partnership (PPP) model that aligns private incentives with long-term service delivery in the vein of the *build-own-operate-transfer/build-operate-transfer* models of implementation be the preferred means of implementation.

Its detailed recommendations are:

- The scope of the concessionaire's work should include both deployment and implementation of OFC and other network infrastructure as well as operating the network for the concession period. Concessionaires shall be entitled to proceeds of revenue from dark fiber and/or bandwidth.
- Concessionaires should be selected by way of a reverse bidding process to determine minimum viability gap funding (VGF) sought for concession. The area of implementation may be analogous with the licensed service areas (LSAs) or the state/UT. The use of a reverse bid process to determine lowest VGF sought can ensure that the amount of support from public funds is rational.
- The contracting agency may, in the first phase, explore the appetite and response of the potential BOOT participants through a bidding process. This can either be done in one go for the entire country (by having states/LSA or packages as *schedules*) or beginning with certain states with larger potential of bidders' response.
- In the second phase (after excluding those areas where BOOT model can be implemented), an EPC contractor may be selected. The EPC contractor should be responsible for building the network and will have a defect-liability period of two years after completing the network. When the network is about to be completed, the contracting agency should engage a third party (through a bidding process) who should be responsible for managing and marketing the network

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Industry Speak

Digitalization of Fiber Maintenance

Major challenge to reduce the number of fiber cuts and MTTR are huge. Infra development is happening all across India and frequent cuts are there. Restoration is slow, Right of Way is very difficult to obtain, coordination between agencies deploying underground infrastructure is missing and finally resultant life of the OFC asset is very low.

Compared with developed nations, which have about 0.2 cuts per 1000 kms per year, India has over 9 cuts per 1000 kms per month, which are 450 percent on higher side.

This high cuts mandates huge investment in terms of money and time for protection and causes huge disturbance during re-convergence and increase of latency.

There is, therefore, a need for very effective maintenance methods or digitalization of optical fiber . Accurate knowledge of OFC assets is essential in terms of geographical location as well as utilization of dark and live fiber pairs.

Some of the methods that can be adopted for faster restoration of cuts are:

GIS / OSS. Specified and high accuracy tools to accurately locate the cables including joint locations.

RFID. Accurate methods of identification of cables belonging to different operators such as pre-defined RFID tags, embedded LC tank circuits.

Simplified splicing. Simplified splicing methods such as bulk splicing of ribbon cables.

Additional electronics. Deployment of electronic equipment like Optical MUX equipment with inbuilt OTDR functionality to maintain the extra / unused fiber pair, which is an asset and needs to be maintained in a manner equal to used pairs. These pairs are going to be revenue generating assets and also assets to be used for use in emergencies.

Customized/robotized FMS/ODF. Deployment of customized FMS for easy and hassle free fiber maintenance and digitization of assets will also help the network managers to get database of un-used assets at a click of button Digitization can help to control opex and increase operational efficiency.

Long-term strategy. Fiber maintenance team has to have long term view while deciding fibre ops strategy. One has to invest in tools and automation to develop a database of faults and manpower skills and field condition.

In short, operational efficiency can be achieved with digitalization and will help in cost reduction in long term. Quality control and reducing wastage can happen with proper investment over a period of time. Equipment and tools pilferage and wastage can be reduced by digitalization of fiber maintenance.