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# Sub-Bottom Imager™ -v- TSS 440 Pipetracker Project Example

# Offshore Wind Farm Inter-Array Cable Survey

• A recent survey of an offshore wind farm's inter-array cables presented an opportunity to carry out a comparison of the cable depth of burial (DoB) determined by SBI with that of previously acquired TSS440 data.

• The survey location comprised complex geology consisting of post-glacial soils (consisting of a various mixtures of sand, silt and clay) and glacial Till containing a high concentration of cobbles and boulders.

• TSS440 as-built survey was carried out in 2012 and February 2013 prior to rock dumping.

• The TSS data was provided after the SBI survey had submitted DoB Report.

• The TSS440 data listings contained: ROV position (easting/northing), KP, DoB as measured by TSS440.

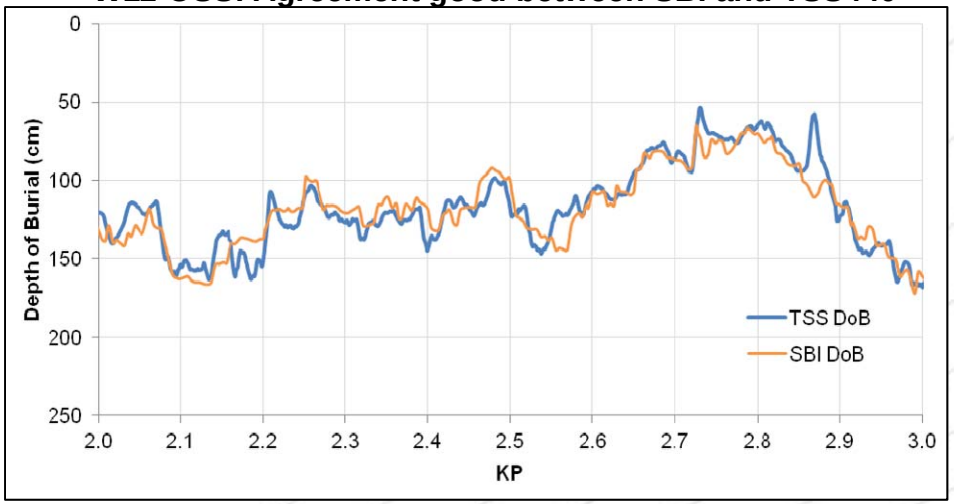
• The SBI imaged the inter-array cables to a depth of 2.64 m where the cable was out-of-range for TSS-440. The SBI data was used to in-fill sections with no previous DoB information where the past TSS440 DoB Survey reported gaps.

# Comparison of SBI-TSS440 Depth of Burial

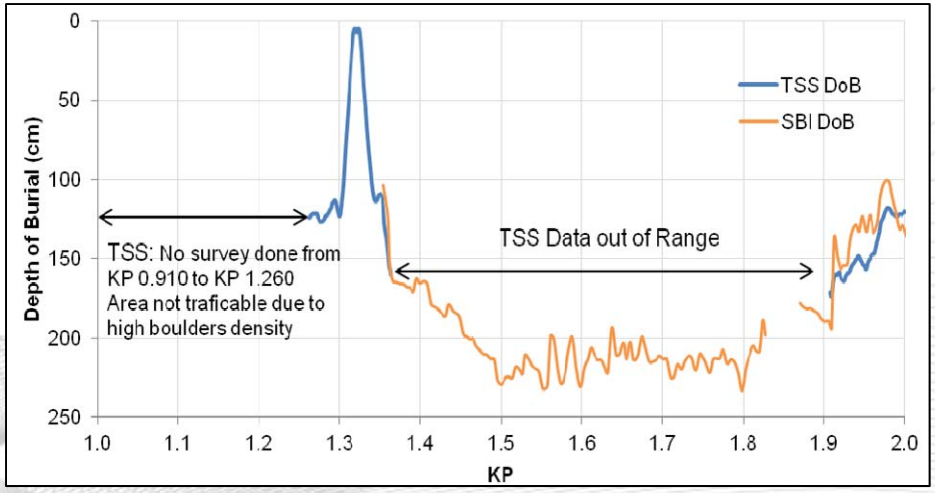
- Comparison involved correlation analysis and side-by-side plots of TSS and SBI DoB

| Cable Section | Cable Length (km) | Correlation Coefficient in SBI and TSS Depth of Burial Results (%) |
|---|---|---|
| W11-OSS | 3.728 | 56.5 |
| W10-OSS | 4.393 | 82.0 |
| OSS-W09 | 4.926 | 60.6 |
| W04-W03 | 0.510 | Insufficient data overlap for analysis |
| W10-W05 | 1.382 | 61.5 |
| W05-W04 | 0.501 | 81.9 |
| W31-OSS | 8.762 | 91.4 |

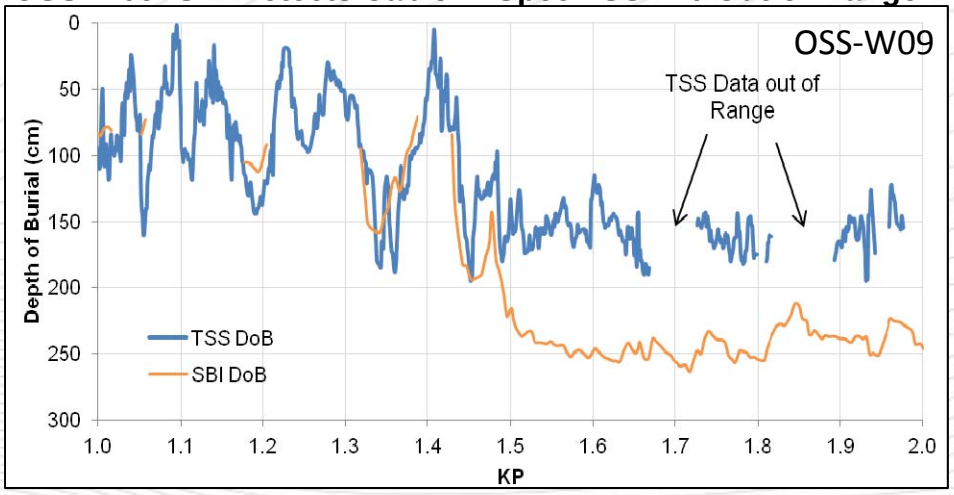
**W11-OSS: Agreement good between SBI and TSS440**




**W11-OSS: SBI Detects Cable where TSS 440 did not**




**OSS-W09: SBI Detects Cable In Spec TSS 440 Out-of-Range**



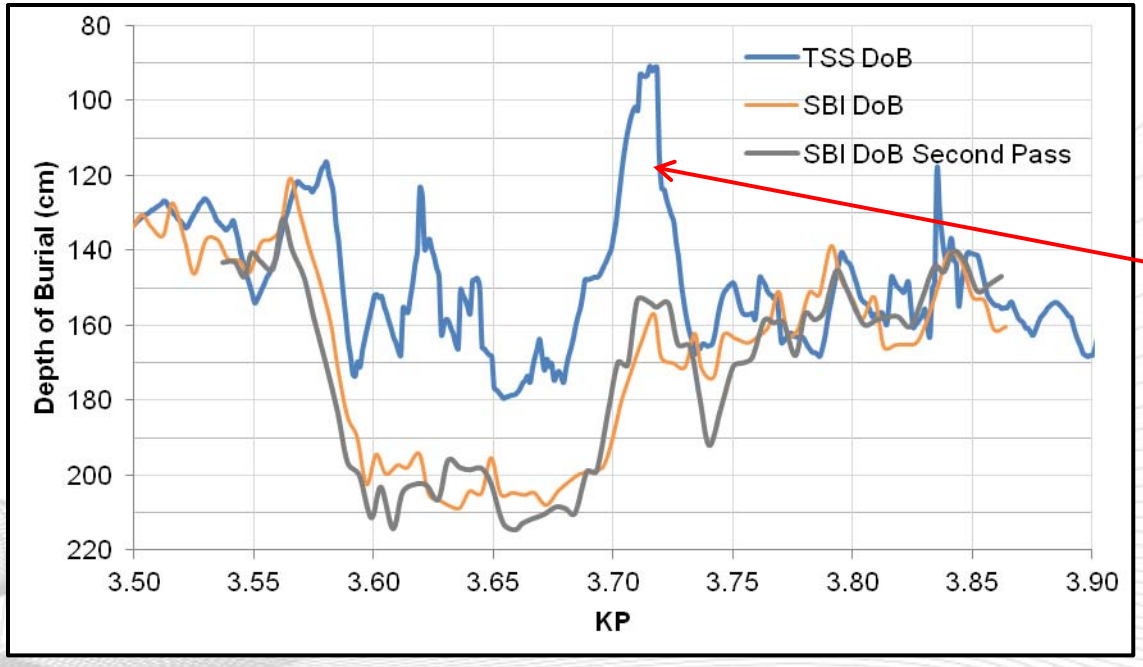
# SBI Repeatability and Comparison with TSS DOB

• SBI DoB repeatability and reliability demonstrated by repeating data acquisition over the same cable section in the opposite direction. Good agreement between passes:

- Agreement was good with DoB correlation coefficient = 92.0%;
- Depths deviate by 10 cm or less on SBI second pass runs.

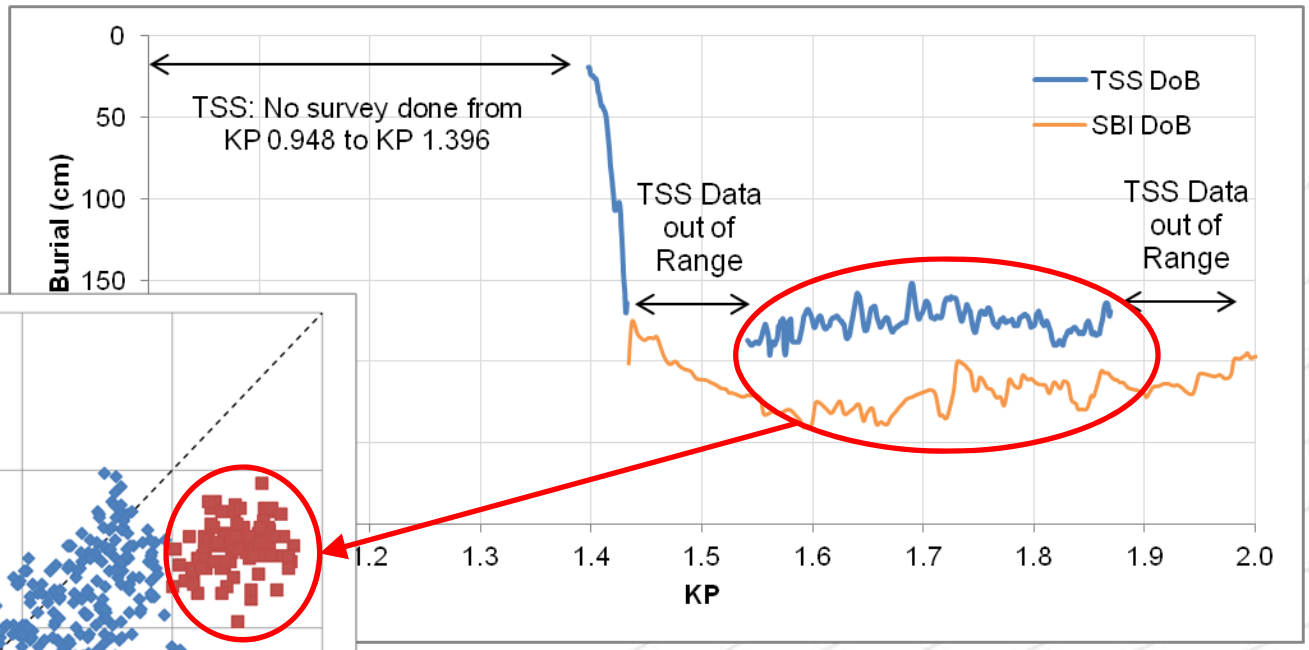
• In this same cable section the TSS440 produced large fluctuations in readings where cable burial >150cm (between KP 3.60-3.75)

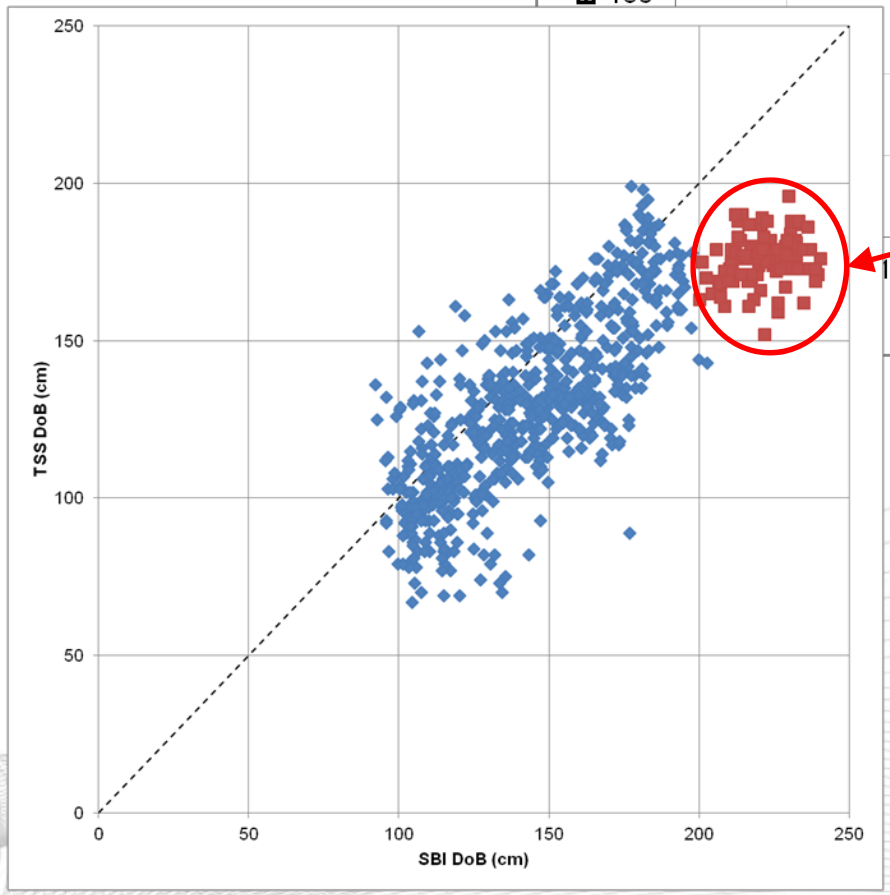
• The DoB reported by the TSS suggests cable out of spec. The Dob reported by both SBI passes indicates cable is buried deeper and is within spec.




Note that operators relying on TSS data would consider costly cable lowering or rock dump in this section in order to meet cable spec. SBI shows that the cable is buried to spec and that no such remedial action is necessary.

# Correlation Analysis of Cable Section W10-OSS



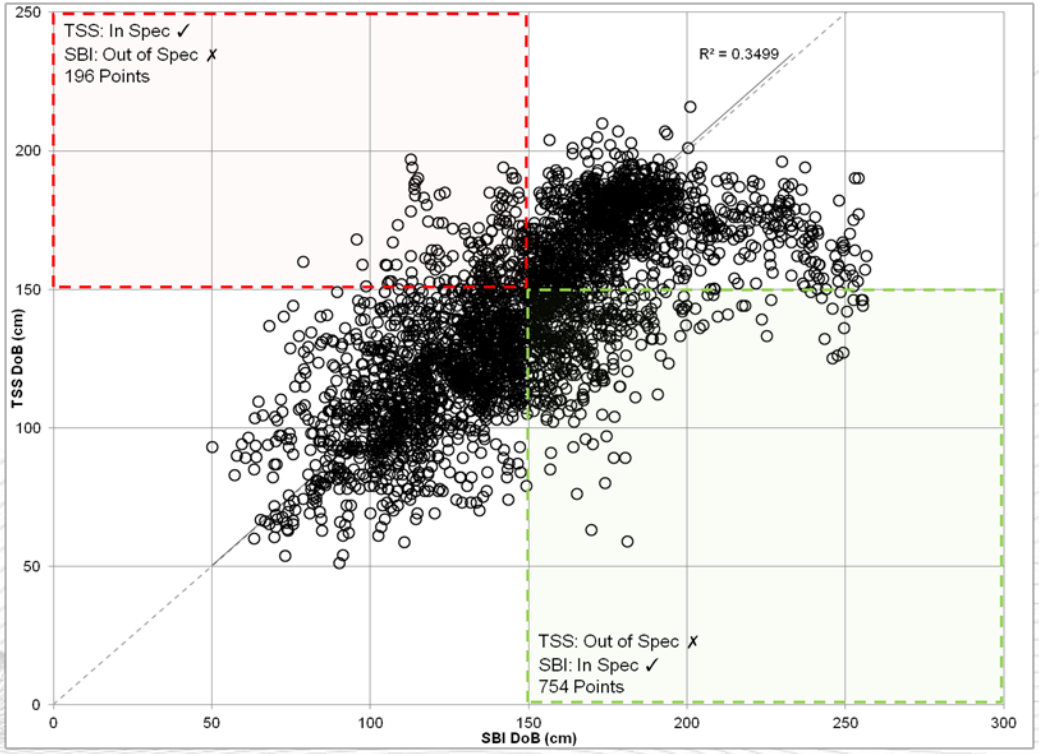

TSS440 reports shallower cable burial depths than the SBI in this particular case. This skews the otherwise approximately linear relationship between the TSS440 and SBI DoB results at burial depths of less than 1.7m.

# SBI v TSS Depth of Burial: Comparison of All Points

- All collocated SBI and TSS DoB data points (totaling 3655 points) are plotted below. The following should be noted:
  - Cable required DoB spec = 1.50m
  - Despite large scatter, the SBI and TSS data has an approximately linear trend over DoB range 0.5m to 1.7m
  - The TSS's limited detection range skews the plot at DoB ≥1.7m (i.e. whereas the SBI continues to report increasing DoB to a maximum of 2.64m the TSS DoB plateaus at *circa*1.7m)
  - The statistics related to variance in out-of-spec cable reporting is as follows and is illustrated in the plot below:

There are 754 points (21% of total) where the **SBI reports** cable to be **within spec**, and **TSS440 reports** cable to be **out-of-spec**.

There are 196 points (5% of total) where the **SBI reports** cable to be **out-of-spec**, and **TSS440 reports** cable to be **within spec**.



# Conclusions of the TSS440 v SBI DoB Analysis

| Survey Constraint | Within TSS440 Capability | Within SBI Capability |
|---|---|---|
| Powered cable survey | No | Yes |
| Cable burial depth varies widely | Limited | Yes |
| Cable depth of burial exceeds 1.5m | Unreliable | Yes |
| Bathymetry is highly variable | Unreliable | Yes |
| Soils are complex and variable | Unreliable | Yes |
| Cable depth of burial provided to ≤10cm accuracy | No | Yes |
| Virtual real-time display of cable | No | Yes |
| Cables of 7.5 cm diameter | No | Yes |