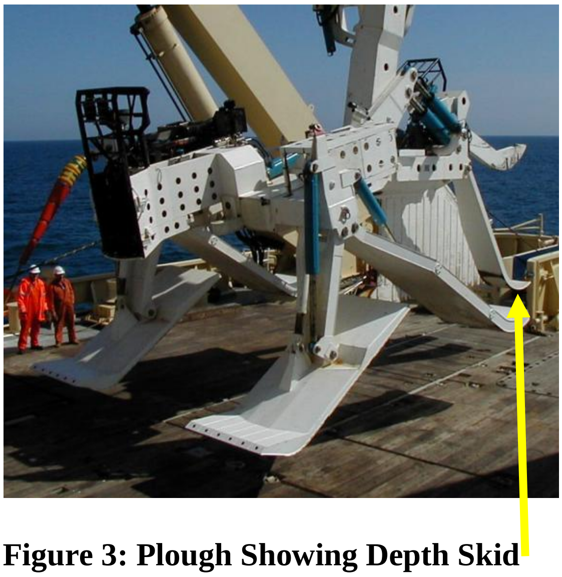

Figure 3: Plough Showing Depth Skid

6. POST LAY BURIAL

Post lay burial (PLB) operations are intended to bury those parts of the system which could not be plough buried such as; cable where it crosses other in-service cables or pipelines, initial, intermediate or final splices, branching units and so on. PLB is not intended for cable burial in areas where the plough could not achieve burial due to unsuitable seabed conditions such as hard sediment or steep slopes.

More often than not, specifications require that a quantity of PLB be included in the supply contract, usually expressed as a percentage of the planned burial length. This is typically 5%, 10% or sometimes as high as 30%.

Post lay burial by jetting ROV is a slow, and therefore expensive, process. Progress rates vary considerably depending on the seafloor terrain and composition but a typical rate would be in the order of 50m per hour, excluding ROV launch and recovery times. Therefore, including a high percentage of PLB which may not be required will add considerable cost to the project.

An alternative approach would be to calculate the actual quantity of PLB required taken from the planned locations (splices, in-service cable/pipeline crossings, branching units etc) which will be identified during the preliminary route planning exercise which is always performed as part of the tendering process. A small percentage could be added to this figure to cover contingencies. This method will produce a more realistic figure and hence cost.

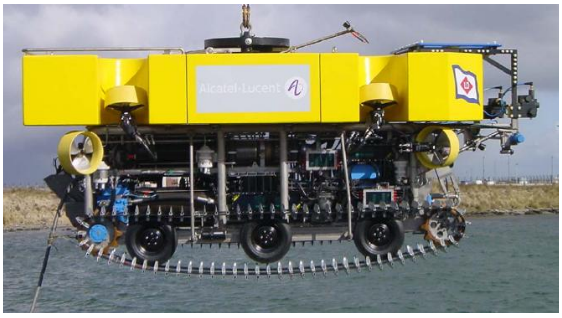

Figure 4: Typical PLB ROV

7. SHORE END PROTECTION

The standard method of shore end protection is to apply a length of articulated pipe seawards from the Beach Manhole. The cable and pipe is then buried utilising divers with jetting equipment and a backhoe for the section across the beach down to the low water mark. The quantity of articulated pipe required will depend on the nature of the shore end landing and specifically, the length of the surf zone, which will be determined during the inshore survey activity.

Application of articulated pipe by divers is a time consuming and weather dependant exercise. Typically, a team of divers will install around 100m of pipe in a day, depending on the water depth. This figure may be significantly reduced during certain tidal phases when strong currents may be present.

If the survey shows that there exists a good level of sediment into which the cable can be well buried and that the beach does not exhibit a high energy surf zone, then the application of articulated pipe is an unnecessary cost. An exception to this could be at locations where there is a known history of cable exposure due to sediment movement (long shore drift or coastal erosion). In this case, the application of pipe could be limited to between the Beach Manhole and the low water mark to give additional protection should the shore end become exposed.

Figure 5: Attaching Articulated Pipe

8. CONCLUSIONS

This paper presents a number of areas where Marine specifications can be adjusted to remove cost from a submarine cable project without impacting the quality. With the exception of the proposed savings for shore end protection, these savings will be reflected in a reduced initial contract price and thus will have a positive impact on the viability of a project. In areas where a focussed approach is needed (for example BAS and water depth limit for burial), it would be recommended to perform the DTS prior to, and outside of, the main project.

9. REFERENCES

[1] Kordahi ME, Shapiro S. & Lucas G., ‘Global Trends in Submarine Cable System Faults’ SubOptic 2010, May 2010, Yokohama, Japan.

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