Requirements for Monitoring Environmental Impact Of Seafloor Cables: Issues And Answers

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Dallas J. Meggitt
(Sound & Sea Technology
Edmonds, WA)

Jeffrey V. Wilson
(Sound & Sea Technology
Ventura, CA)

Abstract

Governmental permitting agencies and Non-Governmental Organizations have expressed increasing concerns about the environmental impacts of seafloor cable systems, both short-term and long term. As a result, increasingly restrictive and costly conditions are being imposed in the permitting process. These requirements affect cable routing options, restrict installation methods and impose substantial requirements to verify the installation condition and to monitor the cable and local environmental impact over periods of many years. The results are increased times to "ready for service" and increased costs for installation and maintenance of undersea cable systems.

All of these requirements are costly and time-consuming to cable installers and owners, both commercial and military. In addition, very few of the requirements can be clearly justified at the technical level. Even fewer have obviously justifiable scientific bases. While it is certainly desirable to minimize environmental impact, it also is important to do so in the most economic and legally credible way possible.

This paper:

a) Describes the kinds of requirements being imposed by various state and local permitting agencies
b) Outlines the technical issues associated with interpreting and complying with those requirements, including both general issues and some specific local examples
c) Compares the impacts of cable operations (particularly burial) to the effects bottom trawling
d) Outlines some general approaches to help resolve the issues, including a technical review of the likely scientific basis for relating cable operations to environmental impact and an analysis of practical measurement methodologies
e) Suggests a series of actions that can be taken by the industry to provide a scientific basis for environmental assessments and mitigation requirements. for submarine cable projects

1. BACKGROUND

The past several years have seen a dramatic increase in the number of submarine cable projects worldwide. Projects landing cables in California and several other areas have received substantially more regulatory scrutiny than previously. In part, this is due to the number of landings planned, which have been described by environmental groups and regulatory agencies as a potential "spaghetti" of offshore cables.

In part, also, the increase in regulatory attention is because of a heightened environmental sensitivity about all projects proposed in jurisdictional ocean waters. Federal, state, and local agencies have recently (within the past three or four years) begun to mandate extensive environmental data collection and analysis as part of the permit-granting process. These issues are discussed in [1]. That paper describes recent environmental permitting and mitigation requirements for several cable projects. Among the requirements were inspections of the as-installed conditions of the cables, to be conducted immediately after completion of the installation and periodically thereafter, typically at 18-month to two-year intervals. These inspections are to be conducted by an ROV capable of following the cable and measuring the depth of burial. The data to be acquired include video documentation of the condition of the area traversed by the cable burial machine, particularly over hard bottom areas. Because this is one of the more controversial and expensive mitigation requirements, this paper concentrates on this issue.

2. MITIGATION COMPLIANCE

Recent experience in landing cables in California is a particularly informative case study. During the period 2000-2001, the California Coastal Commission (CCC) and California State Lands Commission (CSLC) approved permits for the installation of 10 offshore fiber optic cables (five separate projects), with landing sites on the California coast.[1] Although approved by the regulatory agencies, these projects were publicly controversial. A number of non-governmental organizations raised a variety of concerns with respect to the potential of the projects (and the large number of projects) to have adverse impacts on marine resources (particularly marine mammals), water quality, commercial and sport fishing, public access to the coast and marine-related recreation.

A substantial number of permit conditions were imposed on these projects to reduce or eliminate real or potential adverse environmental impacts [2,3]. These conditions included:

a) The cables were landed using horizontal directional drilling ("HDD") technology; a HDD monitoring and contingency plan was required with an emergency spill response team on standby during all drilling operations for possible bentonite spills;
b) Due to concerns about the possibility of marine mammal interactions with the cable during installation operations, marine mammal monitors were required on the installation vessels during cable installation;
c) To the maximum extent feasible, the submarine cables were to be buried to a 1-meter depth in the seafloor to the 1,000-fathom (1855m) depth contour;
d) Immediately (within 30 days) after installation and at intervals thereafter (18-24 months), the as-installed cable routes are to be inspected to document impacts of the installation operations and the cables to rocky substrate; and
e) Payment of a "hard bottom" (rocky substrate) mitigation fee for the purpose of constructing an artificial reef if unavoidable impacts to hard

[1] These projects were: Southern Cross Cable System and Japan-US (MFS Globenet Corporation/MCI WorldCom Network Services, Inc.); Japan-US and China-US (AT&T) Pacific Crossing-1 and Pan-America Crossing-1 (Global Crossing, Ltd.); and Global West (Global Photon, Global West Network, Inc.)

substrate occur.

All of the cables were installed, and the permit conditions have mitigated the impacts with varying degrees of success.

The conditions imposed by the CCC and CSLC were more stringent than those required by any other jurisdiction at the time. Since the California cables were installed, the cable industry has experienced a substantial downturn, and some of the permitting issues have been effectively postponed. However, other US states (e.g., Florida and Hawaii) have stated their intentions to implement similar restrictions on future cable installations.

3. TECHNICAL COMPLIANCE ISSUES

There are a number of technical issues associated with complying with the permit mitigation conditions. This paper considers only those concerning the installation and burial of the cable. In particular, the issue of the short-term and long-term impacts of cable burial is the origin of the requirements for burial to 1-meter depth in the sediments and to substantial water depths (up to 2000m in some instances) and periodic inspections of the cables after installation. Both of these requirements are costly and, in the case of the inspections, continuing.

To minimize the possibility of whale or other marine animal interactions with the cables, and to reduce the potential for conflicts between the cable companies and fishermen, the California agencies required that all cables be buried to a depth of 1.0 meter on a “maximum extent feasible” basis, except where precluded by seafloor substrate. In the case of the California cables, the installers chose routes that were estimated to allow the accomplishment of burial of 93-100% of the routes between the mean high tide line and the 1,000-fathom (1855m) depth contour. Seven of the 10 cables were buried to the desired depth over some 98-100% of their lengths to 1000fm (1855m). The other three had significant lengths that were suspended as much as 25ft (7m) above the seafloor, and had several loops standing proud of the seafloor. This was revealed by the 30-day ROV inspection [2]. The owner of these cables had asserted that 100% burial could be achieved.

The performance of burial plows has been discussed in papers presented at several previous Ocean conferences. Plow depth of burial depends on a number of factors. These include the bathymetry, bottom sediment characteristics, performance of the vessel towing the plow and experience of the crew, and others. These factors combined result in significant uncertainty in the achievable depth of burial. This uncertainty was not taken into account sufficiently in imposing the mitigation requirement for burying the cables to 1.0 meter. Additionally, burial plow operations are generally limited to about 1200m water depth. Beyond this, ROVs with jetting equipment are used to bury cables in deeper water. While plow operations are slow and expensive, ROV burial operations are slower and more expensive.

Typically, installation contracts will specify a nominal burial depth (often 1m) on a “best efforts” basis. Also, cable owners have sought to protect their cables by burying them, and they have been satisfied with burial depths that minimize faults caused by bottom trawl fishing, rather than a specific depth of burial. Also, most fishing-related cable faults have occurred in water depths less than 1,000m. Thus, there has not been strong motivation to bury cables in deeper water.

There have been few, if any, studies of the impacts on the seafloor of cable burial operations or the passage of a burial machine or ROV jetting. Thus, as yet there is no real technical basis for requiring that cables be buried to specific depths in the sediment for environmental reasons, or to specific water depths, other than the fact that there are some regulatory jurisdiction limits at that depth.

4. TRAWLING VS CABLE BURIAL

It has been suggested that the effects of the passage of trawl gear can provide some insights into the impacts of a cable burial machine on the seafloor. A recent National Research Council Ocean Studies Board report [4] describes in considerable detail the effects of trawling on a variety of seafloors. Although this study concentrated on the impact of trawling on habitats, it provides significant insights into the nature and persistence of trawling scars, and thus, of cable burial machine scars.

5. ENVIRONMENTAL IMPACTS OF CABLE BURIAL

In comparing what few data that are available on cable burial machine bottom disturbance (from personal communications with burial machine operators) to the scars left by trawling, it is clear that the impacts from trawl gear are substantially greater in areal extent than from a cable burial machine. In operation, a burial machine rides on the two forward skis and the blade at the rear. Depending on the sediment properties, the skis will sink into the seafloor anywhere from a fraction of a centimeter to several centimeters. The blade leaves a scar that is several centimeters wide. Also depending on the sediment properties, the slot left by the blade will collapse in on itself essentially immediately. The maximum surface that is disturbed is the tracks left by the skis and the area disturbed by the blade. This total is a fraction of the area disturbed by a single trawl board. The depth of the disturbance from the plow is approximately the depth of the blade, where the depth disturbed by a trawl is substantially less. Although there are lessons to be learned from the extensive trawl data that are available, it is important to remain aware of the differences.

The volume of sediment disturbed by a jetter-equipped ROV is significantly greater than that from a burial machine, since the path of disturbed material is significantly wider than the blade of a plow.

In both cases (plow and ROVs, there has been concern for the effects on the benthic infauna. And here also, there are few data on the regeneration rates for disturbed habitats. Other concerns have been raised for the effects of plow operations over hard bottom habitats. Generally, installers attempt to avoid plowing over hard bottoms as presenting risks to the burial equipment. But there are no real data available on the impacts of the passage of a plow over rocky, hard bottom habitats.

6. A SUGGESTED APPROACH

As a result of the regulatory agency permitting conditions, there is now a substantial amount of data on the observed impacts of cable installation activities on a variety of seafloor types, in different current regimes, at varying depths and at diverse geographic locations. These data are in the form of as-built depth of burial records along geo-positioned routes; video records of the burial scars; and in some cases logs of the operations. Other information that is available for some of the cables includes geophysical data from cores, cone penetrometer tests or other

sensors. Taken as a whole, these data provide an interesting opportunity to compile and compare the observed impacts of cable installation and burial operations in a wide range of conditions. This comparison can provide a more scientific basis for permitting conditions and mitigation requirements for future cable systems. This approach will require the cooperation of the cable installers and owners, as well as the regulatory agencies. The current conditions in the undersea cable industry provide an opportunity to develop a scientifically justifiable basis for imposition of permitting conditions, particularly for burial and post-installation inspection of submarine cables.

REFERENCES

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