BIGGER ISN'T ALWAYS BETTER:
Focusing on Pertinent Desktop Study Content

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Abstract: With the quantity of information now available on the internet, data gathering for Desktop Study can easily lead into the trap of just adding more content to make the report look more "scientific". Some DTS reports have hundreds of pages with detailed discussion about the Precambrian rock formation overlain by Phanerozoic sedimentary rocks underlying the sediment cover from Pleistocene times' glacial deposits origin...What value does this have for planning a submarine cable project?

This paper reviews the different topics covered in a standard DTS and assesses the types of information that have a real potential impact on our projects.

1. INTRODUCTION

I worked on my first desktop study (DTS) in 1993 for a short system in Canada. The full report was less than 100 pages with many being photocopies of site visit pictures. We were not using the internet back then, there wasn't much to find on it yet. The information came mostly from nautical charts, sailing directions, sparse research reports if we were lucky and meetings with local experts and residents during site visits. I've since worked on or been provided tens of DTS reports. Nowadays, they can easily be 200 pages, presenting a very broad and detailed range of information, thanks to the ease of finding data on the web. But when I read through these, I often wonder how much that huge data dump is helping me engineer a better system.

My opinion is that DTS should not be a scientific or historical show piece nor teaching materials. DTS is a document meant to help design submarine cable systems and intended for cable engineers. While I agree that, since it is to be presented to our clients that are not always cable specialists and thus needs some basic background information, it should be focused on pertinent risk analysis rather than presenting full historical explanations.

2. RELEVANT DATA SEARCH

ICPC *Recommendation #9 - Minimum Technical Requirements for a DTS* [1] gives the basis of what should be covered in a DTS. Let's review the topics listed and analyze what type of data should be looked for and why.

2.1. Geology

The first area of research to be included in all DTS is geology. My personal pet peeve has always been the geological history. Finding pertinent information was always difficult for me mostly due to my reservations about how any of it could

impact the planned cables. I was thus glad to see that, in the new issue of the ICPC Recommendation released last November, this point has been taken out from the list!

Let's review the remaining geological topics.

Seabed morphology and lithology (or bathymetry and sediment types), as well as sand waves in the same vein, are probably the most obvious and the primary information for route engineering. They will allow initial analysis of depth, slope and potential burial.

Tectonic setting is also something we always look into carefully but what are really the hazards linked to that? We often see long sections about tectonic plates in DTS. But what happens at those boundaries? What comes to mind:

1. movement that could induce tension to the cable
2. seismic/volcanic activity at the boundary

Tens of cables have been installed across tectonic plate boundaries; it`s not something that we can really avoid. So I met with Reinhard Hesse, Professor Emeritus at the Department of Earth & Planetary Sciences of McGill University in Montreal, Canada and asked him the question. Professor Hesse specializes, among other things, in sedimentology and marine geology. Conclusion: not much threat there!

We know that divergent plates drift apart. The maximum movement of the mid-Atlantic Ridge is 4 cm/year, close to the Equator. It goes down to 2 cm/year has we go towards the poles. With design lifetime of a maximum of 25 years, that's only half a meter to a meter which won't affect much the tension on a transatlantic cable. The fastest spreading divergent boundary is the East Pacific Rise which moves at a maximum rate of 20 cm/year in some specific areas. That could be a total of 5 meters over the life time of the system. But even then, the spreading process is very complex in details and is in fact averaged over 1000s or 10,000s years. Active areas of divergent tectonic plates are only where we find volcanoes and hydrothermal fields. Both are well studied and a quick look on the internet should suffice to confirm if any are in close proximity to our study area. Those should obviously be avoided.

Subducting and transform boundary movement can provoke a vertical movement. This vertical movement would typically only be a matter of a meter or 2. This would induce a small suspension but the cables are robust enough for that. The worst hazard linked to those would be submarine landslide like what happened in the in the Strait of Luzon in 2006 and in Japan in 2011 for example. I'll cover seismic activity later, but we mostly have to keep in mind that the subducting and transform boundary movement are rare in a submarine cable timescale in most part of the world.

Surface faults are not a problem either. Sometime you will see them as a small crevasse on the seabed but most of the time you see nothing. And they rarely move. Those that are more active, well… there is a slightly higher risk for earthquake that could induce landslide/turbidity current but these catastrophic events are unpredictable and can happen anywhere, anytime, like what happened during the famous 1929 Grand Banks earthquake that took down 12 transatlantic cables.

So, to summarize, what is important to look for in relation to tectonic settings are

areas of hydrothermal fields and volcanoes. Except where those are, you can cross plate boundaries and faults wherever you want. The DTS should only report the crossing of the boundary and if it has a recent active history (recent in our timescale as opposed to geological timescale!) If not known for activities, then that's it, let's keep it short and move on to the next topic. If it is an active area and can't be avoided, state it and get on to the seismic activities. No need to describe the genesis of the Earth.

Seismicity now. Some regions of the world are more prone to earthquakes and related landslides and tsunamis. Unfortunately, those regions do need to be connected too and there is nothing we can do to stop the earthquakes. Again, what does it do to submarine cables? And what mitigation measure can we put in place? The earthquake itself is not a problem for the cable. It is for the terrestrial station though and the DTS should point to the proper building code in regards to earthquakes and tsunami suitable for that part of the world. Real threats to the cables are the landslides. But those are unpredictable. And also rare. Steep slopes with thick sediment covers where risk is higher should be avoided if possible, but again, sometimes there are no way around and the only mitigation is to go up those slopes as perpendicular as possible and have redundancy. So what do we need in our DTSs? A quick presentation of the seismic activities, mostly in terms of magnitude and frequency to state the level of risk. No need for the full history of each event.

2.2. Climatology

Research on climatological data is primarily to assist in scheduling route survey and installation activities. Best survey and installation windows can be identified although other factors often dictate the timing of marine activities. Working outside of best weather window increases the risk of weather downtime and a review of frequencies of gales, storms and hurricanes statistics will help evaluate the contingency days that should be budgeted in the schedule. Predominant wind direction is the other important topic to be presented in the DTS. This is often the primary factor for deciding in what direction the system will be laid.

The climatology section of the DTS should thus present likelihood of unworkable days due to gales, storms and hurricanes (again, no need for full history of each devastating hurricanes) as well as predominant wind directions. Unless extreme conditions exists, temperature and precipitations don't represent a hazard for the system or the marine activities and they can be presented in a basic table more to help the crew decide what they need to pack in their bags when they go. It does also provide information for the heating / air conditioning requirement for the terminal station.

2.3. Oceanography

Some of the oceanographic information such as typical sea states, surface current, waves, tides and sea fog is primarily for marine operation planning. Research should be done to highlight any unusual/difficult conditions. Those unusual conditions would be, for example, extreme tides, strong currents or regular recurrence of important waves. This type of information is often found in sailing directions or pilot books.

Near shore or shallow water currents, waves and tides information is also important for cable engineering. High energy zones will need proper protection,

typically in the form of heavier armouring, articulated pipes, pinning to sea bed or directionally drilled conduit.

Bottom and midwater currents data are often more difficult to find at the DTS stage. The potential hazard from bottom currents is strumming of the cable with higher risk of abrasion. Up armouring of the cable in area of higher current might thus be required. As for the midwater current, unless they are important, they won't have much impact on neither the engineering nor the installation. They can give a general idea of which way the cable or towed survey equipment might be pushed off track but the data typically available, if any, are very punctual while current through the water column everywhere along the route is very dynamic.

Cables are not sensible to normal water temperatures so bottom water temperature is only pertinent for repeatered systems. And even then, some repeaters might be tuned for mean temperature while others have a fixed design but, in any case, they are good for a range of temperature and, at DTS stage, only information about areas that could potentially reach normal design range limits (e.g. Xtera's covers -5C to +35C) would be of value.

Ice data is important to ensure proper protection of the cable and to identify time of the year when survey, installation and future maintenance could be difficult or even impossible. Rafting ice is one of the information that is often not well documented while it can be a major threat to cables not properly protected. It's the type of information that you have more chance to get during site visit, talking to locals. Icebergs are the other major threat and there is not much that can be done to protect against those if a cable needs to be laid in an area where they abound, apart to go with deep HDD conduits where seabed profile is suitable. Concentration and frequency should be discussed in the DTS to assess the risk level.

2.4. Commercial Operations, Hazards and Restricted Areas

Cable routing should stay clear of anchorage (formal or informal), restricted areas (e.g. mined areas, dumping grounds, culturally significant sites, tourists attractions) and obstructions (buoys, wrecks, offshore energy production structures) so information about those along the route should be presented with locations and limits. No need for much text though, just a short description with risk assessment. The rest should be presented graphically: a picture is worth a thousand words, and all that information that will affect the routing of the cable should be presented in proper GIS format as recommended by ICPC.

Fishing information is another area where a lot of filler information is often used. Description of all existing fishing techniques and gears can be put in appendix if we feel the Client needs to be educated on that subject but the DTS report itself should simply identify the fishing grounds and techniques actually used there with an assessment of the risk. Contact information of the fishing associations is probably the most important information to be provided in this section of the report as good and early communication with the fishing industry is often the best mitigation plan when you have to go through fishing zones.

List of cables and pipelines to be crossed should be put in a tabulated format but a map should also be presented to show all cables in close proximity so one can

understand the potential impact of moving the cable route around. System owners / maintenance authorities contact information is very useful information for the Client to start working on crossing agreements as soon as possible.

The level of security threats and piracy, or political groups that may pose security risks is another point that can be highlighted through a short summary pointing to a reliable agency website that would provide regularly updated information about the situation.

2.5. Biological Factors and Permitting

Biological factors and permitting are closely linked. The DTS is not an environmental impact assessment study. It should identify all protected zones and known coral reefs to be avoided as well as highlight the protected species (flora and fauna) potentially present in the area. It doesn't need to give the full history of how each species has come to be threatened. Seasonal constraints due to nesting birds and animals, migrating whales, etc. are preliminary information that should also be investigated to highlight constraints as soon as possible.

Permitting requirement should be presented and emphasis put on the importance of starting the permitting process, and potentially environmental impact assessment, as soon as possible.

3. CONCLUSION

As much as I enjoy all the interesting facts I learn when I read them, I think there is a lot of time and money lost gathering / processing useless information in Desktop Studies.

DTS data search should cover all the points listed in ICPC recommendation but once it is recognized that the impact is negligible or inexistent, it should just briefly be stated as such and on to the next topics.

Also, presentation of the data should not sound like rocket science and information should be dumbed down to suit the needs.

A good pertinent DTS report will allow more efficient engineering and proper usage by all concerned parties who do not have time to go through hundreds of pages of irrelevant information.

Next topics on "Bigger Isn't Always Better": QHSE documents!

4. REFERENCES

[1] ICPC, Recommendation No. 9 - Minimum Technical Requirements for a Desktop Study (also known as Cable Route Study), Issue Date: 2 November 2015. https://www.iscpc.org/