Telecom Regulatory Authority of India

Recommendations

on

Improving Telecom Services in Andaman & Nicobar Islands and Lakshadweep

22nd July, 2014

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CHAPTER-I: INTRODUCTION

Reference from Department of Telecommunication

1.1. Over the last decade, the growth of telecom infrastructure has become closely linked with the economic development of a country, especially the development of rural and remote areas. The challenge for developing countries is to ensure that telecommunication services, and the resulting benefits of economic, social and cultural development which these services promote, are extended effectively and efficiently throughout the rural and remote areas - those areas which in the past have often been disadvantaged, with few or no telecommunication services.

1.2. The Role of telecommunication connectivity is vital for delivery of e-Governance services at the doorstep of citizens, promotion of tourism in an area, educational development in terms of tele-education, in health care in terms of telemedicine facilities. In respect of safety and security too telecommunication connectivity plays a vital role. It makes it possible for the Government to inform its citizen of impending natural disasters like tsunami, cyclone, floods etc. If and when disasters occur, the Government would be enabled to quickly provide appropriate aid with maximum effectiveness, efficiency and economy of effort. Effective communications is also extremely important tool in countering threats to personal safety and to national security.

1.3. The **A**ndaman and **N**icobar **I**slands (ANI) and Lakshadweep are of immense strategic significance for India. The geographical configuration and the location of the ANI chain in the Bay of Bengal and Lakshadweep in the Arabian Sea safeguards India's eastern and western seaboard respectively. Provision of secure, reliable, robust, and affordable telecom facilities in these islands is of utmost importance for the people living in these islands and from a strategic point of view to the whole country.

1.4. On 7th January 2014, the Department of Telecommunications (DoT) wrote to TRAI on the subject '*Augmentation/Revamping of Telecom Connectivity and Services in Union Territories of Andaman & Nicobar Islands (ANI) and Lakshadweep Islands- Study regarding gap and investment required for formulation of a comprehensive telecom plan'* **(Annexure 1.1)**. The DoT's letter raised concerns about the low telecom coverage in Andaman & Nicobar Islands and Lakshadweep Islands as compared to other parts of the country. It also referred to the lack of high bandwidth communication channels which poses a serious challenge in rolling out e-governance solutions apart from the many constraints in communication both during normal operations as well as during any potential emergency. The DoT requested TRAI to provide its recommendations under section 11(1)(a)(iv) of the TRAI Act on a comprehensive Telecom Plan for ANI and Lakshadweep after making a gap analysis and investment required for providing quality telecommunication services in these islands.

A brief profile of Andaman & Nicobar Islands and Lakshadweep

1.5. ANI is the largest Union Territory of India with 572 islands scattered around 800 Kms from North to South, lying in the south-eastern part of Bay of Bengal. 29 of these islands are inhabited and 90% of the population lives in three islands viz. North, Middle and South Andaman Islands alone. Andaman and Nicobar group of islands are separated by high seas including the "10 Degree Channel" and are close to the Malacca Strait through which one third of the world's sea trade passes. Port Blair, the capital of ANI, is around 1190 Km away from Chennai and 1259 Km from Kolkata through sea-route. Indira Point (in Great Nicobar Island) is the southern most point of ANI (in fact it is the southern most point of India also) and is more than 1700 Km away from Chennai. These islands are also prone to natural disasters such as earthquakes, tsunami

etc. These islands have an Exclusive Economic Zone (EEZ) of around 300,000 sq. km.

1.6. Lakshadweep with an area of around 32 sq Km is the smallest Union Territory of India. It is a group of 36 small islands scattered in the Arabian Sea. Only 11 of these islands are inhabited. Kavaratti is the administrative headquarters of Lakshadweep. The nearby ports are Calicut (346 Km), Kochi (404 km) and Mangalore (352 km). Lakshadweep has lot of natural and other resources like notable territorial water around 20,000 sq.km and exclusive economic zones spread around 400,000 sq. km. which makes the UT very important from the economic point of view. Minicoy Island of Lakshadweep lies near the 9 degree channel, which is one of the busiest shipping routes.

1.7. Both these group of islands are strategically very important from the point of security of the country. ANI are closer to a number of foreign countries than the Indian mainland. At the southern end, Indira Point is just 165 kms from Indonesia. In North, the islands are just 40 kms away from Myanmar. In the East, Thailand is only 500 kms away. In contrast, distance from the mainland (Chennai/Kolkata) is more than 1200 Km as brought out earlier. Similarly, Minicoy Island of Lakshadweep is situated at about 130 km from the northern-most island of Maldives. In comparison, it is at a distance of 398 km from Kochi, the nearest mainland port.

1.8. Presently, these islands are connected through satellite links with the mainland. In the absence of any alternate connectivity, these islands are totally cut-off from the rest of the country in the eventuality of a breakdown in the satellite link. This is precisely what happened during the tsunami in ANI in 2004.

1.9. Keeping all the facts recounted above in mind, it is of utmost importance to have reliable telecommunication connectivity in these islands. The demographic profile, administrative setup and telecom profile of ANI and Lakshadweep is given below.

Table 1.1
Demographic Profile of ANI and Lakshadweep

	Population		
Union Territory	**Urban**	**Rural**	**Total**
ANI	143488	237093	380581
Lakshadweep	50332	14141	64473

Table 1.2
Administrative Set-up in ANI and Lakshadweep

Union Territory	**No. of Districts**	**No. of Sub-Districts**	**No. of Towns**		**No. of Villages**	
			Statutory Towns	**Census Towns**	**Total**	**Inhabited**
ANI	3	9	1	4	555	396
Lakshadweep	1	10	0	6	21	6

Table 1.3
Telecom Profile of ANI and Lakshadweep (As on 31st March 2014)

Name of Union Territory	**Total Population as per 2011 Census**	**Total Wireless Subscribers (2G/3G)**	**Total Wireline Subscribers**	**Wireless Teledensity**	**Wireline Teledensity**
ANI	380581	379697	13760	99.77	3.62
Lakshadweep	64473	47863	5886	74.24	9.13

1.10. Presently, some of the inhabited islands in ANI and Lakshadweep do not have even the basic voice services. These islands are lagging behind in telecom infrastructure development due to their difficult geographic terrain. Lack of bandwidth is a major constraint in providing data services, which is a pre-requisite for providing quality healthcare, education and banking to masses and for inclusive growth of society in general. Moreover, because of the strategic geo-position of the islands, reliable telecommunication connectivity is vital. The absence of a strong

and reliable communication network with the mainland has been acutely felt at the time of natural disasters and calamities.

1.11. Providing connectivity to these islands is a big challenge; not only connectivity with the mainland but also inter-island connectivity. With its relatively small population of around 3.80 lakh in ANI and around 64,000 in Lakshadweep spread across many islands, providing telecom facilities in all the islands is not a viable commercial proposition for the telecom service providers. This is borne out by the fact that not all the Telecom Service Providers (TSPs) having licences, have launched their telecom services in these islands. As per the present telecom licensing framework, ANI is a part of the West Bengal Licenced Service Area (LSA) and Lakshadweep is a part of the Kerala LSA. In ANI, only 4 TSPs (BSNL, Airtel, Vodafone and Reliance) have launched services. In Lakshadweep, only BSNL and Airtel (partly) have launched services. This is in complete contrast to the fact that there are 8 TSPs[1] operating in both West Bengal and Kerala LSAs. Even the TSPs, who have rolled out their network in these islands, are concentrated only around the Capital/DHQs/bigger islands. Even BSNL is not keen to expand its network to all the inhabited islands/villages because these operations are commercially unviable, though it has presence in a number of islands. High satellite costs have undermined the viability of any operations by any TSP in these islands. Added to that the steep rise in satellite transponder charges from April 2012 has aggravated the problem.

1.12. In view of the above, the Authority is of the view that it is necessary for the Government to step-in and utilize the Universal Services Obligation Fund (USOF) for augmentation and development of telecom infrastructure and connectivity in the Union Territories of ANI and Lakshadweep on a priority basis. These recommendations regarding gap

[1] Aircel, Airtel,BSNL, Idea, Reliance, SSTL, TTSL and Vodafone

analysis and investment required for formulation of a comprehensive telecom plan for these islands have been accordingly formulated.

Consultation held by the Authority

1.13. To formulate these recommendations, the Authority held detailed consultations with various stakeholders as detailed below.

a) **Interaction with the UT Administration**: A team of TRAI officers visited both ANI and Lakshadweep to assess the existing telecom facilities, the gaps therein and the actual challenges being faced by the TSPs in the development of telecom networks.

During the visit to ANI, meetings were held with the Lt. Governor, the Chief Secretary and other senior officers of ANI Administration at Port Blair. Detailed discussions were also held with CGM BSNL and representative of other TSPs. The team also visited Mayabandar (Middle Andaman) and Car-Nicobar and met with the respective Deputy Commissioners of these districts. The network set-ups of some of the TSPs were also visited by the team. The problems being faced by the TSPs were also brought to the notice of the UT administration during the meeting(s). The visit note for ANI is placed at **Annexure 1.2**.

Similarly, during the visit to Lakshadweep by the TRAI team, discussions were held with the Lakshadweep Administration. Consultations were also held with the BSNL officers led by CGM Kerala Circle and Airtel representatives. Various issues and challenges which are hindering the development of telecom services were brought out by them.

b) **Study of existing telecom services and infrastructure**: To assess the present status of the telecom infrastructure and the gaps, meetings were held with TSPs operating in ANI and

Lakshadweep Islands. TSPs made presentations on the existing telecom infrastructure available and their future plans of expansion in these Islands. Discussions were held with the Tata Communication Ltd (TCL) to learn about their submarine cable network.

Major Challenges in the Development of Telecom Infrastructure in ANI and Lakshadweep Islands

1.14. During the consultation process, TSPs highlighted the following challenges being faced by them in the development of telecom infrastructure in these Islands.

* **Non availability of submarine cable** – Non-availability of submarine cable connecting these islands to the mainland is a key constraint in providing high speed data and voice services to citizens of ANI and Lakshadweep.

* **High satellite bandwidth cost** – In the absence of submarine cable, telecom connectivity with the mainland and between different islands is provided through satellite medium. The satellite bandwidth cost is very high and even its availability is limited for ANI and Lakshadweep. It makes the task of providing telecom services in these islands commercially unviable. This is one of the main reasons why data service (like 3G) is available in only a few pockets and its speed is very low.

* **Topographical challenges** – There is vast coastline of 1962 Km in ANI. These islands are spread across around 800 Km in length with total 8249 sq. Km geographical area. Only Port Blair is connected through air-service with the mainland. Reaching from one island to another is a challenge due to limited availability of means of transport and the time taken. These Islands are also prone to natural disasters such as earthquakes and sea disturbances. The tsunami of

2004 bears testimony to the destruction of life and property caused by gigantic sea waves, especially to the Nicobar Islands.

* As mentioned earlier, Lakshadweep is a group of 36 islands in the Arabian Sea with an area of 32 sq km, which are approximately 400 Kms away from the coastal city of Kochi in Kerala, air connectivity from the mainland exists only through Agatti Island. Movement from the mainland as well as inter-island movement is a big challenge.

* **Higher cost of infrastructure –** The cost of infrastructure development as compared to the mainland is much higher. Transportation cost is a significant component of total cost of creation of any infrastructure. The labourers are mostly brought from the mainland to work which require permission from the local administration. Due to large inter-island distances and non-availability of jetty facility at a few islands, transportation of material is a challenge and a costly affair.

* **Availability of Power supply –** The power supply is mainly through diesel generating sets. In some of the islands there are frequent power fluctuations and power is available for 12-18 hrs only. Also, there are some islands in ANI, where diesel is not available. Ensuring availability of diesel in these islands where it is not supplied by the Administration is a big challenge and particularly where there is non-availability of Jetty (structure used at sea shore for docking boat/ship) facility e.g. Chowra Island.

* **Other issues:** Apart from the above mentioned challenges, TSPs also mentioned that it is very difficult to get permission from the Forest Department to carry out any activity in forest land. Getting the land for installation of telecom infrastructure is also a challenge as all the tribal land is held by the local people, and <u>not</u> by the Administration. The Right Of Way (ROW) charges in Andaman and Nicobar Islands

are very high (approximately Rs. 1000 per meter). There is only one rate i.e. rate for cutting pucca road, which is made applicable for different strata of surfaces. In ANI, Octroi charges are applied by the municipal body for bringing telecom material into the islands. These are considerably high (around 8% of product value) and adds to the cost of material.

1.15. On account of the aforementioned challenges, the development of telecom services in the islands has been poor compared to the other parts of the country. This is borne out by the fact that of the total 396 villages in ANI, there are 204 villages which have no telecom connectivity till date. Moreover, due to the lack of sufficient transmission media connectivity (OFC, Microwave, and Satellite), adequate bandwidth for high speed broadband is not available even at District Headquarters. Thus, the gap in telecom infrastructure and service rollout in these islands vis-à-vis that available in other parts of country is wide and glaring.

Structure of the Recommendations

1.16. The Authority, after due consultation with stakeholders, has finalised these recommendations on "Improving Telecom Services in Andaman & Nicobar Islands and Lakshadweep". Chapter–II of these recommendations covers the methodology adopted by the Authority for analyzing the gaps in ANI and Lakshadweep and estimation of the investment required for infrastructure development in the region. The gap analysis and investment required for ANI is presented in Chapter-III and for Lakshadweep in Chapter-IV. Chapter–V is devoted to policy initiatives and action that would facilitate telecom connectivity in ANI and Lakshadweep Islands. Chapter–VI summarises all the recommendations that have been made by the Authority in previous chapters.

CHAPTER – II: METHODOLOGY FOLLOWED FOR THE ASSESSMENT OF THE TELECOM INFRASTRUCTURE REQUIRED

Existing Telecom Infrastructure

2.1. Detailed discussions were held with all the TSPs that are operating in ANI and Lakshadweep and information regarding the existing telecom infrastructure and services was obtained. The data received from different TSPs was compiled and analysed to figure out the status of existing telecom facilities in these Islands. The specific information which was derived was (i) connectivity of each of the inhabited islands and UT headquarter with the rest of the country, (ii) connectivity of each of inhabited islands with UT headquarters, (iii) status of coverage of '2G' service in each town and village, (iv) 3G coverage in each town and village, and (v) status of '2G' coverage on National Highway.

Identification of the Islands which require telecom services

2.2. The first task was the identification of the islands which need to be provided reliable telecom connectivity. This was done based on the population of the islands. Not all islands of ANI and Lakshadweep are inhabited. Also, many of the inhabited islands of ANI have very less population. Therefore, those islands which have population of 100 or more were identified. These islands have been included for providing telecom services in the first phase. Apart from inhabited islands (with population of 100 or more), there are few islands which are important from tourism point of view or have police/army settlements. Such islands were identified after consultation with the UT administration(s). The number of islands which have been identified for providing telecom services are given in Table 2.1 below.

Table 2.1
No. of Islands which require telecom services

Union Territory	No. of Islands				No. of Islands where Telecom Connectivity required in 1st Phase
	Total	Inhabited	With Population 100 or more	Important from Tourism/other reasons	
ANI	572	29	18	4	22
Lakshadweep	36	11	10	1	11

Gap analysis and Telecom plan for improving telecom services and infrastructure

Objective and Plan

2.3. Telecommunications is no longer limited to voice. The vision of the National Telecom Policy 2012 (NTP 2012) is to provide secure, reliable, affordable and high quality converged telecommunication services anytime, anywhere for accelerated inclusive socio-economic development. In line with NTP 2012, the objective of the Authority is to build a robust, secure and state-of-the-art telecommunication network with seamless coverage in ANI and Lakshadweep. It is envisaged that the following telecom facilities should be planned in these islands to achieve the stated objectives:

a. Sufficient bandwidth for broadband and e-governance services.

b. 2G services in all habitation with population >100

c. 3G services in all DHQs/SDHQs and towns

d. Augmentation of 2G and 3G network in the towns/villages to improve coverage and traffic carrying capacity

e. Extending mobile coverage to entire National Highways

a. Sufficient Bandwidth for Broadband e-Governance Services

i. Projection of Bandwidth requirement

2.4. To fulfil the objective of 'Broadband on Demand' and ensuring equitable and inclusive development, it is essential that sufficient bandwidth is made available in these islands for connectivity with the rest of the country. The issue at hand is the assessment of future requirement of bandwidth. In this context, it is useful to consider the Authority's earlier recommendations on "National Broadband Plan" dated 8th December 2010. In these recommendations, the Authority estimated the requirement of backhaul bandwidth. The Authority had recommended a broadband target of 75 million broadband connections by 2012 and 160 million broadband connections by 2014 in the National Broadband Policy. It had projected that broadband penetration would be 12% and 32% in villages, 39% and 80% in towns, and 64% and 130% in cities, by 2012 and 2014 respectively. It was also recommended that in order to effectively support broadband requirement for bandwidth intensive applications, on an average a minimum of 2 Mbps bandwidth per household will be required by 2012 and 4 Mbps per household by 2014.

2.5. Broadband penetration in both ANI and Lakshadweep is almost negligible, mainly because of the dependency exclusively on the satellite media for outside connectivity. Even in the rest of the country, broadband penetration is way behind the projected figures. Therefore, for estimating the requirement of BW in ANI and Lakshadweep, projections are based on the Phase-I plan of the earlier recommendation viz. availability of 2 Mbps bandwidth per household with projected penetration of 12%, 39% and 64% in villages, towns and cities respectively with a contention ratio[2] of 1:10. Accordingly, the estimated

[2] Not all persons access the internet at a given time. Therefore concept of contention ratio is used to plan the bandwidth requirement. Contention ratio of 1:10 means that at a time 1 out of 10 persons will access the internet.

backhaul requirement has been worked out for these islands. Population profile of ANI and Lakshadweep as per Census 2011 and the details of estimated of bandwidth are given in Table 2.2 and Table 2.3 respectively.

Table 2.2
Urban and Rural Household (Census 2011)

Union Territory	Urban Population		Rural Population	Urban Households		Rural Households
	Population of Cities[3]	Population of Towns		Households in Cities	Households in Towns	
Andaman & Nicobar	108058	35430	237093	27049	8972	58530
Lakshadweep	0	50332	14141	0	8864	2710

Table 2.3
Bandwidth Requirement for connectivity with rest of the country

Union Territory	Current availability (in Gbps)	Total Bandwidth required (in Gbps)
Andaman & Nicobar Islands	0.279	55.66
Lakshadweep	0.106	7.56

ii. Reliable and redundant media for connectivity of identified islands:

2.6. ANI and Lakshadweep are at a distance of more than 1200 Km and 400 Km respectively from the mainland. Therefore, there are only two feasible media types to provide telecom connectivity to these islands: (a) through submarine cable, and (b) through satellite. Both options are discussed below:

Through Submarine Cable

2.7. Currently, there is no submarine cable connectivity to ANI or Lakshadweep. In the absence of submarine cable, satellite is the only medium through which connectivity to these islands exist. However,

[3] Town with population of 1 lakh or more has been classified as city.

there is a practical limitation on the quantum of bandwidth that can be provided through satellite owing to the high cost of satellite bandwidth charges. Moreover, there is shortage of satellites having footprints on these islands. The scarce availability and high cost of satellite bandwidth does not provide a commercially viable solution to the TSPs to deploy state-of-the-art technologies providing high speed data services. The augmentation of satellite bandwidth may provide a short-term solution, but for the medium-term and long-term, submarine optical fibre cable is the only feasible solution.

2.8. Further, it is always preferable to have redundancy in connectivity. Dependence only on satellite links may result in complete cut-off of certain islands in the event of outage of this link. When the TRAI team visited ANI, many islands, which are being served by BSNL, were totally cut-off because INSAT-3E, the satellite serving ANI, went out of services before its life and the links being served by INSAT-3E had to be shifted to INSAT-3C satellite. Now, all the satellite links of BSNL are being catered to by INSAT-3C, whose life is also due to expire in a year or so. Moreover, Indian Space Research Organisation (ISRO) could provide only 201 MHz bandwidth to BSNL in INSAT-3C in lieu of 302 MHz bandwidth which was available through INSAT-3E.

2.9. In view of the above, the Authority is of the opinion that laying of submarine cable is the most essential component for improving telecom connectivity in ANI and Lakshadweep. Further, it is of the view that:

- UT headquarters should be connected with the mainland through submarine cable.
- All the major islands should also be connected through submarine cable. This will ensure catering to the long-term requirement of bandwidth of these islands.

2.10. The idea of laying submarine cable for connecting all major islands of ANI administration is not new. A project for laying the submarine cable for connecting some major islands of ANI was planned long ago. Its background and the progress made to date is given below:

- In September 2010, the Planning Commission of India constituted a Technical Committee for studying the existing available bandwidth, future requirement and strategy to be adopted for providing adequate bandwidth through reliable connectivity to ANI. The Technical Committee after conducing several rounds of discussion with the stake-holders viz. ISRO, Ministry of Defense, NIC, BSNL, ANI Administration etc. submitted its report to Planning Commission in January 2011. In its report, the Technical Committee proposed provisioning of submarine optical fiber connectivity to six major islands viz. Port Blair, Havelock, Little Andaman, Car Nicobar, Kamorta and Campbell Bay and satellite connectivity for other islands. As per the proposal, the six islands should be connected through one of the existing consortium cables passing through the region with two branching units in a ring configuration with redundancy on the international cable.

- Based on the report of the Technical Committee, the Planning Commission, in April 2011, conveyed its in-principle approval for laying the undersea optical fibre cable to connect six major islands of ANI. It also directed ANI Administration to take immediate necessary steps in accordance with the extant rules and guidelines for implementing the recommendations of the Committee for providing submarine optical fibre cable connectivity to ANI.

- ANI Administration prepared a proposal for obtaining approval of Expenditure Finance Committee (EFC) and sent it to the DoT in

December 2011 for connecting six islands through submarine cable.

- Meanwhile, in December 2011, ANI Administration, through ANIIDCO[4], floated a RFP[5] and invited bids for implementation of the project including its operation and maintenance for 15 years on turnkey basis. As per the Planning Commission report, it was proposed to connect six islands by submarine cable, and retain one transponder for the islands of Katchal and Terrasa. However, ANI Administration decided that in addition to these six islands, three more islands (Neil, Teressa and Katchal) and two creeks of Middle Andaman may also be included in the project proposal. Accordingly, the RFP sought proposal to provide 10Gbps (1 lambda) through submarine cable to six islands alongwith the optional offer for undersea cable connectivity to three more islands and two creeks as stated above.

- ANI Administration revised EFC memo, by taking into account the cost estimates received from the financial bid of the eligible bidder and other components of the project. It submitted the revised proposal to the DoT on 7th August 2013.

2.11. Recently, the DoT has communicated through a letter dated 27th May 2014 that in a meeting convened by the Planning Commission, the following strategy for laying submarine cable to ANI has been taken:

- The best approach would be to provide a direct communication link through a dedicated submarine cable from Chennai Cable Landing Station (CLS) to Port Blair CLS rather than adopt the approach of spur-lines from an international submarine cable.

[4] Andaman and Nicobar Islands Integrated Development Corporation (ANIIDCO) is a wholly owned Government company of A&N Administration and engaged in trading, development of tourism, fisheries etc.
[5] RFP: Request for Proposal

- The project would be implemented in two phases. The first phase of the project to be taken up immediately would provide submarine OFC from Chennai to Port Blair and two other islands, namely Car Nicobar and Little Andaman. The second phase of the project to provide submarine OFC to Havelock, Kamorta and Great Nicobar Islands would be taken up on completion of the first phase after due assessment of bandwidth requirements.

- The connectivity to North Andaman, Middle Andaman, Baratang Islands and South Andaman would be through terrestrial OFC from Port Blair CLS. Intra-island and inter-island telecom connectivity for remaining islands would be taken up after TRAI recommendations are received.

- It was decided that the DoT may urgently take up the work of preparation of a detailed project report (DPR) on the above lines.

2.12. Since the submarine project has already been conceptualized, it was decided not to further examine that particular proposal given that there has already been inordinate delay since the in-principle approval given by the Planning Commission way back in April 2011. Any suggestion/modification to the project detail may further delay the entire project and may kick-start a *de novo* examination. After the sanction, its execution is likely to take another 18 -24 months. The Authority is in broad agreement with the objectives of the project, though it is of the opinion that all 6 major islands should be connected in the first phase itself. **Therefore, the Authority recommends that considering the state of telecommunications services in ANI and strategic locations of these islands, connectivity through submarine cable must be established at the earliest possible for all the six identified islands by the DoT viz. Port Blair, Havelock, Little Andaman, Car Nicobar, Kamorta and Great Nicobar, in the first phase itself and project**

implementation should be monitored at the highest level in the DoT.

2.13. In addition to above stated submarine connectivity of ANI from Chennai, if submarine connectivity is also extended from Kolkata, this will ensure that submarine connectivity to ANI shall be in the form of a ring. As the time taken to repair submarine cables is high, the ring formation is essential to provide much needed redundancy. Additionally, connectivity from Kolkata may be used to route traffic from the entire North-Eastern region of the country directly to Chennai, bypassing the large fault-prone terrestrial part of the international connectivity from Kolkata to Chennai. It may also be used to provide connectivity to South Asian Association for Regional Cooperation (SAARC) nations such as Nepal, Bhutan and Bangladesh. Traffic to and from Myanmar can also be taken on this cable. Further, Chennai is already connected to Srilanka and Srilanka is connected to Maldives on submarine cable. Therefore, most of the SAARC countries will be able to connect on submarine cable(s). This part of the cable can be named as **SAARC cable**. Connectivity through this cable will have significant impact on Broadband /Internet connectivity on the Indian subcontinent. Though there will be an incremental cost of about Rs. 600 crore, the ring formation is important from strategic point of view also. **Therefore, the Authority recommends that in addition to the already planned connectivity through Chennai, connectivity of ANI should also be made from Kolkata through a submarine cable. The submarine cable connecting Chennai – Port Blair – Kolkata could be named the 'SAARC' cable.**

2.14. In Lakshadweep, a submarine cable project has been planned to connect Kavaratti, Agatti, Androth and Minocoy islands in the first phase. It will also connect en-route islands of Kalpeni and Amini. It will cover almost 81% of the population of Lakshadweep. Kadmat is very near to Amini.

Therefore, a Microwave link between these two islands should be feasible. The remaining islands viz. Kiltan (population 3946), Chetlat (population 2347) and Bitra (population 271) can remain connected by only satellite media, as their population is comparatively small.

Connectivity through Satellites Transponders

2.15. As has already been pointed out, presently satellite is the only medium of connectivity of ANI and Lakshadweep. Even in future, connectivity through satellite is very critical because of the reasons explained below:

- Even if the submarine cable is planned, execution of the project has its associated challenges and time-line constraints. As discussed above, the proposal to connect major islands of ANI has been under consideration for many years. Once it is approved, its execution will take about 18-24 months.

- NTP-2012 envisages support to platform neutral services in e-governance and m-governance in key social sectors such as health, education and agriculture that are at present limited to a few organizations in isolated pockets. On interaction with ANI and Lakshadweep administrations, it was observed that non-availability of proper connectivity and sufficient bandwidth is a major hurdle in the furtherance of the different services being planned under e-Governance project. ANI administration has opened many Customer Service Centres (CSCs), but delivery of most of these e-Governance services is being done through off-line mode. Therefore, augmentation of satellite bandwidth is the only way out to cater to the immediate and short-term requirement of connectivity with the mainland and also for inter-island connectivity.

- It is always desirable to have media diversity in the connectivity to avert these islands getting completely isolated in case of a failure of transmission media. Therefore, till the time there is connectivity through submarine cable in ring formation, the connectivity through satellite media should be retained. Afterwards, requirement of connectivity through satellite media may be reviewed. **Therefore, the Authority recommends that the requirement of connectivity through satellite media for those islands of ANI that will be connected in a ring fashion from both sides (Chennai and Kolkata), may be reviewed later after completion of submarine cable laying project. However, in case of Lakshadweep, as submarine cable has been planned to provide connectivity from Kochi in linear fashion (i.e. without redundancy), connectivity through satellite should be retained even after the commissioning of submarine cable.**

2.16. In view of above, the following approach has been adopted.

- Augmentation of existing capacities of satellite links has been planned. However, considering the cost and the scarcity of the satellite bandwidth, augmented capacity of satellite links has been kept just enough to cater to the immediate and short-term bandwidth requirement of connectivity with the mainland as well as with UT headquarters.

- All major islands should be connected to the UT headquarters as well as to the mainland with direct satellite links. Connectivity with the UT headquarter is preferable for voice communications and networks like State Wide Area Networks (SWANs), whereas, for data communication, direct links from each island to the mainland are preferred. In ANI, all the islands have connectivity with Port Blair only. Therefore, new satellite links from major islands to the

mainland has been planned. On the other hand, all the islands of Lakshadweep are connected to Ernakulam/Bangalore only. Therefore, new satellite links from all the islands of Lakshadweep to Kavaratti have been proposed.

- There are some islands with small population. However they do not have any telecom connectivity till date. Such islands may have only one type of connectivity which can be provided by establishing a microwave link from an existing telecom node at a nearby island, wherever feasible. In case microwave link is not feasible, a satellite link may be established for connectivity with the UT headquarter.

b. 2G services in all habitation with population greater than 100

2.17. All inhabited towns and villages should at least have voice communication facilities. Therefore, all such villages have been identified where absolutely no telecommunication facility is available from any of the TSPs. For this purpose, information regarding coverage of existing telecom services was taken from the TSPs. The data received was superimposed to identify the villages where no TSP is providing telecom services.

2.18. The current status of '2G' coverage in different DHQs/SDHQs/Towns /Villages is given in the Table 2.4. It can be seen that all the DHQs, SDHQs and Towns have mobile coverage. But there are many villages in ANI and one village in Lakshadweep, which do not have mobile coverage.

Table 2.4
'2G' coverage status

Name of Union Territory	Number of DHQs		Number of SDHQs		Number of Towns		Number of Villages	
	Total	With 2G coverage	Total	With 2G coverage	Total	With 2G coverage	Total	With 2G coverage
ANI	3	3	9	9	5	5	396	192
Lakshadweep	1	1	10	10	6	6	6	5

2.19. The Population-wise segmentation of uncovered villages of ANI, on the basis of census data based on the 2011, is given in Table 2.5.

Table 2.5
Population-wise segmentation of uncovered villages

Sl. No.	Population	No. of 'uncovered' villages
1.	<100	99
2.	100 or more but <250	53
3.	250 or more but <500	23
4.	500 or more	29
	Total	**204**

2.20. The Authority is of the view that all the uncovered villages should be covered in a phased manner. The following possibilities were examined to determine which villages of ANI can be provided '2G' coverage in the first phase.

Table 2.6
Plan to cover remaining uncovered villages

District	Total Population	% of population having coverage	% of total population that will be covered		
			If villages with population of 500 or more are covered	If villages with population of 250 or more are covered	If villages with population of 100 or more are covered
North & Middle Andaman	105597	76%	90%	93%	98%
South Andaman	238142	97%	99%	99%	100%
Nicobars	36842	56%	82%	91%	98%
Total	**380581**	**87%**	**95%**	**97%**	**99%**

2.21. It can be seen from Table 2.6, that if all villages with a population of 100 or more are considered for providing '2G' mobile coverage, 99% population of ANI shall have mobile coverage. In view of this, **the Authority recommends that all villages with a population of 100 or more should be provided with '2G' mobile coverage in the first phase.** In view of the possibility of incidental coverage from the nearby villages, the actual number of uncovered villages should be determined

after the completion of the first phase. Such villages can be considered for providing '2G' mobile coverage subsequently.

2.22. As far as Lakshadweep is concerned, all towns and villages have atleast '2G' coverage. The only village (Suheli Cheriyakara), under Kavaratti SDHQ, does not have any mobile connectivity. However it has only 3 households with population of 11. It is on a separate island which is nearly 60 Km away from Kavaratti. Therefore, this may be considered for providing connectivity later.

c. 3G services in all DHQs/SDHQs and towns

2.23. The current status of '3G' coverage in different DHQs/SDHQs/Towns/ Villages is given in Table 2.7. It can be seen that penetration of '3G' network in ANI and Lakshadweep is very thin. Even all the DHQs, SDHQs and towns do not have '3G' coverage. Now-a-days, when the entire thrust is shifting towards data services, the current limited presence of '3G' services is far from satisfactory.

Table 2.7
'3G' coverage status

Name of Union Territory	Number of DHQs		Number of SDHQs		Number of Towns		Number of Villages	
	Total	With 3G coverage	Total	With 3G coverage	Total	With 3G coverage	Total	With 3G coverage
ANI	3	2	9	4	5	4	396	46
Lakshadweep	1	1	10	1	6	1	6	0

2.24. The Authority is of the view that the '3G' coverage needs to enhanced in a phased manner. In the first phase, all the DHQs, SDHQs and the entire urban population should have '3G' network coverage. Accordingly, DHQs, SDHQs and all towns were identified which do not have '3G' coverage. In all such places, '3G' network coverage has been planned in these recommendations.

2.25. The limitation in the availability of bandwidth has been the major constraint in the expansion of the high speed network (3G) in these islands. Therefore, expansion of '3G' services needs to be carried out in synchronization with the augmentation of backhaul bandwidth of these islands with the mainland.

d. Augmentation of 2G and 3G network in the towns/villages to improve coverage and traffic carrying capacity

2.26. During the visit of the TRAI team, it was felt that even in towns/villages, where there is 2G or 3G coverage, there are wide pockets which are either uncovered or have a lot of congestion. Therefore, there is a need to augment the coverage area and also the capacity of the network. For estimating the number of BTSs required in these towns, it has been assumed that one 2G BTS will be required for every 2500 population and one Node-B will be required for every 3000 population.

e. Extending mobile coverage to entire National Highways

2.27. There is no national highway in Lakshadweep. However, there is one national highway (NH 223- The Andaman Trunk Road) in ANI, which is approximately 300 Km in length. It connects important towns of Port Blair (in South Andaman), Rangat and Mayabandar (both in Middle Andaman) and Diglipur (in North Andaman). It passes through the Jarawa Tribal Reserve Area, where no commercial and tourist activity is permitted.

2.28. The status of current mobile coverage on NH 223 was collected from all the TSPs operating in ANI. It was noticed that BSNL is providing the maximum coverage (around 170 Km) along the National Highway. All other TSPs have mobile coverage in only small parts of NH-223 which is already covered by BSNL. The Authority is of the opinion that entire NH-

223, except the Jarawa Tribal Reserve Area, ought to have mobile coverage. The augmentation of 2G network along the NH 223 has been planned accordingly.

Estimation of investment required for implementation of the suggested overall plan.

a. Provisioning of Bandwidth through submarine cable:

2.29. The submarine cable laying for connecting ANI or Lakshadweep will be the first project of its kind. There are a few consortium cables passing through Indian Sea(s). Some of them have termination at Cable Landing Station at Mumbai/Chennai. But, there is no information available about their execution cost. However, as discussed earlier, ANI Administration had invited bids for connecting some of the islands. For making an estimation of the investment required for laying the submarine cable, the Authority has used the cost discovered through the bids called by ANI Administration **(Annexure-2.1)**. A broad estimate of the cost for submarine cable, thus derived, is given in Table 2.8.

Table 2.8
A broad estimate of the cost for submarine cable

Sl. No.	Item	Cost (crore)
1	Capital cost of around 1205 Km of submarine cable i.e. from branching point to various islands including cost of hiring the bandwidth in the existing submarine cable running from Chennai to Singapore.	430.91
2	Indefeasible rights of use (IRU) charges i.e. the cost of hiring the bandwidth in the existing submarine cable running from Chennai to Singapore.	119.01
3	Net capital cost (1-2)	311.9
4	Annual Maintenance Charges (@5% of Net Capital Cost) for 15 years	233.93
5	Total Project Cost (3+4)	545.83
6	Per Km cost of submarine cable along with all other associated components	0.45 (rounded off to 0.5)

b. Provisioning of Bandwidth through satellite media:

2.30. Currently, BSNL is able to extract a maximum of 32 Mbps throughput (both directions) from 24 MHz satellite bandwidth utilising carrier-in-carrier Intermediate Data Rate (IDR)[6] modems. For computing the satellite bandwidth requirement, the same spectral efficiency (i.e. 1.33 Mbps/MHz) has been assumed.

2.31. Apart from the augmentation of satellite transponder bandwidth as discussed above, upgradation of ground segment is also required to utilise the space segment bandwidth. For the purpose of estimating the investment required for the upgradation of ground segment, it has been assumed that IDR systems will be deployed. However, state-of-the-art equipments with better spectral efficiency systems should be deployed. Based on the discussion with stakeholders, the costs of new / upgradation of IDR systems as given in Table 2.9 below, have been considered for estimating the investment required for the upgradation of ground segment.

Table 2.9
Cost Estimation for IDR Equipment

Sl. No.	Name of Item	Price (Crore)
1	2 Mbps IDR	0.70
2	4 Mbps (2x2 Mbps) IDR	0.80
3	8 Mbps IDR	1.00
4	16 Mbps (2x8 Mbps) IDR	1.40
5	34 Mbps IDR	2.40
6	Upgradation from 2 to 8 Mbps IDR	0.50
7	Upgradation from 8 to 2x8 Mbps IDR	0.50
8	Upgradation from 8 to 34 Mbps IDR	2.1
9	2 Mbps CnC Modems	0.10
10	8 Mbps CnC Modems	0.25
11	34 Mbps CnC Modems	0.55
12	Hub	1.6 + Modem costs

[6] IDR systems provides terrestrial interface in form of standard G.703 E1s (2.048 Mbps streams), which can directly be used by Telecom Nodes.

2.32. Annual hiring charges of satellite bandwidth in C-Band (high power) w.e.f. 01.04.2012 are Rs. 5 crore per transponder (36 MHz) (i.e. 13.16 lakh per MHz). This rate has been applied to calculate the satellite bandwidth hiring charges.

c. Extending '2G' coverage

Investment required to enhance the '2G' coverage

2.33. To estimate the investment required for enhancing '2G' mobile coverage, it is essential to estimate (a) number of BTSs required and their configurations, (b) the backhaul requirement (OFC km/MW hops) and (c) Tower particulars i.e. whether it is Ground Based Tower (GBT) or Roof Top Tower (RTT) and what is the height.

2.34. The Population of most of the uncovered villages is less than 1000. Therefore, for estimating the number of BTSs required to cover these villages, it has been assumed that one BTS will be required for each village. For the augmentation of the capacity of the network in an area to decongest the network or improve the coverage, one BTS for every 2500 people has been also considered.

2.35. In order to determine the backhaul requirement, TSPs were asked to provide the details of backhaul and type of towers currently being used by existing BTSs in ANI and Lakshadweep. The details of the existing BTSs that are served by different types of backhaul and towers are given in the tables below:

Table 2.10

Backhaul and Tower details of Existing BTSs

UT	Type of Backhaul[7]		Type of Tower	
	BTSs on Microwave	BTSs on OFC	BTSs on RTT	BTSs on GBT
ANI	51%	49%	24%	76%
Lakshadweep	15%	85%	20%	80%

2.36. It can be seen from Table 2.10 that in ANI, BTSs on microwave backhaul and OFC backhaul are almost equal whereas in Lakshadweep, 85% of the BTSs are on OFC backhaul. Accordingly, the same proportions have been maintained while planning new BTSs in these recommendations. Further, it has been assumed that if OFC is laid to connect any BTS site, it will require 2.5 Km of OFC. Similarly, if microwave backhaul is used then single hop microwave links will be sufficient to connect each new BTS to the nearest point of presence. However, for new BTSs planned for extending coverage on National Highway, 0.5 Km of spur OFC per BTS has been assumed.

2.37. For expending the coverage along National Highway, it has been assumed that all BTSs will be 2+2+2 configurations on 40 meter GBTs. To provide 2G coverage in the uncovered villages and to decongest the existing network, 80% of BTSs have been considered with 2+2+2 configuration with GBTs while remaining 20% have been considered with 4+4+4 configuration with RTTs. Further, it has been assumed that in ANI, one-third of new GBTs will be of 60 meters height and assumed the remaining two-thirds will be of 40 meters height, while in Lakshadweep all towers will be of 40 meters height only.

2.38. To estimate the cost of extending 2G coverage, all TSPs operating in ANI were asked to conduct a sample survey of some uncovered villages and

[7] Connectivity to each island through submarine cable and satellite media and its cost implications have been dealt separately. Once the island has connectivity with other islands/the mainland, then microwave or OFC is used for providing connectivity to the BTSs in the same island. Therefore, BTSs on satellite media have been excluded here to arrive at the percentage share of OFC and MW in the backhaul.

submit an estimation of the expenditure required to extend mobile coverage in such uncovered villages. A sample report submitted by one of the TSPs is attached as **Annexure-2.2**. Based on the reports submitted by the TSPs and our own analysis, the costs of different elements required for erection of '2G' BTS are given in Table 2.11 below. Considering the remoteness, transportation and installation cost in North & Middle Andaman and Nicobar districts have been taken as 1.5 times and 2 times respectively as compared to South Andaman. Transportation and installation cost in Lakshadweep are taken same as that in North and Middle Andaman.

Table 2.11
Cost of different elements required for erection of '2G' BTS

Sl. No.	Item	Cost (in Rs. Lakh)			
		South Andaman	North & Middle Andaman	Nicobar	Lakshadweep
1.	BTS(2+2+2) along with other infrastructure items (Battery, Power plant, AC, Diesel generator set etc)	24.72	26.78	28.84	26.78
2.	BTS(4+4+4) along with other infrastructure items (Battery, Power plant, AC, Diesel generator set etc)	28.12	30.18	32.24	30.18
3.	Roof Top Tower (RTT)	15.0	20.0	25.0	20.0
4.	GBT cost (40 Meter)	25.0	34.0	43.0	34.0
5.	GBT cost (60 Meter)	35.0	45.5	56.0	45.5
6.	OFC Laying Cost including terminal cost (per Km)	5.0	5.0	5.0	5.0
7.	Digital Microwave cost (Per hop cost including equipment, antenna etc.)	4.0	4.5	5.0	4.5

2.39. Keeping in view, the different configuration of BTS, media for backhaul connectivity, tower type and also based on the variable cost of transportation and installation in different districts, the following table provides the estimated costs of BTSs deployment in different settings:

Table 2.12
Estimated Cost of BTSs in various configuration

Sl. No.	Different type of BTS	Cost (in Rs Lakh)			
		South Andaman	North & Middle Andaman	Nicobar	Lakshadweep
1.	BTS(4+4+4) with 40 m GBT and MW backhaul	57.12	68.68	80.24	68.68
2.	BTS(4+4+4) with 40 m GBT and 2.5 km OFC backhaul	65.62	76.68	87.74	76.68
3.	BTS(4+4+4) with RTT and 2.5 km OFC backhaul	55.62	62.68	69.74	62.68
4.	BTS(4+4+4) with RTT and MW backhaul	47.12	54.68	62.24	54.68
5.	BTS(2+2+2) with 40 m GBT and MW backhaul	53.72	65.28	76.84	65.28
6.	BTS(2+2+2) with 60 m GBT and MW backhaul	63.72	76.78	89.84	76.78
7.	BTS(2+2+2) with 40 m GBT and 2.5 km OFC backhaul	62.22	73.28	84.34	73.28
8.	BTS(2+2+2) with 60 m GBT and 2.5 km OFC backhaul	72.22	84.78	97.34	84.78
9.	Highway BTS (2+2+2) with 40m GBT and 500m OFC	52.22	63.28	74.34	63.28

d. Extending '3G' coverage

2.40. For estimating number of Node-Bs required in each DHQ/SDHQ/Town, it has been assumed that one Node-B will be required for 3000 population.

2.41. 3G Node-Bs are likely to be installed on existing '2G' BTS sites. Therefore, expenditure on sites, towers and other related infrastructure except elements such as battery, power plant, media capacity etc may not be required for installing a '3G' Node-B. . For installation of Node-Bs, an expenditure of Rs. 15 lakh has been considered for each site, which includes the cost of Node-B and the approximate cost of infrastructure

augmentation. Different transportation and installation costs have been taken for different districts of ANI as shown in Table below. Transportation and installation cost in Lakshadweep are taken same as that in North and Middle Andaman.

Table 2.13

Estimated Cost of Node Bs

Sl. No.	Item	Cost (in Rs. Lakh.)			
		South Andaman	North & Middle Andaman	Nicobar	Lakshadweep
1	Cost of Node-B and augmentation of infrastructure elements	15	15	15	15
2.	Transportation and Installation Cost	3	4.5	6	4.5
	Total Cost	18	19.5	21	19.5

Summary of investment required for implementation of the suggested plan for ANI and Lakshadweep

2.42. As per the approach discussed in this chapter, the gap analysis and investment required for ANI is presented in Chapter-III and for Lakshadweep in Chapter-IV. A summary of the same is provided in the following paras.

Submarine Connectivity

2.43. Lack of bandwidth through connectivity with the mainland as well as inter-island connectivity is the main constraint in these islands. For a medium-term and long-term solution, providing submarine cable connectivity to both ANI and Lakshadwep has been recommended.

2.44. Providing connectivity to ANI through submarine cable has been discussed in detailed in 2.10 to 2.13. The Authority has noted that the DoT/Planning Commission has decided to connect six islands in two phases. The Authority has recommended that all six identified islands

should be connected in a single phase. It has also recommended that the submarine cable connectivity to ANI should also be extended from Kolkata. As mentioned earlier, the Authority has not worked out the details of the expenditure for the submarine project but, to reflect the extent of investment required, it has relied on estimates of the expenditure in the EFC proposal submitted by ANIIDCO. Accordingly, the Authority has indicated Rs. 1000 crore for the submarine connectivity of six islands of ANI from Chennai. Applying the same rate derived from the submarine cable connectivity plan of ANI from Kolkata, the Authority has indicated Rs. 600 crore for the submarine connectivity from Kolkata in its investment plan for ANI.

2.45. For Lakshadweep, submarine cable connectivity has been planned to connect six islands. Approximately 936 Km of cable will be required with an estimated expenditure of Rs. 468 crore. Its details are given in para 4.6 to 4.9 of Chapter IV.

Augmentation of Satellite Bandwidth

2.46. Augmentation of satellite bandwidth for providing immediate and short-term bandwidth requirement has been planned for both ANI and Lakshadweep. The justification for augmentation of satellite capacity, despite planning a submarine cable, has been discussed in Para 2.15 and 2.16. Details of the approach adopted for the satellite bandwidth augmentation and the expenditure involved for ANI has been discussed in Para 3.13 and 3.19 of Chapter-III. Details of the same in respect of Lakshadweep are given at 4.10 to 4.13 of Chapter-IV.

2.47. The Authority has also recommended that the requirement of connectivity through satellite media for those islands of ANI that will be connected in a ring fashion from both sides (Chennai and Kolkata), may be reviewed later after completion of submarine cable laying project. However, in case of Lakshadweep, submarine cable has been planned to

provide connectivity from Kochi in linear fashion, connectivity through satellite should be retained even after the commissioning of submarine cable. (Para 2.15).

Extension of 2G network

2.48. The Authority has adopted the following approach for extension of the 2G network.

- Providing 2G services to all the villages with population of 100 or more (discussed in Para 2.17 to 2.22 of this Chapter): Details of the plan and expenditure required in respect of ANI are given in Para 3.23 to 3.30 of Chapter-III. As far as Lakshadweep is concerned, the issue has been discussed in 4.14 to 4.16 and it has been concluded that there is no need for any augmentation in the 2G network for this purpose.
- Augmentation of existing 2G network to improve coverage and traffic carrying capacity to improve Quality of Service (QoS): Details of the plan and expenditure required in respect of Lakshadweep are given in Para 4.17 to 4.19 of Chapter-IV. However, in view of the facts that there are sufficient number of 2G BTSs in ANI, additional BTS have not been planned for this purpose.
- Extension of 2G coverage to entire National Highways: It has been proposed that 2G coverage should be available along the National Highways (NH). There is no NH in the Lakshadweep. Details of the plan and the expenditure involved for extending the 2G coverage along the NH-223, the only NH in the ANI, is discussed in Para 3.34 to 3.35 of Chapter III.

Extension of 3G network

2.49. As discussed in Para 2.23 to 2.25, the Authority has adopted following approach for the extension of 3G network.

- Extension of the 3G network to all the DHQs, SDHQs and entire urban population of ANI and Lakshadweep.
- Augmentation of existing 3G network to improve coverage and traffic carrying capacity to reduce the congestion.

2.50. As discussed above, Chapters III and IV provides the details of the telecom plan to improve the telecom services in ANI and Lakshadweep. However, an extract of the investment required is given in Table 2.14 below.

Table 2.14
Estimated Capital Investment Required

UT	2G Connectivity Plan				3G Connectivity Plan			Satellite Equip-ment cost (Rs Cr)	OFC cost (Rs Cr)	Total Cost (Rs Cr)	Total cost along with 20% towards survey and other overheads (Rs. Cr)	Sub-marine Cable	Total One Time Invest-ment (Rs Cr.)
	No. of BTSs required to provide coverage to uncovered villages	No. of BTS required to enhance traffic capacity	No. of BTS required to extend coverage on NH	Investment Required (Rs Cr)	No. of Node Bs required to cover the uncovered Towns	No. of Node Bs required to enhance traffic	Investment Required (Rs Cr)						
ANI	109	0	6	86.7	9	26	6.47	30.95	20	144.09	172.91	1600	1772.91
Laksha dweep	0	10	NA	8.07	22	2	4.68	18.05	0	30.8	36.96	468	504.96
Total	109	10	6	94.7	31	28	11.15	49.00	20	174.89	209.87	2068	2277.87

2.51. **The Authority recommends that the investment as shown in Table 2.14 be incurred for providing reliable and quality telecom services in ANI and Lakshadweep.**

2.52. As discussed in Para 5.10 to 5.12 of Chapter-V, there is a huge cost involved towards satellite bandwidth hiring charges and substantial

O&M charges which makes provision of telecom services in these islands a commercially unviable option. Therefore, the Authority has also recommended (Para 5.12) that the annual satellite bandwidth hiring charges for providing telecom services in these islands should be borne by USOF completely. Estimation of satellite bandwidth hiring charges in respect of ANI and Lakshadweep can be seen at Para 3.19 of Chapter-III and Para 4.12 of Chapter-IV respectively. As far as Operation & Maintenance charges are concerned, these are taken as 10% of capital investment (excluding investment of submarine cable as submarine cable cost includes O&M charges for 15 years).

2.53. In view of above, **the Authority recommends that apart from the one-time capital investment, the DoT/UT administration should compensate the Telecom operation on yearly basis as viability gap funding as given in Table 2.15. It may be reviewed after five years.**

Table 2.15
Annual Investment Required

UT	Annual Hiring Charges of Satellite Bandwidth (Rs crore)	Operation & Maintenance (Rs Crore)	Total Annual Investment Required (Rs crore)
ANI	86.84	17.32	104.16
Lakshadweep	22.55	3.69	26.24
Total	109.39	21.01	130.40

CHAPTER – III: TELECOM PLAN FOR ANDAMAN & NICOBAR ISLANDS

3.1 Andaman & Nicobar Islands (ANI) is a Union Territory (UT) of India. Port Blair is the capital of ANI. These islands lie between 6°-14° North Latitude and 92°-94° East Longitude. ANI comprises of two island groups - Andaman group of islands and Nicobar group of islands. The total area of Andaman group of islands is 6408 square km. and Nicobar group of islands is 1841 square km. Costal line of ANI is around 1962 Km. These two groups are separated by the 10° N parallel Channel.

3.2 There are 572 islands in ANI. Before the Tsunami in 2004, there were 37 inhabited islands. Later on, some inhabited villages were relocated and at present, there are 29 inhabited islands. Almost 80% population resides in South Andaman, Middle Andaman and North Andaman Islands. There are several islands with minimal population. Some other islands, though not inhabited, are popular tourist destinations (Ross, Viper Islands etc).

3.3 There are 3 districts, 9 sub-districts, 5 towns and 555 villages in ANI. As per census 2011, only 396 villages are inhabited. The population of Andaman and Nicobar Islands (ANI) is 380581 with 37.70% urban population and average population density of 46 persons per sq km. The highest population density of 80 persons per square Km is observed in South Andaman district whereas lowest population density of 20 persons per square Km is observed in Nicobar district District-wise and Island-wise demographical details are given in Table 3.1 and Table 3.2 respectively.

Table 3.1
District-wise Population and Geographical Area of ANI

Sl. No.	District	Population			Total Area[8] (Sq. km)	Density (per Sq Km)
		Rural	Urban	Total		
1.	North & Middle Andaman (N&M Andaman)	102856	2741	105597	3736	28
2.	South Andaman	97395	140747	238142	2672	89
3.	Nicobar	36842	0	36842	1841	20
	Total	237093	143488	380581	8249	46

Table 3.2
Island-wise Population and Geographical Area of ANI

Sl. No.	Name of District	Name of Island	Population			Total Area (Sq. km)	Density (per Sq Km)
			Rural	Urban	Total		
1	North & Middle Andaman	Aves Island	2	0	2	0.2	10
2		Baratang Island	3174	0	3174	297.8	11
3		Curlew Island	2	0	2	0.03	67
4		East Island	16	0	16	6.1	3
5		Interview Island	15	0	15	133.4	0
6		Land Fall Island	6	0	6		0
7		Long Island	1035	0	1035	17.9	58
8		Middle Andaman Island	55408	2741	58149	1535.5	38
9		Narcondum Island	16	0	16	6.8	2
10		North Andaman Island	42541	0	42541	1376	31
11		Smith Island	600	0	600	24.7	24
12		Stewart Island	2	0	2	7.2	0
13		Strait Island	39	0	39	6	7
14	South Andaman	Flat Bay Island	5	0	5	0.14	36
15		Havelock Island	6315	0	6315	113.9	55
16		Little Andaman	18823	0	18823	731.6	26
17		Neil Island	3040	0	3040	18.9	161
18		North Sentinel Island	15	0	15	59.67	0
19		Rutland Island	347	0	347	137.2	3
20		South Andaman Island	68850	140747	209597	1347.97	155
21	Nicobar	Nicobar Island	17841	0	17841	126.9	141
22		Chowra Island	1270	0	1270	8.2	155
23		Great Nicobar Island	7903	0	7903	1045.1	8
24		Kamorta Island	3688	0	3688	188.2	20
25		Katchal Island	2955	0	2955	174.4	17
26	Nicobar	Little Nicobar Island	438	0	438	159.1	3
27		Nancowry Island	775	0	775	66.9	12
28		Teressa Island	1934	0	1934	101.4	19
29		Tillang Chong Island	38	0	38	16.8	2

[8] http://www.and.nic.in/stats/2006/islandwise.htm

Identification of the Islands which require telecom services

3.4 Ideally all inhabited islands should be provided telecom connectivity in a phased manner. However, The Authority is of the opinion that in the first phase, all islands with population of 100 or more should have telecom connectivity. There are 18 such islands. In the remaining islands, population is less than 40. In addition, there are some islands, which though uninhabited, are important from other reasons such as presence of police/forest camps or from tourism purposes. ANI Administration has identified four such islands (Table 3.3). Accordingly these are included in the comprehensive telecom plan.

Table 3.3

Sl No.	Name of District	Name of Island	Total Area (Sq. km)
1	N&M Andaman	North Passage Island	22
2	N&M Andaman	Spike Island	11.7
3	South Andaman	John Lawrance Island	41.98
4	South Andaman	Viper Island	0.3

3.5 This telecom plan has been prepared keeping in view that telecom connectivity is to be provided in 18+4=22 islands as summarized in Table below:

Table 3.4

Sl No.	Name of District	No. of Islands
1	N&M Andaman	7
2	South Andaman	7
3	Nicobar	8
	Total	**22**

Telecom Connectivity of ANI from rest of the Country:

3.6 Satellite is the only media for the connectivity of ANI with rest of the country. It is connected through satellite media to Asansol, Kolkata, New

Delhi and Mumbai with aggregate bandwidth of 292.1 Mbps. The major share of this connectivity is from BSNL which is providing 260 Mbps.

3.7 Almost all the satellite links in ANI, meant for telecom connectivity with the rest of the country, have one end in Port Blair. However, there are a few satellite links which are connecting other stations also directly to the mainland namely BSNL has connected Car Nicobar (DHQ) directly to Kolkata and New Delhi by satellite links of 2 Mbps each. Similarly Reliance has connected Mayabunder (DHQ), Rangat (SDHQ), Diglipur (SDHQ) directly to Mumbai through satellite links of 0.4 Mbps each. Connectivity details of ANI with rest of the country are given in Table 3.5 below.

Table 3.5
Connectivity of ANI with rest of the country

Sl. No	Name of Island	Name of Station	Connected to	Media System	Bandwidth (Mbps)	Operator
1.	North Andaman	Diglipur	Mumbai	Satellite	0.4	Reliance
2.	Middle Andaman	Mayabunder	Mumbai	Satellite	0.4	Reliance
		Rangat	Mumbai	Satellite	0.4	Reliance
3.	South Andaman	Port Blair	Asansol, Kolkata, New Delhi, Mumbai	Satellite	18	Airtel
					256	BSNL
					6.1	Reliance
					6.8	Vodafone
4.	Car Nicobar	Car Nicobar	Kolkata, New Delhi	Satellite	4	BSNL
	Total				**292.1**	

Connectivity of DHQ/SDHQ with Port Blair

3.8 BSNL has laid OFC cable along NH223. This OFC route, connects Port Blair to 4 SDHQs viz. Ferrargunj (in South Andaman), Rangat, Maybandar (both in Middle Andaman) and Diglipur (North Andaman). Remaining 4 SDHQs viz. Car Nicobar, Campbell Bay, Hutbay and Kamorta are connected with Port Blair only through the satellite links.

Table 3.6

Connectivity of DHQ/SDHQ with Port Blair

Sl. No.	Sub-District	SDHQ	Connectivity Status			OFC Bandwidth (in Mbps)	Satellite Bandwidth (in Mbps)
			OFC	Micro-wave	Satellite		
1	Car Nicobar	Car Nicobar	No	No	Yes		20
2	Diglipur	Diglipur	Yes	No	Yes	155	8.90
3	Ferrargunj	Ferrargunj	Yes	No	No	155	0
4	Great Nicobar	Campbell Bay	No	No	Yes		8
5	Little Andaman	Hutbay	No	No	Yes		18.86
6	Mayabunder	Mayabunder	Yes	No	Yes	155	9.62
7	Nancowry	Kamorta	No	No	Yes		8
8	Rangat	Rangat	Yes	No	Yes	155	10.62
Total							**84**

Inter-Island Telecom Connectivity

3.9 Presently, only 12 islands have telecom connectivity through satellite media with Port Blair. Three of these islands viz. Middle Andaman, North Andaman and Baratang are also connected through OFC to Port Blair (in South Andaman Island). Neil is the only island which is connected by a microwave link. Out of the identified 22 islands, included in the comprehensive telecom plan, there are 9 islands, which are not having any telecom connectivity. These islands are Chowra, Little Nicobar, Nancowry, Smith, North Passage, Spike, Rutland, John Lawrance and Viper. Current connectivity status of all 22 islands with the Port Blair is as given in Table 3.7.

Table 3.7
Connectivity Status of A & N Islands with Port Blair

Sl. No.	Name of Island	Population of Island	Connectivity Status			Satellite Bandwidth (Mbps)
			OFC	Micro-wave	Satellite	
1	Car Nicobar Island	17841	No	No	Yes	20[9]
2	Chowra Island	1270	No	No	No	0
3	Great Nicobar Island	7903	No	No	Yes	8
4	Kamorta Island	3688	No	No	Yes	8
5	Katchal Island	2955	No	No	Yes	4
6	Little Nicobar Island	438	No	No	No	0
7	Nancowry Island	775	No	No	No	0
8	Teressa Island	1934	No	No	Yes	4
9	Baratang Island	3174	Yes	No	Yes	1
10	Long Island	1035	No	No	Yes	4
11	Middle Andaman Island	58149	Yes	No	Yes	18.24
12	North Andaman Island	42541	Yes	No	Yes	11.40
13	Smith Island	600	No	No	No	0
14	North Passage Island	0	No	No	No	0
15	Spike Island	0	No	No	No	0
16	Havelock Island	6315	No	No	Yes	18
17	Little Andaman	18823	No	No	Yes	18.88
18	Neil Island	3040	No	Yes	Yes	4
19	Rutland Island	347	No	No	No	0
20	John Lawrance Island	0	No	No	No	0
21	Viper Island	0	No	No	No	0
22	South Andaman Island	209597	Not applicable as Port Blair is in South Andaman Island only.			

Future requirement of bandwidth

3.10 The methodology to assess the future requirement of bandwidth has been discussed in Chapter-II. Following the projections for phase-I, made in the Authority's earlier recommendations on "National Broadband Plan" dated 8th December 2010, i.e. availability of 2 Mbps bandwidth per household with projected penetration of 12%, 39% and 64% in villages,

[9] Car Nicobar Island is connected to Port Blair through 16 Mbps satellite links and with Delhi and Mumbai through satellite links of 2 Mbps each.

towns and cities respectively with a contention ratio of 1:10, estimated backhaul requirement for these islands has been worked out as given in Table below.

Table 3.8
Estimated bandwidth requirement in each Island[10]

Sl. No.	Name of Islands	City Households	Town Households	Rural Households	Present Bandwidth (Gbps)	Total Bandwidth Required in Gbps
1	Car Nicobar Island	0	0	4250	0.02	1.02
2	Chowra Island	0	0	367	0	0.09
3	Great Nicobar Island	0	0	2149	0.008	0.52
4	Kamorta Island	0	0	915	0.008	0.22
5	Katchal Island	0	0	777	0.004	0.19
6	Little Nicobar Island	0	0	94	0	0.02
7	Nancowry Island	0	0	181	0	0.04
8	Teressa Island	0	0	551	0.004	0.13
9	Baratang Island	0	0	800	0.009	0.19
10	Long Island	0	0	327	0.004	0.08
11	Middle Andaman Island	0	724	13627	0.166	3.84
12	North Andaman Island	0	0	10533	0.172	2.53
13	Smith Island	0	0	160	0	0.04
14	North Passage Island	0	0	0	0	0.00
15	Spike Island	0	0	0	0	0.00
16	Havelock Island	0	0	1641	0.018	0.39
17	Little Andaman	0	0	5093	0.019	1.22
18	Neil Island	0	0	735	0.006	0.18
19	Rutland Island	0	0	119	0	0.03
20	John Lawrence Island	0	0	0	0	0.00
21	Viper Island	0	0	0	0	0.00
22	South Andaman Island	27049	8248	16167	0.274	44.94
	Total	**27049**	**8972**	**58486**	**0.712**	**55.66**

[10] Four islands viz. North Passage Island, Spike Island, John Lawrence Island and Viper Island are un-inhabited islands but are important due to other reasons such as presence of police/forest camps or tourism purposes. Being un-inhabited islands, the projected bandwidth requirement, which is based on the population, is being shown NIL in above table.

Requirement of Additional Connectivity and the Estimated Expenditure

a. Submarine connectivity for major Islands

3.11 Proposal to connect major islands of ANI is under consideration since many years. Recently, the DoT has communicated through letter dated 27th May 2014 that the project would be implemented in two phases. The first phase of the project to be taken up immediately would provide submarine OFC from Chennai to Port Blair and two other islands, namely Car Nicobar and Little Andaman. The second phase of the project to provide submarine OFC to Havelock, Kamorta and Great Nicobar Islands would be taken up on completion of the first phase after due assessment of bandwidth requirements.

3.12 In Chapter-II, the Authority has also pointed out that there has already been inordinate delay since the in-principle approval was given by the Planning Commission in April 2011 to connect six major islands through submarine cable. Keeping in mind, the state of telecommunications services and strategic locations of these islands, the Authority has also recommended for connecting major islands of ANI through submarine cable without any further delay. The Authority has also recommended that the apart from the connectivity of ANI from Chennai, connectivity should also be made from Kolkata. The issue of submarine connectivity of major islands has not been examined by the Authority, though the Authority recommended in the previous chapter that all 6 major islands should be connected in the first phase itself and the submarine connectivity of ANI should also be made from Kolkata. The Authority has recommended that in addition to the already planned connectivity through Chennai, connectivity of ANI should also be made from Kolkata through a submarine cable. The Authority has not worked out the details of the expenditure for submarine project but to reflect the extent of investment required, it has relied upon the estimates of the expenditure

in the EFC proposal submitted by ANIIDCO. Accordingly, the Authority has indicated Rs. 1000 crore for the submarine connectivity of six islands of ANI from Chennai. Applying the same rate derived from the submarine cable connectivity plan of ANI from Kolkata, the Authority has indicated Rs. 600 crore for the submarine connectivity from Kolkata in its investment plan for ANI.

b. Provision/upgradation of bandwidth through Satellite links

3.13 As discussed in the preceding section, there are six major islands, where connectivity has been planned through submarine cable in two phases. However, the execution of the submarine cable will take considerable time. Therefore, the Authority is of the opinion that capacity of the existing satellite links should be enhanced to cater to the immediate and short-term bandwidth requirement of inter-island connectivity. These satellite links will act as a redundant links after the commissioning of the submarine cable.

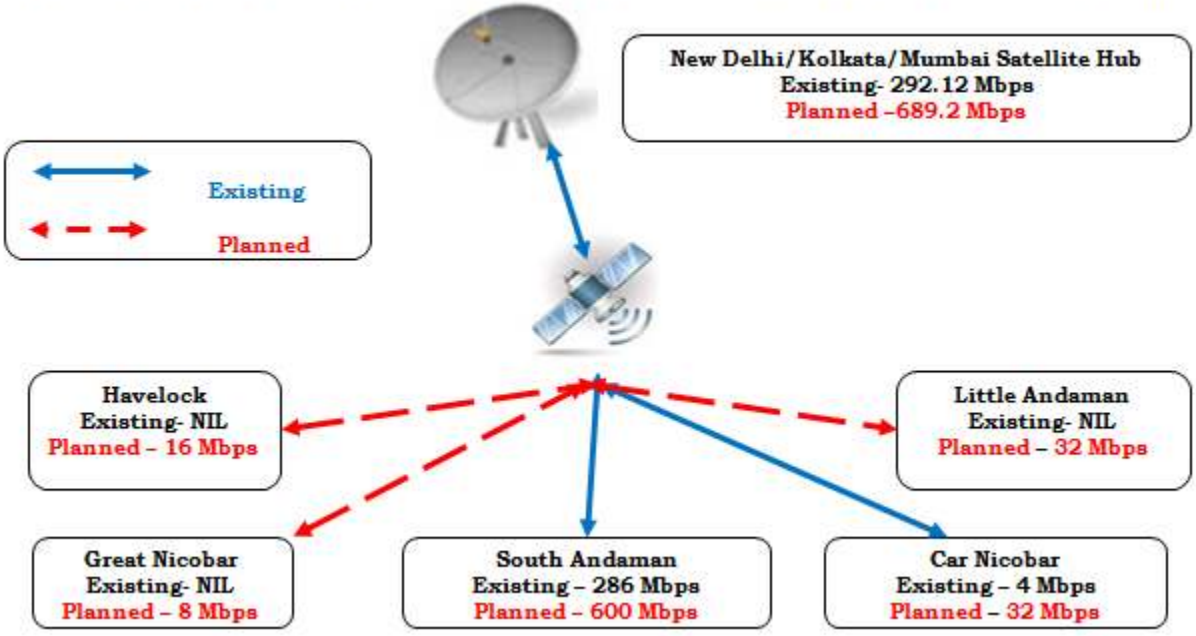
3.14 The approach adopted for the augmentation of satellite connectivity to ANI has been discussed in Chapter-II. Accordingly, upgradation of satellite systems planned for ANI is given below.

- Upgradation of satellite bandwidth from existing 274 Mbps to 600 Mbps has been planned at Port Blair.
- In case of North Andaman, Middle Andaman and Baratang which are connected through OFC as well as satellite links to the Port Blair, only augmentation of existing OFC systems has been planned. No separate augmentation of satellite bandwidth has been planned in these islands. Planned upgradation of satellite bandwidth at Port Blair shall cater to the requirement of these islands also.
- Currently, all islands of ANI are connected to Port Blair which is in turn connected to the mainland. Therefore, connectivity from any

island to the mainland is established through Port Blair only. This configuration is preferable for voice communications and networks like State Wide Area Network (SWAN). However, for data communication, it is preferable to have independent links from each island to the mainland. Therefore, new satellite links (34 Mbps or 8 Mbps) have been planned at the major four islands of ANI, for direct connectivity with the mainland. These islands are Car Nicobar, Great Nicobar, Havelock and Little Andaman. **(Fig 3.1)**

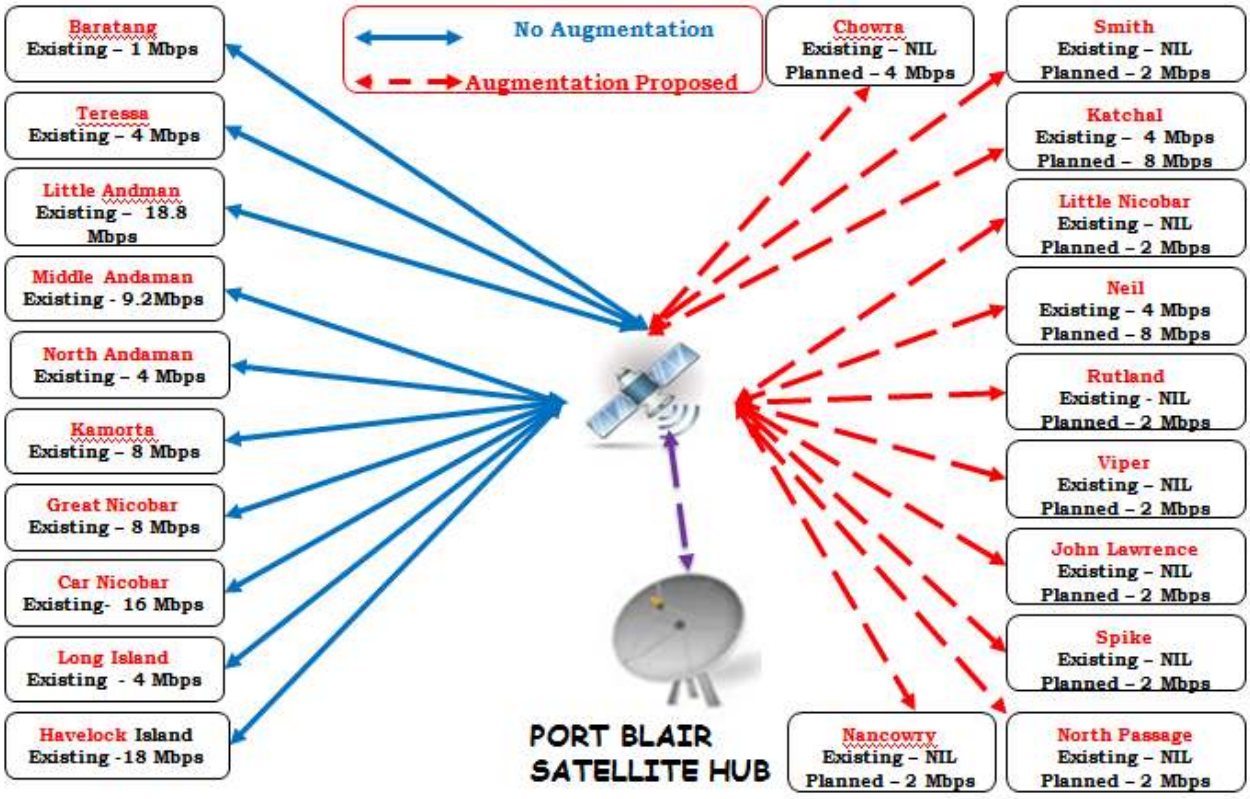
- There are some islands viz. Kamorta, Terresa and Long island where there is enough link capacity. However, augmentation of satellite link capacity to 8 Mbps has been planned in respect of Katchal, and Neil islands.
- Requirement of connectivity through satellite media for those islands of ANI that will be connected in a ring fashion from both sides (Chennai and Kolkata), will be reviewed later after completion of submarine cable laying project.

Fig. 3.1- Augmentation of Satellite Bandwidth- Connectivity of ANI from Mainland



- As mentioned earlier that there are some islands which are not having any telecom connectivity till date. These islands are Chowra, Nancowry, Little Nicobar, Smith, North Passage, Spike, Rutland, Viper and John Lawrence. New satellite links (4 Mbps link for Chowra and 2 Mbps link for each of the other islands) for connectivity with Portblair have been planned in these islands. **(Fig. 3.2)**

Fig. 3.2 -Augmentation of Satellite Bandwidth- Connectivity of ANI from Port Blair



3.15 The comprehensive plan for inter-island connectivity through satellite media is described below.

Table 3.9

Planned Augmentation of Inter-island connectivity through satellite media

Sl. No.	Name of Islands	Popu-lation of Island	Existing Satellite Bandwidth (in Mbps)		Planned Satellite Bandwidth (in Mbps)	
			Connectivity with Port Blair	Connectivity with the mainland	Connectivity with Port Blair	Connectivity with the mainland
1	Car Nicobar Island	17841	16	4	16	32
2	Chowra Island	1270	0	0	4	0
3	Great Nicobar Island	7903	8	0	8	8
4	Kamorta Island	3688	8	0	8	0
5	Katchal Island	2955	4	0	8	0
6	Little Nicobar Island	438	0	0	2	0
7	Nancowry Island	775	0	0	2	0
8	Teressa Island	1934	4	0	4	0
9	Baratang Island	3174	1	0	1	0
10	Long Island	1035	4	0	4	0
11	Middle Andaman Island	58149	17.44	0.8	17.44	0.8
12	North Andaman Island	42541	11.0	0.4	11.0	0.4
13	Smith Island	600	0	0	2	0
14	North Passage Island	0	0	0	2	0
15	Spike Island	0	0	0	2	0
16	Havelock Island	6315	18	0	18	16
17	Little Andaman	18823	18.86	0	18.88	32
18	Neil Island	3040	4	0	8	0
19	Rutland Island	347	0	0	2	0
20	Viper Island	0	0	0	2	0
21	John Lawrence	0	0	0	2	0
22	South Andaman Island	209597	NA	286.92	NA	600
Total Requirement			**114.30**	**292.12**	**142.33**	**689.20**

3.16 To accomplish the above mentioned bandwidth up-gradation as well to establish new satellite links, Island-wise requirement of Intermediate Data Rate (IDR) systems and the estimated expenditure is given in Table 3.10 and 3.11 respectively.

Table 3.10
Island-wise requirement of IDR systems

Sl. No.	Name of Islands	2 Mbps IDR	2x2 Mbps IDR	8 Mbps IDR	2x8 Mbps IDR	34 Mbps IDR	Up-gradation of 2 to 8 Mbps	2 Mbps modems	8 Mbps modems	34 Mbps modems
1	Car Nicobar Island	0	0	0	0	1	0	0	0	1
2	Chowra Island	0	1	0	0	0	0	2	0	0
3	Great Nicobar Island	0	0	1	0	0	0	0	1	0
4	Kamorta Island	0	0	0	0	0	0	0	0	0
5	Katchal Island	0	0	0	0	0	1	0	1	0
6	Little Nicobar Island	1	0	0	0	0	0	1	0	0
7	Nancowry Island	1	0	0	0	0	0	1	0	0
8	Teressa Island	0	0	0	0	0	0	0	0	0
9	Baratang Island	0	0	0	0	0	0	0	0	0
10	Long Island	0	0	0	0	0	0	0	0	0
11	Middle Andaman Island	0	0	0	0	0	0	0	0	0
12	North Andaman Island	0	0	0	0	0	0	0	0	0
13	Smith Island	1	0	0	0	0	0	1	0	0
14	North Passage Island	1	0	0	0	0	0	1	0	0
15	Spike Island	1	0	0	0	0	0	1	0	0
16	Havelock Island	0	0	0	1	0	0	0	2	0
17	Little Andaman	0	0	0	0	1	0	0	0	1
18	Neil Island	0	0	0	0	0	1	0	1	0
19	Rutland Island	1	0	0	0	0	0	1	0	0
20	Viper Island	1	0	0	0	0	0	1	0	0
21	John Lawrence Island	1	0	0	0	0	0	1	0	0
22	South Andaman Island	0	0	0	0	0	0	0	0	20
Total Requirement		**8**	**1**	**1**	**1**	**2**	**2**	**10**	**5**	**22**

Table 3.11
IDR System Costs

Sl. No.	Name of Equipment	No. of Equipments	Unit Price[11] (Rs Crore)	Total Price (Rs Crore)
1	No. of Equipments required for 2 Mbps IDR	8	0.70	5.6

[11] Costs of IDR systems have been given in Table 2.9.

Sl. No.	Name of Equipment	No. of Equipments	Unit Price[11] (Rs Crore)	Total Price (Rs Crore)
2	No. of Equipments required for 2x2 Mbps IDR	1	0.80	0.8
3	No. of Equipments required for 8 Mbps IDR	1	1.00	1.0
4	No. of Equipments required for 2x8 Mbps IDR	1	1.40	1.4
5	No. of Equipments required for 34 Mbps IDR	2	2.40	4.8
6	No. of Equipments required for upgradation from 2 to 8 Mbps IDR	2	0.50	1.0
7	No. of 2 Mbps CnC Modems	11*	0.10	1.1
8	No. of 8 Mbps CnC Modems	6*	0.25	1.5
9	No. of 34 Mbps CnC Modems	25*	0.55	13.75
	Total			**30.95**

* Includes 10% as spares.

3.17 Above requirement of IDR equipments have been considered purely for the purpose of estimating the expenditure required. It is to be kept in mind that the actual fund requirement may vary as it depends upon various factors such as whether the existing satellite bandwidth and the additional bandwidth are made available from the satellites at same or different orbits, whether the additional bandwidth is in the C-band or other bands, existing infrastructure available at each earth station, its remaining usable life etc. These can be ascertained only while making the detailed project report (DPR).

3.18 There are some islands, whose distance from the nearest islands is less than 40 Km **(Table 3.12).** It may be possible to provide microwave links in some of these islands from the nearest island. Accordingly, the Authority had requested TSPs providing services in ANI to conduct feasibility study. Most of them have opted for table-top exercise. As a sample, survey report submitted by one of the TSPs is placed at **Annexure 3.1**. Being table-top exercise, these reports do not instill confidence to draw firm conclusions. Therefore, a detailed feasibility

study needs to be undertaken by visiting each of these islands. Instead of establishing the earth station, setting up of MW links may prove to be a cheaper option,. It will also affect actual requirement of new IDR stations proposed in this plan. Therefore, the Authority recommends that the feasibility study of establishing the MW link may be completed before deciding to establish a new earth station.

Table 3.12
Islands which are at a less than 40 Km distance from the nearest Island

Sl. No.	Name of Island	Nearest Station/Island	Approx. distance from the nearest station (in Km)
1	Chowra Island	Teressa	25
2	Nancowry	Kamorta	20
3	Little Nicobar Island	Great Nicobar	30
4	Smith Island	Diglipur	20
5	Spike Island	Rangat	10
6	Rutland Island	Port Blair	18
7	Viper Island	Port Blair	10
8	John Lawrance Island	Havelock	25
9	North Passage Island	Rangat	25

Satellite Bandwidth Hiring Charges:

3.19 As discussed in Chapter II, it has been assumed that 1 MHz of satellite bandwidth is required to cater to 1.33 Mbps. Accordingly, annual satellite bandwidth hiring charges comes out to be Rs. 86.84 crore as shown in Table below.

Table 3.13
Cost Estimation for Satellite Bandwidth Hiring Charges

Item	Value	Remark
Connectivity requirement through satellite	831.53 Mbps	142.33 Mbps for connectivity with Portblair+689.2 Mbps for connectivity with the mainland.
Total satellite BW required	625.21 MHz	1.33 Mbps per MHz
No. of Transponders Required	17.37	One Transponder = 36 MHz
Annual satellite bandwidth hiring charges	**Rs. 86.84 crore**	@Rs. 5 crore per Transponder

c. Bandwidth upgradation of the Islands connected through OFC

3.20 An OFC with STM-1 system already exists along the NH223 from Port Blair to Diglipur connecting North Andaman, Middle Andaman, Baratang and South Andaman Islands. Therefore, augmentation of bandwidth can be achieved by enhancing the capacity of existing transmission systems. Existing STM-1 can be replaced by the STM-16 systems. As a result, bandwidth at these islands will increase from 155 Mbps to 2.5 Gbps.

3.21 However, the OFC links is working in linear fashion and is prone to fault. It is desirable to have OFC in ring configuration to provide redundancy, particularly when it is connecting another DHQ (Mayabandar) to Port Blair. As per the feedback given by BSNL, there is no alternate route available for laying the OFC. Therefore, it is recommended to lay the OFC on the other side of the NH 223.

3.22 The transmission system planned is based on 40λ, 2.5G, DWDM. The route considered is Port Blair – Ferrarganj – Rangat – Mayabander – Diglipur. The requirement of equipment for system up-gradation and estimated expenditure requirement are given below:

Table 3.14
Proposed OFC and Telecom Equipment Requirement

OFC Length	Total OFC cost[12]	Equipment Required	Total Equipment Cost[13]	Total Cost
300 Km approx	15 crore	OADM-18, OTM-2, DXC-2	5 crore	20 crore

2G Mobile Coverage

3.23 All the 3 district headquarters and 9 sub-district headquarters in ANI have 2G mobile coverage. As far as coverage of towns is concerned, all the 5 towns are covered by 2G. Status of 2G coverage in A & N Islands is given below:

[12] OFC laying cost=5 Lakh per Km.
[13] Cost per OTM=Rs. 0.6 Crore, OADM=Rs. 0.1 Crore and DXC= Rs. 1 Crore

Table 3.15
Status of 2G coverage

Name of District	Whether DHQs are covered by 2G	Total No. of Towns	Total No. of towns covered by 2G Coverage	Total No. of SDHQs	Total No. of SDHQs having 2G Coverage
N&M Andaman	Yes	1	1	3	3
South Andaman	Yes	4	4	3	3
Nicobar	Yes	0	0	3	3
Total		**5**	**5**	**9**	**9**

3.24 In Nicobar, BSNL is the sole telecom provider. However, in North & Middle Andaman and South Andaman, three other TSPs viz. Airtel, Vodafone and Reliance are also having presence though at a few places only. SDHQ-wise availability of 2G networks of different TSPs is given in Table below.

Table 3.16
SDHQ wise coverage of 2G network

Sub-District Headquarter of	BSNL	Bharti Airtel	Vodafone	Reliance
Car Nicobar	Y	N	N	N
Nancowry	Y	N	N	N
Great Nicobar	Y	N	N	N
Diglipur	Y	Y	Y	Y
Mayabunder	Y	Y	Y	Y
Rangat	Y	Y	Y	Y
Ferrargunj	Y	Y	Y	Y
Port Blair	Y	Y	Y	Y
Little Andaman	Y	Y	Y	N

3.25 Out of total 396 villages, only 192 villages have 2G mobile coverage and there are 204 villages which do not have any mobile coverage in ANI. The status of 2G mobile coverage is given in Table below.

Table 3.17
Status of Village coverage

Name of District	Total No. of inhabited villages	No. of Villages having mobile coverage	% of Villages having mobile coverage	Uncovered Villages
N&M Andaman	198	87	44	111
South Andaman	108	77	71	31
Nicobar	90	28	31	62
Total	**396**	**192**	**48**	**204**

Phase Wise Plan to increase '2G' mobile coverage

3.26 As discussed in Chapter-II, all the villages having population of 100 or more, are planned to be covered in phase–I. It will increase the population having 2G mobile coverage, from present figure of 87% to 99%, as shown in Table below. It will require that out of total 204 uncovered villages in ANI, 105 villages should be provided 2G mobile services.

Table 3.18
District Wise Plan to cover remaining uncovered villages

District	Total Population	% of population having coverage	No. of villages with population of 100 or more that are required to be provided 2G coverage	% of total population that will be covered if villages with population of 100 or more are covered
N&M Andaman	105597	76%	56	98%
South Andaman	238142	97%	17	100%
Nicobar	36842	56%	32	98%
Total	**380581**	**87%**	**105**	**99%**

3.27 If all the 105 villages, as discussed above, are provided with 2G coverage, island-wise distribution of population having 2G coverage will be as given in Table below.

Table 3.19
Island Wise Plan to cover remaining uncovered villages

Sl. No.	Habited Islands	Population	Population having 2G Coverage currently	Population that will have 2G coverage
1	Baratang Island	3174	80%	96%
2	Car Nicobar Island	17841	48%	100%
3	Chowra Island	1270	0%	100%
4	Great Nicobar Island	7903	83%	96%
5	Havelock Island	6315	83%	100%
6	Kamorta Island	3688	72%	98%
7	Katchal Island	2955	46%	100%
8	Little Andaman	18823	88%	99%
9	Little Nicobar Island	438	0%	32%
10	Long Island	1035	99%	99%
11	Middle Andaman Island	58149	82%	98%
12	Nancowry Island	775	73%	97%
13	Neil Island	3040	100%	100%
14	North Andaman Island	42541	69%	99%
15	Rutland Island	347	0%	49%
16	Smith Island	600	44%	100%
17	South Andaman Island	209597	98%	100%
18	Teressa Island	1934	51%	100%
	Total Population of ANI	**380581**	**87%**	**99%**

3.28 It can be seen from the table above, that in Little Nicobar and Rutland Islands, still a sizeable percentage of population will not be having 2G coverage, even after providing all the villages with population of 100 or more with 2G coverage. However, if the following four villages are also provided with 2G coverage, then approximately 67% population in Little Andaman and 96% population in Rutland will have 2G coverage. Therefore, total 109 (listed at **Annexure 3.2**) villages will be required to be given 2G coverage.

Table 3.20
Additional villages planned for 2G coverage

Sl. No.	Name of District/ Sub District/ Town/ Village	Name of Island	Total Population
1	Pulloullo/Puloulo	Little Nicobar Island	81
2	Pulopanja	Little Nicobar Island	75
3	Rutland	Rutland Island	76
4	Bamboo Nallaha incl. Kichad Nallaha	Rutland Island	96

Accordingly, 2G BTSs have been planned for these villages also.

Infrastructure and Estimated Expenditure required

3.29 As discussed in Chapter-II, it has been assumed that one BTS shall be required for each village; BTSs shall be using microwave backhaul and OFC backhaul in almost equal proportion; 80% of towers shall be Ground based Towers (GBTs) while remaining 20% shall be Roof Top Towers (RTT). Further, it has been assumed that one thirds of total GBT required will be of 60 meters height and rest will be of 40 meters height. The infrastructure required for 2G mobile Coverage of 109 villages and the estimated expenditure, as per the estimated costs of BTSs in various configurations given in Table 2.12, shall be as given in Table below.

Table 3.21
Infrastructure and Estimated Expenditure required for enhancing 2G mobile Coverage

Name of District	No. of BTSs required	No. of BTSs with MW backhaul			No. of BTSs with OFC in backhaul			Total BTSs cost (in crore)
		With RTT	With 40 meter GBT	With 60 meter GBT	With RTT	With 40 meter GBT	With 60 meter GBT	
N&M Andaman	56	6	15	7	6	15	7	39.13
South Andaman	19	2	4	3	2	5	3	11.39
Nicobar	34	3	10	4	3	10	4	27.56
Total	**109**	**11**	**29**	**14**	**11**	**30**	**14**	**78.09**

3.30 Further considering two new BSC[14]s to cater to 109 new BTSs, total cost will be around Rs. 83.09 crore.

3G Mobile coverage

3.31 The '3G' coverage in ANI is very limited. Not even all DHQs and SDHQs are having 3G coverage. District-wise coverage of 3G network is given in Table below.

Table 3.22

Summary of 3G coverage

District	Total No. of Sub-districts	No. of SDHQs covered by 3G	Total No. of Towns	Total No. of towns covered by 3G	Total No. of Inhabited Villages	No. of Villages Covered by 3G
N&M Andaman	3	3	1	0	198	17
South Andaman	3	1	4	4	108	29
Nicobars	3	0	0	0	90	0
Total	9	4	5	4	396	46

Plan to increase '3G' mobile coverage and the Estimated Expenditure Required

3.32 As discussed in Chapter-II, all the DHQ/SDHQ/Towns should have 3G coverage. Further it has been assumed that one Node-B will cater to 3000 population. Requirement of Node-Bs, thus calculated, is given in Table 3.24. It will require an estimated investment of approximately Rs. 6.47 crore.

[14] Cost of one BSC has been taken as Rs. 2.5 crore.

Table 3.23

Node-Bs required for augmentation of 3G capacity

Name of District	DHQ/SDHQ/Town	Total Population	Existing 3G Node Bs	Estimated 3G Node Bs	Additional Node Bs required
N&M Andaman	Diglipur	3797	1	2	1
N&M Andaman	Mayabunder	2845	1	1	0
N&M Andaman	Rangat	3784	1	2	1
N&M Andaman	Bakultala	2741	0	1	1
South Andaman	Bambooflat	7962	1	3	2
South Andaman	Port Blair	108058	22	37	15
South Andaman	Prothrapur	10308	1	4	3
South Andaman	Garacharma	14419	1	5	4
South Andaman	Ferrargunj	1314	0	1	1
South Andaman	Hut Bay	7075	0	3	3
Nicobar	IAF Camp	731	0	1	1
Nicobar	Kamorta/Kalatapu (Incl.Sanuh)	1885	0	1	1
Nicobar	Campbell Bay	5736	0	2	2
Total			**28**	**63**	**35**

Table 3.24

Estimated Investment required for augmentation of 3G network

District	No. of Node Bs required	Cost[15] (Rs crore)
Nicobar	4	0.84
N&M Andaman	3	0.59
South Andaman	28	5.04
	Total	**6.47**

Connectivity along Highway Coverage:

3.33 The Andaman Trunk Road, which is also known as National Highway No. 223 (NH223), runs through three major islands of Andaman which are North, Middle & South Andaman. Among the TSPs, BSNL has the highest coverage along this highway as shown in table below. Coverage provided by other TSPs is in that part of the highway which is already having coverage by BSNL.

[15] Cost per Node B has been specified in Table 2.13.

Table 3.25
Summary of Highway Coverage by TSPs

Name of TSP	Total Length of NH 223 (Km)	Mobile Coverage (Km)	Percentage Coverage
Airtel	300	70	23%
BSNL	300	171	57%
Reliance	300	0	0%
Vodafone	300	35	12%

3.34 Out of total 300 km of National Highway, approximately 80 km falls under Jarwa tribal reserve belt and Forest area which can be left uncovered. Remaining 49 km of uncovered National Highway need to be covered as 171 km is already covered. In the uncovered portion of National Highway (49KM), GBT based 2G BTSs have been planned.

Estimated Cost

3.35 As per the survey report by BSNL, 6 BTS would be sufficient to cover this uncovered 49 km of the highway. It is assumed that 500 meter spur OFC and 40 meter GBT shall be required for each BTS. Applying the cost of the BTS with such a configuration, as mentioned in table 2.12, estimated investment required will be around **Rs. 3.58 crore**[16].

Summary of investment required for ANI

3.36 Investment required for the augmentation of telecom connectivity and various telecom services in ANI have been discussed in this chapter. As shown in Table 3.26, there is a requirement of Rs. 1772.91 crore as onetime investments.

[16] Out of 6 additional planned BTSs. 2 will be installed in South Andaman and remaining 4 will be installed in N&M Andaman District.

Table 3.26
Summary of Capital Investment Required

Sl. No.	Item	Investment Required (in crore)
1.	Equipments for the augmentation of satellite bandwidth	30.95
2.	Upgradation of OFC network	20.00
3.	Augmentation of 2G mobile coverage	83.09
4.	Augmentation of 3G mobile coverage	6.47
5.	Augmentation of National Highway coverage	3.58
6.	Total Cost	144.09
7.	Cost along with 20% overheads	172.91
8.	Submarine Cable	1600
9.	**Total One Time Investment**	**1772.91**

3.37 Apart from the capital investment, there is requirement of investment on annual basis mainly for satellite bandwidth charges and the maintenance charges. Annual satellite hiring charges have been estimated as Rs. 86.84 crore (Table 3.13). Considering O&M charges being 10% of the onetime capital investment, there is a requirement of **Rs. 104.16 crore** on annual basis in ANI as sown in Table 3.27. The investment on annual basis may be reviewed after a period of five years.

Table 3.27
Summary of Investment Required on Annual Basis

Sl. No.	Item	Annual Investment Required (in crore)
1.	Satellite Bandwidth Charges	86.84
2.	Operation and maintenance Charges	17.32
	Total	**104.16**

CHAPTER–IV: COMPREHENSIVE TELECOM PLAN FOR LAKSHADWEEP

4.1 Lakshadweep is the smallest Union Territory of India. This archipelago consists of 36 islands with an area of around 32 sq. Km. which are scattered over a total area of around 20,000 Sq. Km. Lakshadweep has total lagoon area of 4,200 Sq. Km and Exclusive Economic Zone of about 4,00,000 Sq. Km. These islands lie between 8°-12° North Latitude and 71°-74° East Longitude and are about 220 to 440 kilometers away from Kochi in Kerala. Out of 36 islands, only 11 islands viz. Kavaratti, Kalpeni, Minicoy, Agatti, Kadmat, Androth, Amini, Kiltan, Chetlat, Bitra and Bangaram are inhabited. Kavaratti is the capital of Lakshadweep.

4.2 Lakshadweep has only one district and 10 sub-districts. There are only 6 towns and 6 villages in Lakshadweep. As per census 2011, its population is 64473 with 78.08% urban population. It has a high population density of over 2000 persons per sq km.

Table 4.1
Island wise Population and Geographical Area of Lakshadweep

Name of Island	Population			Total Area (Sq. km)	Density (per Sq Km)
	Rural	Urban	Total		
Agatti	7521	0	7521	3.84	1959
Amini	0	7661	7661	2.6	2947
Androth	0	11191	11191	4.9	2284
Bangaram	45	0	45	2.3	20
Bitra	271	0	271	0.11	2464
Chetlat	2347	0	2347	1.4	1676
Kadmat	0	5404	5404	3.2	1689
Kalpeni	0	4419	4419	2.79	1584
Kavaratti	11	11210	11221	4.22	2659
Kiltan	3946	0	3946	1.76	2242
Minicoy	0	10447	10447	4.8	2176
LAKSHADWEEP	**14141**	**50332**	**64473**	**31.92**	**2020**

Telecom Connectivity of Lakshadweep with rest of the Country:

4.3 Satellite is the only media for the connectivity of Lakshadweep with rest of the country. All the islands, except Bangaram have direct satellite links to Ernakulam and/or Bangalore. Bangaram is connected to Agatti through MW link. Total available bandwidth with the TSPs for connectivity with mainland is 106 Mbps. The major part of bandwidth (102 Mbps) is provided by BSNL.

Table 4.2
Telecom connectivity of Lakshadweep from rest of the country

Sl.No.	Name of Island	Connected to	Bandwidth (MHz)	Bandwidth (Mbps)	Name of Operator
1	Agatti	Ernakulam	NA	2	Airtel
			7	8	BSNL
		Bangalore	4	2	BSNL
2	Amini	Ernakulam	7	8	BSNL
		Bangalore	4	2	BSNL
3	Androth	Ernakulam	5.8	4	BSNL
		Bangalore	8	4	BSNL
4	Bitra	Ernakulam	3	2	BSNL
		Bangalore	4	2	BSNL
5	Chetlat	Ernakulam	1.8	2	BSNL
		Bangalore	4	2	BSNL
6	Kadmat	Ernakulam	13.8	10	BSNL
7	Kalpeni	Ernakulam	3	2	BSNL
		Bangalore	4	2	BSNL
8	Kavaratti	Ernakulam	NA	2	Airtel
			48	34	BSNL
9	Kiltan	Ernakulam	12	8	BSNL
10	Minicoy	Ernakulam	12	8	BSNL
		Bangalore	4	2	BSNL
	Total		**145.4**	**106**	

Inter-Islands Telecom Connectivity

4.4 As stated above, Bangaram is connected through MW link to Agatti. Apart from this, there is no direct links for inter-island connectivity in Lakshadweep. The bandwidth of 106 Mbps with the mainland is also utilised for inter-island connectivity.

Future requirement of bandwidth

4.5 As mentioned above, only 106 Mbps bandwidth is available on Lakshadweep Islands. Clearly, this bandwidth is not sufficient. The methodology to assess the future requirement of bandwidth has been discussed in Chapter-II. Following the projections for phase-I, made in the Authority's earlier recommendations on "National Broadband Plan" dated 8th December 2010, i.e. availability of 2 Mbps bandwidth per household with projected penetration of 12%, 39% and 64% in villages, towns and cities respectively with a contention ratio of 1:10, estimated backhaul requirement for these islands has been worked out as given in Table below.

Table 4.3
Estimated Bandwidth requirement at each island

Sl. No.	Island	Rural Household	Urban Household	Total Bandwidth (in Gbps)
1	Agatti	1311	0	0.31
2	Amini	0	1375	1.07
3	Androth	0	1806	1.41
4	Bangaram	17	0	0.00
5	Bitra	75	0	0.02
6	Chetlat	526	0	0.13
7	Kadmat	0	1061	0.83
8	Kalpeni	0	934	0.73
9	Kavaratti	3	2246	1.75
10	Kiltan	778	0	0.19
11	Minicoy	0	1442	1.12
Total		**2710**	**8864**	**7.56**

Requirement of Additional Connectivity and the Estimated Expenditure involved

a. Submarine connectivity for major Islands

4.6 Currently, communication to these islands is through satellite only with no redundant media available. Therefore, any outage in the satellite link leads to complete cut-off of these islands with the mainland. Submarine

OFC cable may be an alternate media. But, surely, it is not going to be commercial viable option considering the fact that the entire population of Lakshadweep is only 64473. Moreover, there is not a single island, where bulk of the population resides. The population is almost evenly distributed over many islands.

4.7 The Authority is of the firm opinion that, keeping in view its strategic importance to the country, a secure and reliable connectivity to Lakshadweep is essential. Therefore, its headquarter i.e. Kavaratti and other major islands viz. Agatti, Androth and Minicoy should be connected with the mainland through a submarine OFC. As shown in Fig 4.1, Amini and Kalpeni, being on the proposed submarine route, may also be connected. The planned submarine cable connectivity plan for connecting these six islands of Lakshadweep is given in the Fig 4.1 below.

Fig 4.1
Submarine cable connectivity plan

4.8 Route length to connect different islands as per above plan is given in Table below. To connect these six islands, approximately 936 Km of submarine cable laying will be required.

Table 4.4
Route Distance of the planned submarine cable

Sl. No.	Segment	Approx. Distance (in Kms)
1	Cochin to Kalpeni	287
2	Kalpeni to Kavaratti	122
3	Kavaratti to Agatti	66
4	Agatti to Amini	66
5	Amini to Androth	105
6	Androth to Kalpeni	81
7	Kalpeni to Minicoy	209
	Total	**936**

4.9 As discussed earlier, ANI Administration had invited bids for connecting some of the islands of ANI. Based on these bids, a broad estimate was made in Chapter-II to lay the submarine cable which comes out to be approx. Rs. 0.5 crore per Km. In the absence of any other information regarding the cost of laying submarine cable, the Authority has used this cost for making an estimation of the investment required for laying the submarine cable in Lakshadweep. Applying this rate, total estimated cost of laying submarine cable to connect six islands of Lakshadweep as per above plan comes out to be Rs. 468 crore. Accordingly, **the Authority recommends that keeping in view strategic importance of Lakshadweep, a secure and reliable connectivity should be established through a submarine cable. This cable will connect Kochi/Cochin with Kavaratti, Agatti, Androth, Kalpini, Amini and Minicoy islands. For this purpose 936 Km submarine cable may be laid with an estimated expenditure of Rs 468 crore.**

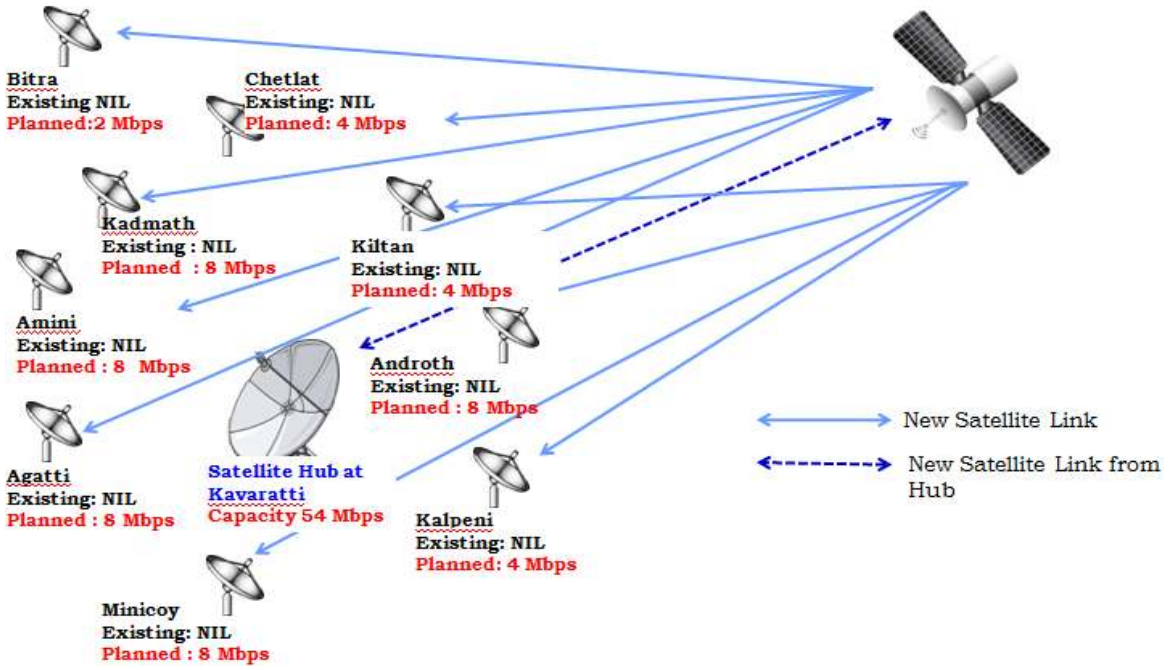
b. Satellite Bandwidth Augmentation:

4.10 The Authority is of the opinion that capacity of the existing satellite links should be enhanced to cater to the immediate and short-term bandwidth requirement of inter-island connectivity. These satellite links will act as redundant links after the commissioning of the submarine OFC cable. The approach adopted for the augmentation of satellite connectivity to Lakshadweep has been discussed in Chapter-II. Network upgradation of satellite systems planned for Lakshadweep is given below.

- Augmentation of 36 Mbps satellite bandwidth available at Kavaratti by additional 34 Mbps.

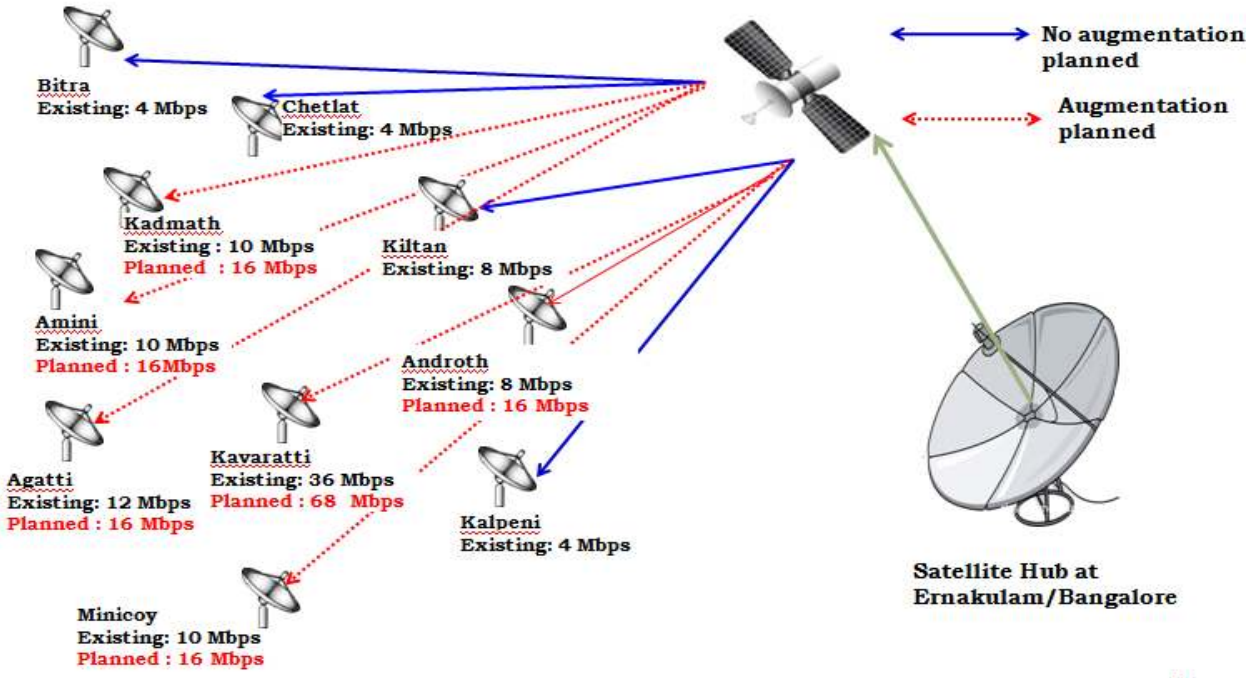
- In Lakshadweep, currently all islands are connected directly to Ernakulam and/or Bangalore satellite hub station. Apart from the Bangaram Island, which is connected through MW link to Agatti, there is no direct inter-island telecom connectivity links. To establish direct inter-island links, a satellite hub at Kavaratti and 2Mbps/8 Mbps links from each island have been planned, which can be used for (i) SWAN network (ii) Landline network of BSNL and (iii) as a backup link for mobile network working on direct satellite links from each of the Islands to Ernakulam/Bangalore. **(Fig. 4.2)**

Fig. 4.2 Augmentation of Satellite Bandwidth- Connectivity of Lakshadweep from its Headquarter (Kavaratti)



- Augmentation of the capacity of some of the existing satellite links based depending upon population of islands. **(Fig. 4.3)**

Fig. 4.3 Augmentation of Satellite Bandwidth- Connectivity of Lakshadweep from Mainland



4.11 The satellite bandwidth augmentation plan for different islands as given in Table below.

Table 4.5
Satellite Bandwidth Augmentation Plan for Lakshadweep islands

Sl No.	Name of Island	Satellite Bandwidth Connectivity to Kavaratti		Satellite Bandwidth Connectivity to Mainland		Total Existing Bandwidth (Mbps)	Total Planned Bandwidth (Mbps)
		Existing Bandwidth (Mbps)	Planned Bandwidth (in Mbps)	Existing Bandwidth (Mbps)	Planned Bandwidth (Mbps)		
1	Agatti	0	8	12	16	12	24
2	Amini	0	8	10	16	10	24
3	Androth	0	8	8	16	8	24
4	Bitra	0	2	4	2	4	4
5	Chetlat	0	4	4	4	4	8
6	Kadmath	0	8	10	16	10	24
7	Kalpeni	0	4	4	4	4	8
8	Kiltan	0	4	8	4	8	8
9	Minicoy	0	8	10	16	10	24
10	Kavaratti	NA	NA	36	68	36	68
	Total	**0**	**54**	**106**	**162**	**106**	**216**

4.12 As discussed in Chapter II, it has been assumed that spectral efficiency of satellite links will be 1.33 Mbps/MHz and annual cost of hiring satellite bandwidth has been considered as Rs. 5 crore per transponder (i.e. 13.89 lakh/MHz). Accordingly, annual hiring charges for satellite bandwidth comes out to be Rs. 22.55 crore as shown in Table below.

Table 4.6
Cost Estimation for Satellite BW

Item	Value	Remark
Connectivity requirement through satellite	216 Mbps	54 Mbps for connectivity with Kavaratti and 162 Mbps for connectivity with the main land
Total satellite BW required	162.4 MHz	1.33 Mbps per MHz
No. of Transponders required	4.51	One Transponder = 36 MHz
Annual satellite bandwidth hiring charges	**Rs. 22.55 crore**	**@5 crore per transponder**

4.13 To accomplish the above described bandwidth up-gradation as well to establish new satellite links, island-wise requirement of IDR systems and the estimated expenditure is given in Table 4.7 and 4.8 respectively.

Table 4.7
Island-wise requirement of IDR systems

Sl No.	Name of Island	2 Mbps IDR	2x2 Mbps IDR	8 Mbps IDR	34 Mbps IDR	Upgradation of 8 to 16 Mbps	2 Mbps modems at hub site	No. of 8 Mbps modems at hub site	No. of 34 Mbps modems at hub site
1	Agatti			1		1		2	
2	Amini			1		1		2	
3	Androth			1		1		2	
4	Bitra	1					0		
5	Chetlat		1				2		
6	Kadmath			1		1		2	
7	Kalpeni		1				2		
8	Kiltan		1				2		
9	Minicoy			1		1		2	
10	Kavaratti				1				1
	Total	**1**	**3**	**5**	**1**	**5**	**6**	**10**	**1**

Table 4.8
IDR systems Costs

Sl. No.	Name of items required	No. of Item	Unit Price (crore)[17]	Total Price (crore)
1	2 Mbps IDR	1	0.70	0.7
2	2x2 Mbps IDR	3	0.80	2.4
3	8 Mbps IDR	5	1.00	5
5	34 Mbps IDR	1	2.40	2.4
6	upgradation from 8 to 16 Mbps IDR	5	0.50	2.5
7	2 Mbps CnC Modems*	7	0.10	0.7
8	8 Mbps CnC Modems*	11	0.25	2.75
9	Hub at Kavaratti	1	1.60	1.6
	Total			**18.05**

* Includes 10% modems as spares.

[17] Costs of IDR systems have been given in Table 2.9.

2G Mobile Coverage

4.14 All the inhabited islands of Lakshadweep are having coverage of 2G network. Information about DHQ/SDHQ/Town and village wise 2G coverage is given in Table below:

Table 4.9
Status of Village Coverage District-wise

No. of Districts	Whether DHQ is having 2G coverage	No. of SDHQs covered by 2G	Total No. of towns covered by 2G	No. of Villages Covered by 2G
1	Yes	All 10	All 6	5 out of 6

4.15 As can be seen from above Table, except one village, all the towns and inhabited villages have 2G mobile coverage. The only village that does not have 2G mobile coverage is Suheli Cheriyakara which is at a separate small island comprising of only 3 households (11 persons). Though it is under Kavaratti SDHQ it is about 60KM away on a separate island. Therefore, its coverage may be planned at a later stage.

Augmentation of 2G network

4.16 Though islands of Lakshadweep have 2G mobile coverage, but during the visit by a team of TRAI officers, congestion was observed in 2G network in many parts of Lakshadweep. Also, at many important parts of towns, there was no 2G coverage. It was observed that, in general, there is a shortage of BTSs. Therefore, it was felt necessary to consider the augment the 2G network to improve the coverage and Quality of Services (QoS).

4.17 Actual number of BTSs required and their location can be determined only after carrying out detailed survey that can be carried out while preparing the detailed project report. However, for deciding the additional BTSs required, it has been assumed that one BTS shall be able to cater

to maximum 2500 population. Accordingly, DHQ/SDHQ-wise requirement of additional BTSs was calculated and is given in Table below:

Table 4.10
2G Augmentation Plan

Sl. No.	DHQ/SDHQ	Population	Existing BTSs[18]	Required No. of BTSs	Additional Planned BTSs
1	Agatti	7521	2	3	1
2	Amini	7661	1	3	2
3	Androth	11191	2	4	2
4	Bitra	271	1	1	0
5	Chetlat	2347	1	1	0
6	Kadmat	5404	2	2	0
7	Kalpeni	4419	1	2	1
8	Kavaratti	11210	3	4	1
9	Kiltan	3946	1	2	1
10	Minicoy	10447	2	4	2
	Total	**64417**	**16**	**26**	**10**

4.18 Methodology adopted to estimate the expenditure required to install additional 10 BTs has been discussed in Chapter II. Type of backhaul is one of the factors that affect the investment required. The proportion of OFC and microwave in the existing BTSs' backhaul is 85% and 15% respectively. Same proportions have been maintained while planning new BTSs. Configurations of 80% of new BTSs have been taken as 2+2+2 with GBTs while remaining 20% have been taken as 4+4+4 with RTT. Further, it has been assumed that all the GBTs will be of 40 meters height. The infrastructure required for the installation of additional 10 number of 2G BTSs and the estimated expenditure involved, as per the estimated costs of BTSs in various configurations given in Table 2.12, shall be as given in Table below.

[18] Existing BTSs of only BSNL has been considered as Airtel has only 3 BTSs and they carry very less traffic.

Table 4.11
Investment Required

No. of BTSs required	No. of BTSs with MW backhaul		No. of BTSs with OFC in backhaul		Total Cost (in crore)
	With RTT	With 40 meter GBT	With RTT	With 40 meter GBT	
10	0	1	2	7	8.07

3G Mobile Coverage

4.19 The '3G' coverage in Lakshadweep is very limited. As can been from Table below, no other SDHQ except Kavaratti has 3G coverage where BSNL is providing 3G coverage.

Augmentation of 3G network

4.20 The Authority is of the opinion that all DHQ/SDHQs/Towns should have 3G coverage. To estimate the quantum of Node Bs required for the augmentation of 3G networks in Lakshadweep, it has been assumed one Node B will cater to 3000 population. Hence no. of node-Bs required to augment 3G services in Lakshadweep is calculated as given in Table below:

Table 4.12
Node-Bs required for enhancing 3G Coverage

Sl. No.	DHQ/ SDHQ	Population	Existing 3G Node Bs	Estimated 3G Node Bs	Planned Node Bs
1	Agatti	7521	0	3	3
2	Amini	7661	0	3	3
3	Androth	11191	0	4	4
4	Bitra	271	0	1	1
5	Chetlat	2347	0	1	1
6	Kadmat	5404	0	2	2
7	Kalpeni	4419	0	2	2
8	Kavaratti	11210	2	4	2

Sl. No.	DHQ/ SDHQ	Population	Existing 3G Node Bs	Estimated 3G Node Bs	Planned Node Bs
9	Kiltan	3946	0	2	2
10	Minicoy	10447	0	4	4
	Total	**64417**	**2**	**26**	**24**

4.21 Based on the above table, no. of node-Bs required to augment 3G services in Lakshadweep is 24 which will require an estimated investment of Rs. **4.68 crore**[19].

Summary of Investment required for Lakshadweep

4.22 Investment required for the augmentation of telecom connectivity and various telecom services in Lakshadweep have been discussed in this chapter. As shown in Table 4.13, there is a requirement of Rs. **504.96 crore as onetime investments**.

Table 4.13
Summary of Capital Investment Required

Sl. No.	Item	Investment Required (in Crore)
1.	Equipments for the augmentation of satellite bandwidth	18.05
2	Augmentation of 2G mobile coverage	8.07
3	Augmentation of 3G mobile coverage	4.68
4	Total	30.8
5	Cost along with 20% overheads	36.96
6	Submarine Cable	468
7	**Total One Time Investment**	**504.96**

4.23 Apart from the capital investment, there is requirement of investment on annual basis mainly for satellite bandwidth charges and the maintenance charges. Annual satellite hiring charges have been

[19] Cost of one Node B is taken as Rs 19.5 lakhs as specified in Table 2.13.

estimated as Rs. 22.55 crore (Table 4.6). Considering O&M charges being 10% of the onetime capital investment, there is a total requirement of **Rs. 26.24 crore** on annual basis in Lakshadweep as sown in Table 4.14. These annual charges may be reviewed after a period of 5 years.

Table 4.14
Summary of Investment Required on Annual Basis

Sl. No.	**Item**	**Annual Investment Required (in Crore)**
1.	Satellite Bandwidth	22.55
2.	Operation and Maintenance	3.69
	Total	**26.24**

CHAPTER–V: SUPPORTING POLICY INITIATIVES

5.1 The National Telecom Policy 2012 (NTP 2012) envisions transforming the country into an empowered and inclusive knowledge-based society, using telecommunications as a platform. NTP-2012 articulates the need for ***Broadband on Demand*** and also envisages leveraging telecom infrastructure to enable all citizens and businesses, both in rural and urban areas, to participate in the Internet and web economy thereby ensuring equitable and inclusive development across the nation. One of the objectives of NTP is to provide high speed and high-quality broadband access to all Gram Panchayats through a combination of technologies by the year 2014 and progressively to all villages and habitations by 2020. This will enable citizens to participate in and contribute to e-governance in key sectors like health, education, skill development, employment, banking etc. to ensure inclusive growth. Clearly, one of the thrust areas of NTP 2012 is to make provisions for broadband services throughout the country.

5.2 India has achieved a lot in telecom in terms of accessibility and connectivity throughout the country. After tremendous growth in voice services over the last 20 years, the telecom industry is now in the midst of a transformational shift, driven by a huge surge in data traffic on telecom networks. A number of mobile operators are rolling out 3G/4G networks across the country. However, their focus is on urban areas.

5.3 The roll-out of new networks has further accentuated the digital divide between urban and rural/remote areas. In view of the need to facilitate participation of rural India in the growth of the economy through e-Governance, special attention has to be given to developing the telecom infrastructure in rural and remote areas. Though the Government has

taken a number of steps to augment the telecom network in remote areas, a lot still needs to be done.

5.4 The status of telecom services in ANI and Lakshadweep has been discussed in detail in previous chapters. These islands are dependent exclusively on satellite media for inter-island connectivity as well as for connectivity with the mainland. Acute shortage of bandwidth is a major constraint in extending broadband services, which is a pre-requisite for the roll-out of e-governance, e-education, e-health and other similar services.

5.5 While preparing the comprehensive telecom plan for ANI and Lakshadweep, it has been concluded that providing telecom services in these islands is, at present, a commercially non-viable option. This is the prime reason why only 2 TSPs in Lakshadweep and 4 TSPs in ANI are providing telecom services. Apart from BSNL, other TSPs are providing only 2G services, that too in a limited parts of these islands. BSNL is also not keen on expanding its services in these islands, as it is a loss-making proposition. In fact, BSNL has surrendered some transponders last year which were rendered excess due to better utlisation/redistribution of satellite bandwidth available without compromising bandwidth in terms of throughput.

5.6 In view of the above, one time capital investment only may not be sufficient. It is necessary to adopt other suitable measures, including viability gap funding to make the telecom investment attractive. The Authority is of the view that following are the important policy initiatives that are required to be undertaken for the orderly growth of telecom infrastructure in ANI and Lakshadweep.

a. Ensuring Availability of Additional Satellite Bandwidth

5.7 Satellite is the only media, at present, for providing connectivity to these islands. In these recommendations, connectivity through submarine cable has been envisaged. However, to cater to the short-term and medium-term requirement and thereafter also to retain the satellite connectivity as a redundant media, augmentation of satellite bandwidth has been planned as mention in Para 2.15 and 2.16 of Chapter-II.

Table 5.1
Existing and Planned Satellite Bandwidth in ANI and Lakshadweep

UT	Existing Satellite Bandwidth (MHz)	Additional bandwidth planned (MHz)	Total satellite bandwidth planned (MHz)	Satellite bandwidth charges (crore)
ANI	356.07	269.14	625.21	86.84
Lakshadweep	147.84	14.57	162.41	22.55
Total	503.91	283.71	787.62	109.39

5.8 To discuss the feasibility of augmentation of satellite bandwidth in ANI and Lakshadweep and related issues, a meeting with ISRO and BSNL was held in TRAI on 28th May 2014. A tentative plan for the augmentation of satellite bandwidth was discussed in the meeting. ISRO provided details of the future plans of launch of satellites. Minutes of the meeting are placed at **Annexure 5.1**. The salient points of discussion are:

- Nearly a year ago, BSNL was offered 1.5 transponders in lower Ext-C band (3600 to 3655 MHz) in GSAT-10 Satellite. Additional 4.5 transponder capacity (3425 to 3600 MHz), which has been identified for terrestrial use, can also be allotted to BSNL, subject to clearance from DoT. However, BSNL has not accepted even 1.5 transponder capacity allotted to it.

- Planned addition to the space segment capacity by ISRO is as given below:

Sl. No.	Satellite	Time frame	Capacity (no. of transponders)
1.	GSAT-16	3rd quarter of 2014	C band: 6 transponder (for allocation)+18 for mandatory spare; Upper Ext C Band : 12 Ku Band : 12
2.	GSAT-11	2016-17	Ku Band: 32 spot beam with 10 Gbps throughput.
3.	GSAT-17	24-30 months after cabinet approval	Replacement of INSAT-3A capacity
4.	GSAT-18	24-30 months after cabinet approval	Replacement of INSAT-3C capacity

- GSAT-11 will have 32 Ku band user beams with corresponding gateway links operating in Ka band and will be very suitable for broadband communication.
- BSNL has been assigned 201 MHz in INSAT 3C in lieu of 302 MHz in INSAT-3E, w.e.f. 23rd March 2014.
- After the sudden decommissioning of INSAT-3E, BSNL requires another satellite for ANI for redundancy purposes. Therefore, BSNL may be provided capacity either in INSAT-4 series of satellites or in any foreign satellite with competitive rates.

5.9 **The Authority recommends the following:**

i. **Additional 283.71 MHz of satellite bandwidth should be made available for telecom connectivity of ANI and Lakshadweep to cater to immediate and short-term requirements.**

ii. **In GSAT-16, which is scheduled to be launched in 3rd quarter of 2014, at least 6 transponders of C-band may be allocated to BSNL**

exclusively for providing telecom services in ANI and Lakshadweep. As BSNL is running telecom operations in the C-band, additional bandwidth in the same band is a preferable option.

iii. **The DoT should explore utilisation of 3400-3600 MHz band for satellite communication only for ANI and Lakshadweep islands. This will require that one of the earth stations in the main land may also be allowed to use this band for satellite communication. Some adjoining areas around the earth station will also have to be excluded from IMT services to avoid interference. For the rest of the country, this band may be utilised as per National Frequency Allocation Plan (NFAP) 2011[20].**

iv. **Due to sudden disruption of services of INSAT 3E, BSNL now has entire satellite bandwidth for ANI on INSAT 3C whose life is going to expire in 2015. Replacement of INSAT 3C and INSAT 3E are not planned in near future. Therefore, ISRO must try to explore the feasibility of distributing the satellite bandwidth on at least two different satellites for redundancy purpose.**

v. **BSNL should be permitted to hire satellite bandwidth directly from foreign satellites which are on the ISRO coordinated orbits.**

vi. **The DoT should explore the utility of Ku band user beam planned in GSAT-11 for providing broadband services in ANI and Lakshadweep. On obtaining requirements from the DoT, DoS should make assignments some user beams to the TSPs.**

[20] As per NFAP 2011, the requirement of IMT including Broadband Wireless Access (BWA) in the frequency band 3400-3600 MHz may be considered for coordination on a case by- case basis subject to availability of spectrum in this band and appropriate protection from out of band emission to the networks in the FSS in the frequency band 3600- 4200 MHz

b. High Satellite Bandwidth Hiring Charges

5.10 Annual satellite bandwidth charges are a major component in total operational costs of TSPs in ANI and Lakshadweep. Satellite bandwidth charges for VSAT application in different bands are given in Table 5.2 below.

Table 5.2

Satellite bandwidth Charges (per Transponder of 36 MHz per annum)

Band	Application	Price w.e.f. 01.04.2012 (crore)	Price escalation over previous price
Ku High Power	VSAT	5.50	14.5%
Ku Low Power	VSAT	4.00	32%
C High Power (INSAT 4 series and above)	VSAT	5.00	-
C Low Power (INSAT 3 series)	VSAT	4.75	93.8%
Extended C Band	VSAT	3.25	32.6%

5.11 There has been a sharp increase in the hiring charges w.e.f. April 2012. Moreover, capital investments as well as other operational and maintenance expenses in these islands are comparatively high because of the remoteness from the mainland and other challenges. Providing coverage in these islands is not remunerative due to the huge mismatch in coverage costs and revenue. These have undermined the viability of telecom operations in these regions. BSNL's revenue and operational costs for the last two years for ANI and Lakshadweep are given in Table 5.3.

Table 5.3
BSNL's Revenue and Expenditure Statement for ANI

Year	Revenue (Rs. Cr.)	Operational costs			Loss (Rs. Cr.)
		Satellite BW charges (Rs. Cr.)	Other costs (Rs. Cr.)	Total operational costs (Rs. Cr.)	
2013-14	53.09	61.80	55.61	117.41	64.3
2012-13	48.15	55.20	53.55	108.75	60.6

Source: BSNL

Table 5.4
BSNL's Revenue and Expenditure Statement for Lakshadweep

Year	Revenue (Rs. Cr.)	Operational costs			Loss (Rs. Cr.)
		Satellite BW charges (Rs. Cr.)	Other costs (Rs. Cr.)	Total operational costs (Rs. Cr.)	
2013-14	9.10	23.05	10.21	33.26	24.16
2012-13	7.34	23.05	8.89	31.94	24.60

Source: BSNL

5.12 Keeping in view the costly satellite bandwidth hiring charges, higher infrastructure cost and the small population scattered over a number of islands, providing telecom services is not commercially viable in these islands. The Authority is of the view that satellite bandwidth charges should completely be borne by the USOF to sustain the loss-making TSP's operations in ANI and Lakshadweep islands. Accordingly, **the Authority recommends that the annual satellite bandwidth hiring charges for providing telecom services in these islands should be borne by USOF completely.**

c. Efficient Utilisation of Satellite Bandwidth

5.13 Satellite bandwidth is a scarce resource. Its effective utlisation to carry data traffic depends on many factors such as compression and modulation techniques, power requirement etc. Nowadays, satellite modems are available that allows full duplex satellite links to transmit concurrently in the same segment of transponder bandwidth. Modern technology allows the use of higher order modulation such as 16QAM, 16APSK, 32 APSK etc. Concurrent use of same segment of transponder

bandwidth for full duplex operation, use of higher order modulation and other technological development results in more efficient use of satellite bandwidth. As the downloaded data is generally significantly more than the data to be uploaded, asymmetric use of satellite bandwidth can also be exploited to deliver more throughputs in the forward direction.

5.14 **Annexure 5.2 and 5.3** provide the link-by-link details of the satellite bandwidth utilisation by the TSPs in ANI and Lakshadweep respectively. An abstract of the same is provided in Table below:

Table 5.3
Satellite Bandwidth Utilisation by TSPs in ANI and Lakshadweep

UT	Total No. of Satellite Links	No. of links operating with C-n-C modems	Satellite Bandwidth Utilisation		
			in MHz	in Mbps	Spectral Efficiency (Mbps per MHz)
ANI	56	21	356.07	407	1.14
Lakshadweep	22	5	147.44	103.5	0.70

5.15 It can be seen from above table, that TSPs are not using the satellite bandwidth in the most optimal manner. Carrier-in-Carrier (C-n-C) modems permit the use of same segment of transponder bandwidth for full duplex operation. BSNL has deployed these modems in many links. Airtel also used this technology in 4 links but still there are many other links which are using conventional modems. Many of the links are using lower order modulation such as QPSK. Considering the scare availability of the satellite bandwidth, it is preferable to use satellite bandwidth most efficiently by using latest technology. In view above, **the Authority recommends that TSPs should deploy the latest technology in the space segment to exploit the satellite bandwidth most efficiently. The DoT should ensure its implementation.**

d. Active Cooperation required from UT administration.

5.16 During the consultation process, the TSPs have brought out some issues on which active cooperation from UT administration is warranted. These issues were taken up by the visiting TRAI team with the respective UT administrations and the response from them was both positive and assuring. Some of these issues are summarized below.

5.17 Entry permit is required to be taken from UT Administration for entering Lakshadweep. Similarly, entry permit is required to enter Nicobar Group of islands. This poses an additional requirement and sometimes causes delay in transportation of equipment and movement of personnel which is otherwise also difficult due to distance from the main land. There is limited chopper facility available between a few islands, which are under the control of the respective UT administrations. Therefore inter-island movement of material is dependent on availability of suitable boats and ferries. The problem is further aggravated by non-availability of jetties in many islands.

5.18 Another issue brought out by the TSPs was land acquisition and necessary permissions from the local authorities such as permission to erect tower, right of way permission etc. Most of the land is forest land in a tribal belt. Therefore, getting permission for setting up towers or installing other telecom facilities is very difficult. TSPs informed that in ANI, UT administration has notified reinstatement charges for black-top road and these rates are applied for all types of surfaces.

5.19 Ensuring availability of diesel in those islands where it is not supplied by the Administration is a big challenge, particularly in islands not having the facility of a jetty (structure used at sea shore for docking boat/ship) like Chowra Island. For bringing telecom material in the island, municipal bodies of ANI impose an octroi charge @ 6% of the cost of

material. This further escalates the cost of providing telecom services in the island. The UT administration ought to consider waiver of this charge or, at the least, a major reduction, say, to 2%, for telecom equipment.

5.20 The Authority is of the opinion that UT administration has to play an active role in facilitating the movement of the personnel and equipment and for resolving all other issues discussed above. Cooperation of UT administration is crucial for the operations and maintenance as well as development of telecom facilities in these islands.

The Authority recommends that

i. **UT administrations should extend all possible cooperation for ensuring the movement of men and material engaged in providing telecom services in these islands.**

ii. **UT Administrations should ensure issuance of entry permits at short notice. It can also explore the possibility of long time entry permits for a few personnel, identified by the TSPs, who are frequently required to visit these islands for operation and maintenance of telecom facilities in ANI and Lakshadweep.**

iii. **UT administrations should accord priority in the allotment of land and necessary permissions to BSNL/other TSPs for the establishment of any telecom infrastructure such as a tower or for laying OFC etc.**

CHAPTER- VI: SUMMARY OF RECOMMENDATIONS

A summary of recommendations has been provided in this Chapter to list out the salient points made in these recommendations. However, it may kindly be noted that the recommendations are to be read in totality along with the reasoning and analysis provided in detail in the previous chapters.

6.1 The Authority recommends that considering the state of telecommunications services in ANI and strategic locations of these islands, connectivity through submarine cable must be established at the earliest possible for all the six identified islands by the DoT, viz. Port Blair, Havelock, Little Andaman, Car Nicobar, Kamorta and Great Nicobar, in the first phase itself and project implementation should be monitored at the highest level in the DoT. [Para 2.12]

6.2 The Authority recommends that in addition to the already planned connectivity through Chennai, connectivity of ANI should also be made from Kolkata through a submarine cable. The submarine cable connecting Chennai – Port Blair – Kolkata could be named the 'SAARC' cable. [Para 2.13]

6.3 The Authority recommends that the requirement of connectivity through satellite media for those islands of ANI that will be connected in a ring fashion from both sides (Chennai and Kolkata), may be reviewed later after completion of submarine cable laying project. However, in case of Lakshadweep, as submarine cable has been planned to provide connectivity from Kochi in linear fashion (i.e. without redundancy), connectivity through satellite should be retained even after the commissioning of submarine cable. [Para 2.15]

6.4 The Authority recommends that all villages with a population of 100 or more should be provided with '2G' mobile coverage in the first phase. [Para 2.21]

6.5 The Authority recommends that the investment of Rs. 2277.87 crore (Rs. 1772.91 crore for ANI and Rs. 504.96 crore for Lakshadweep), as shown in Table 2.14, be incurred for providing reliable and quality telecom services in ANI and Lakshadweep. [Para 2.51]

6.6 The Authority recommends that apart from the one-time capital investment, the DoT/UT administration should compensate the Telecom operation on yearly basis for Rs. 130.40 crore (Rs. 104.16 crore for ANI and Rs. 26.24 crore for Lakshadweep) as viability gap funding as given in Table 2.15. It may be reviewed after five years. [Para 2.53]

6.7 The Authority recommends that keeping in view strategic importance of Lakshadweep, a secure and reliable connectivity should be established through a submarine cable. This cable will connect Kochi/Cochin with Kavaratti, Agatti, Androth, Kalpini, Amini and Minicoy islands. For this purpose 936 Km submarine cable may be laid with an estimated expenditure of Rs 468 Cr. [Para 4.9]

6.8 The Authority recommends the following:

i. Additional 283.71 MHz of satellite bandwidth should be made available for telecom connectivity of ANI and Lakshadweep to cater to immediate and short-term requirements.

ii. In GSAT-16, which is scheduled to be launched in 3rd quarter of 2014, at least 6 transponders of C-band may be allocated to BSNL

exclusively for providing telecom services in ANI and Lakshadweep. As BSNL is running telecom operations in the C-band, additional bandwidth in the same band is a preferable option.

iii. **The DoT should explore utilisation of 3400-3600 MHz band for satellite communication only for ANI and Lakshadweep islands. This will require that one of the earth stations in the main land may also be allowed to use this band for satellite communication. Some adjoining areas around the earth station will also have to be excluded from IMT services to avoid interference. For the rest of the country, this band may be utilised as per National Frequency Allocation Plan (NFAP) 2011[21].**

iv. **Due to sudden disruption of services of INSAT 3E, BSNL now has entire satellite bandwidth for ANI on INSAT 3C whose life is going to expire in 2015. Replacement of INSAT 3C and INSAT 3E are not planned in near future. Therefore, ISRO must try to explore the feasibility of distributing the satellite bandwidth on at least two different satellites for redundancy purpose.**

v. **BSNL should be permitted to hire satellite bandwidth directly from foreign satellites which are on the ISRO coordinated orbits.**

vi. **The DoT should explore the utility of Ku band user beam planned in GSAT-11 for providing broadband services in ANI and Lakshadweep. On obtaining requirements from the DoT, DoS should make assignments some user beams to the TSPs. [Para 5.9]**

[21] As per NFAP 2011, the requirement of IMT including Broadband Wireless Access (BWA) in the frequency band 3400-3600 MHz may be considered for coordination on a case by- case basis subject to availability of spectrum in this band and appropriate protection from out of band emission to the networks in the FSS in the frequency band 3600- 4200 MHz

6.9 The Authority recommends that the annual satellite bandwidth hiring charges for providing telecom services in these islands should be borne by USOF completely. [Para 5.12]

6.10 The Authority recommends that TSPs should deploy the latest technology in the space segment to exploit the satellite bandwidth most efficiently. The DoT should ensure its implementation. [Para 5.15]

6.11 The Authority recommends that:

i. **UT administrations should extend all possible cooperation for ensuring the movement of men and material engaged in providing telecom services in these islands.**

ii. **UT Administrations should ensure issuance of entry permits at short notice. It can also explore the possibility of long time entry permits for a few personnel, identified by the TSPs, who are frequently required to visit these islands for operation and maintenance of telecom facilities in ANI and Lakshadweep.**

iii. **UT administrations should accord priority in the allotment of land and necessary permissions to BSNL/other TSPs for the establishment of any telecom infrastructure such as a tower or for laying OFC etc. [Para 5.20]**

Annexure 1.1

No. 70-01/2013-SU

Government of India
Ministry of Communications & IT
Department of Telecommunications,
PSU Division, Room No. 1206

***

Sanchar Bhawan, New Delhi
Dated 7th January 2014

The Secretary
Telecom Regulatory Authority of India (TRAI)
Mahanagar Doorsanchar Bhawan,
J. L. Nehru Marg (Old Minto Road)
New Delhi

Subject: **Augmentation/Revamping of Telecom Connectivity and Services in Union Territories of Andaman & Nicobar Islands (ANI) and Lakshadweep Islands- Study regarding gap and investment required for formulation of a comprehensive telecom plan.**

Sir,

The telecom coverage in Andaman & Nicobar Islands and Lakshadweep Islands are low as compared to the other parts of the country. Geographical location also acts as a deterrent in provision of quality, reliable telecommunication services in these islands.

2. Union Territory of Andaman & Nicobar Islands is an archipelago of many islands scattered across an area of over 800 kms in the Bay of Bengal and it is a part of West Bengal Licensed Service Area (LSA). Union Territory of Lakshadweep, comprising of 36 islands whereas its population mainly residing in 10 islands scattered in the Arabian Sea, is a part of Kerala LSA. Both Union Territories are facing the many problems regarding telecommunication connectivity both with the mainland as well as within the islands comprising the Union Territories.

3. The basic requirement of the Islands is to provide wide access to information services to all citizens to bridge the digital divide and to socially integrate a geographically dispersed population. Lack of high bandwidth communication channels poses a serious challenge in rolling out e-governance solutions apart from the many constraints in communication both during normal operations as well as during any potential emergency. In this regard, various communications have been received from the Administration of Andaman and Nicobar Islands and Lakshadweep Islands. Beside, the strategic importance of the geographical location of these two Island systems requires robust, reliable connectivity to meet security needs.

4. Andaman & Nicobar administration has taken up the matter for submarine cable connectivity between Andaman and Chennai. Andaman & Nicobar Administration is implementing the execution of the submarine cable connectivity project through its PSU with funding directly from Planning Commission.

5. The problem of reach and quality in telecommunication services in the two Islands has been a matter of concern. This issue was examined in DoT and it was observed that Telecom Regulatory Authority of India (TRAI) may assess the present state of telecom connectivity in the Andaman & Nicobar Islands and Lakshadweep Islands including by private operators and prepare a gap analysis with an investment plan for providing quality telecommunication services to the Andaman & Nicobar Islands and Lakshadweep.

6. In view of the above and in exercise of the powers available under section 11(1)(a)(iv) of the TRAI Act, TRAI is requested to take up a study in the matter and give its recommendations after making a gap analysis, and assessing the investment required for implementing a comprehensive telecom plan for the Andaman & Nicobar Islands and Lakshadweep.

Yours Sincerely,

Umashankar

(V. Umashankar)
Joint Secretary to the Govt. of India
Telephone No: 23036716.

Annexure 1.2

REPORT

on

"Visit of TRAI Officers (1st April to 5th April 2014) to Andaman & Nicobar Islands to assess the on-the-ground situation regarding telecom connectivity"

DoT has sought TRAI's recommendations after making a gap analysis and assessing the investment required for implementing a comprehensive telecom plan for the Union Territories of Andaman & Nicobar Islands (ANI) and Lakshadweep.

2. In this connection, a team of following officers visited Andaman and Nicobar Islands from 1st to 5th April 2014 to assess the ground situation regarding telecom connectivity in Andaman & Nicobar Islands.

S.No	Name (S/Sh.) & Designation of Officer
1.	Sanjeev Banzal, Advisor
2.	Jaipal Singh Tomar, Joint Advisor
3.	Sumeet Hemrajani, Senior Research Officer

3. Meetings were held with the Lt. Governor, the Chief Secretary and other senior officers of ANI Administration, CGM BSNL and representative of Private Telecom Service Providers. The team also went to Mayabandar (Middle Andaman) and Car-Nicobar and met with the receptive Deputy Commissioners. Networks set-ups of some TSPs were visited by the teams in Portblair and Car Nicobar. The details are as follows:-

Date	Meeting with
1.4.2014 4.30 pm	Special Secretary (IT), NIC, Deputy Director General (DOT, ANI Circle), CGM BSNL and representative of Private Telecom Service Providers.
2.4.2014 10.30 am	MD Andaman and Nicobar Islands Integrated Development Corporation Limited (ANIIDCO)
2.4.2014 11.00 am	Chief Secretary
3.4.2014 9.00 am	Deputy Commissioner (North & Middle Andaman) at Mayabunder
3.4.2014	Lt. Governor
4.4.2014 11.00 am	Deputy Commissioner (Car Nicobar) at Car Nicobar.

4. **Challenges being faced by the TSPs**: TSPs have highlighted the following major challenges faced by telecom service providers in providing connectivity in ANI:

- Non availability of undersea cable is a major bottleneck.
- High satellite bandwidth cost (around 45 lakh for each E1 for VSAT connectivity). Even its availability is limited.
- Topographical challenges.
- Higher cost of infrastructure development as compared to the mainland. Even higher costs of infrastructure at remote islands such as Chowra, Campbell bay etc.
- Ensuring availability of Diesel in those islands where it is not supplied by the Administration is a big challenge, particularly where there is no availability of Jetty (structure used at sea shore for docking boat/ship) facility in some of the islands e.g. Chowra Island.
- Unstable Power Supply: Being DG generated supply, there are power fluctuations. In some islands, power is available for 12-18 hrs.
- Allotment of Land for exchange/tower erection, particularly in Forest Area.
- Forest Department permission for setting up the towers
- Municipal Octroi Charges @ 6% for bringing telecom material.
- High ROW charges – Rs. 8 lakh for 800 metres. Same rate is prescribed for black top and side/kaccha road.

5. **Suggestions provided by telecom service providers:** TSPs gave the following suggestions to improve telecom connectivity in ANI.

- Need of undersea cable connecting the mainland. Once it is laid, its charges for the TSPs should be subsidized.
- Infrastructure support from Government.
- There is no cable landing station for eastern region of the country. Therefore, a cable landing station may be brought up at Kolkata or nearby place (e.g. Haldia) which will take care of latency, cable breakdown etc.
- Better EB Connectivity.
- USOF Support.

6. **Issues raised by ANI Administration:**

- Major issue is bandwidth constraint.
- Only about 0.3 Gbps is currently available. Bandwidth of 1 Gbps may be immediately facilitated out of present requirement of 8 Gbps.
- 33 Customer Service Centres (CSC) have been set up out of total 56 planned. Providing bandwidth is the main challenge.
- There is great potential for IT/Tourism/hotel etc in the island. However, telecom bandwidth is the main constraint in the development of any infrastructure.
- E-Governance project is not taking off due to constraint.
- Transponder Charges are high. e.g. NIC has taken 8 Mbps satellite bandwidth from BSNL. So the network is choked for 80% of time. Therefore, it wants to upgrade the bandwidth of lease line to 34 Mbps, but cannot do so because the charges are very high.
  DoT or MHA has to provide the fund for providing connectivity to ANI.
- BBNL project: In Nicobar group of islands, there are no village panchayats. There are tribal councils which need to be connected to respective block headquarters. These have not been made part of BBNL project. Also, the actual fibre requirement in the BBNL project will be much more than the projected figure.
- Both population and security requirement may be taken into consideration for deciding the mobile coverage.
- Inter island connectivity, though very costly, is very important. Certain areas are very tough e.g. Little Nicobar.
- Solar power based technologies are not successful, as for 6-7 months in a year; there is rain in the islands.
- Strong connectivity in ANI is utmost needed as it is about 1200 km from mainland, while Indonesia, Thailand, Myanmar are within 500 km distance.

7. **Issues of TSPs brought before Chief Secretary by TRAI**

- Ensuring availability of diesel in those islands where it is not supplied by the Administration particular where there is no availability of Jetty facility e.g. Chowra Island.
- Allotment of land for exchange/tower erection.
- Forest Department permission for setting up the towers

- Municipal Octroi Charges @ 6% for bringing telecom material.
- Unstable Power Supply.
- ROW charges – Rs. 8 lakh for 800 metres length. Same charges for black top and kuchha/side roads.

8. **Gist from meeting with Lieutenant Governor.**

- Lt. Governor expressed displeasure over present connectivity station in ANI.
- He requested for short-term solution by augmenting satellite bandwidth and Long-term solution by laying undersea cable
- He also desired that provision of bandwidth may be monitored at the highest level.

9. **Issues raised by DC of Mayabunder District**

- All connectivity is through OFC in Mayabunder district. When OFC breaks down, all telcom connectivity to Mayabandar is lost. Therefore, redundancy of fibre link is essential.
- For local calls or for calls upto Portblair, there should not be any dependency on the satellite link.
- WLL Access is better than GSM coverage. However, there is some constraint on part of BSNL in the supply of WLL handsets, charger and battery.
- BSNL does not provide broadband connections due to, probably, bandwidth constraints.
- Radio/FM station should be made available which can be an important tool for the disaster management to send message in the coastal areas.

10. **Issues raised by DC of Nicobar District**

- Two or three towers of BSNL are always down. Only the tower situated in HQ area is working properly.
- Broadband facility is only available in Car Nicobar. Kamorta and Campbell Bay only have 2G connectivity
- Electricity is not a problem in villages in Car Nicobar. Although, some villages have 12 hrs/18 hrs availability of electricity per day. That can be improved.

- Chowra Island – Though there are 1200 people residing on island but no mobile connectivity.
- In Teressa Island – no coverage is there in Laksi and Chukmaschi villages.
- In Katchal Island, there is no coverage in upper part of Katchal, where the population is very scattered.
- In Kamorta Island: There is no coverage in Kakana and Pilpillow villages. Even if one tower is set up at the junction point, it will cover both villages. Dareng village gets coverage off and on from Vikas Nagar.
- No connectivity in Tapong (Nancowry Island)
- Population of Great Nicobar is 7,500. There is one mobile tower at Campbell Bay. Following villages needs connectivity viz. Joginder nagar, Vijay nagar, Shastri nagar, Gandhi nagar and Laxmi nagar. Two towers should be sufficient to cover these villages.
- Afra bay in Great Nicobar – no connectivity, no jetty facility
- Population in Little Nicobar is very scattered, so providing coverage is a challenge. Major settlement is in Makachua which is uncovered. No jetty facility is there.
- Transportation cost in Nicobar Islands is higher by (135-150%) in comparison to Portblair.

Annexure-2.1

1. Cost estimates given by ANI Administration in its proposal submitted to the DoT in June 2012 are as given in Table below:

Table 1

Costs Estimates

Sl. No.	**Particulars**	**Amount (in Rs Crore)**
1.	Capital cost of connection 6 islands	355.50
2.	Annual maintenance Charge (@5% of the capital cost i.e. Rs. 20 crore per year) for 15 years.	300
3.	Hiring of Transponder Charge @Rs 6 crore for 15 years[22]	90
4.	Thirds party audit charges	25
4.	Service Charges (1% of above charges) of ANIDCO and other overheads	8.51
Total Project Cost		**778.51**

2. Considering only the capital cost (Item 1) and Annual Maintenance Charges (item No. 2), the total project cost comes out to be Rs. 655.5 crore.

3. ANI Administration again revised EFC memo, The cost estimates in the revised proposal of ANI Administration submitted to the DoT on 7th August 2013 are as given in table below. These estimates are prepared by taking into account the cost estimates received from the financial bid of the eligible bidder and other component of the project.

[22] In the proposal, A&N Administration suggested that cost of hiring transponders for 3 islands, which are not amongst the six islands to be connected through submarine cable, may be utilised for undersea cable connectivity if otherwise found economical..

Table 2

Total Project Cost

SL. No.	Particulars	Six Islands	Optional three Islands	Total (Amount in Rs. Crore)
1	Capital Cost	453.41	41.14	494.55
2	O&M Charges @ Rs. 26.86 crore per year for six islands and Rs. 1.42 crore for optional three islands.	402.9	21.3	424.2
3	Hire Charges for transponder @ Rs. 6.00 crore per year for 15 years	90	0	90
	Total	**946.31**	**62.44**	**1008.75**

Table 3

Details of Capital Cost

Sl. No.	Particulars	Six Islands	Optional three islands and two creeks	Total
1	Desktop study and marine survey	21.29	2.84	24.13
2	Undersea Cable and other submerged equipment excluding marine installation and commissioning			
(i)	Undersea Cable	53.35	5.5	58.85
(ii)	Other submerged equipment	24.37	1.16	25.53
(iii)	IRU Charges for the fiber pair for 15 years	119.01		119.01
(iv)	Initial 10G restoration	0.95		0.95
(v)	**Sub Total**	**197.68**	**6.66**	**204.34**
3	Utilities including installation and commissioning	13.73	3.43	17.16
4	Terminal station equipment, terrestrial cable and spares including installation and commissioning			
(i)	Beach manhole and landing station equipment	78.68	8.01	86.69
(ii)	Terrestrial Cable	10.45	2.32	12.77
(iii)	**Sub Total**	**89.13**	**10.33**	**99.46**
5	Marine Installation	58.66	9.83	68.49
6	**Total (1+2+3+4+5)**	**380.49**	**33.09**	**413.58**
7	Terrestrial cable for redundancy	10.45	2.32	12.77
8	10% variation on undersea cable, marine installation and terrestrial cable	13.29	2	15.29
9	**Total (6+7+8)**	**404.23**	**37.41**	**441.64**

Sl. No.	Particulars	Six Islands	Optional three islands and two creeks	Total
10	Building for cable landing station	2.86	2.18	5.04
11	NLD license fee	2.5		2.5
12	100% cash margin for bank guarantee to DOT	20		20
13	Cost of EIA Study	1.5	0.75	2.25
14	Contingency including expenses for ROW, permits, etc @ 1% of capital cost	4	0.4	4.4
15	Cost of third party inspection	10.78		10.78
16	Administrative overhead	3.06		3.06
17	**Sub Total (9+10+11+12+13+14+15+16)**	**448.93**	**40.74**	**489.67**
18	Service charge of ANIIDCO @ 1% on SL No. 17	4.48	0.4	4.88
19	**Total Capital Cost (17+18)**	**453.41**	**41.14**	**494.55**

Note: The capital cost (Sl. No. 1 to 6) is as per the rate of L1 bidder in the bid submitted in Oct 2012. Other items have been added by ANI Administration.

4. An broad estimate of the cost for submarine cable project can be estimated as given below:

Table 4

Sl. No.	Item	Cost (crore)
1	Capital cost of around 1205 Km of submarine cable i.e. from branching point to various islands including cost of hiring the bandwidth in the existing submarine cable running from Chennai to Singapore.	430.91[23]
2	Indefeasible rights of use (IRU) charges i.e. the cost of hiring the bandwidth in the existing submarine cable running from Chennai to Singapore.	119.01
3	Net capital cost	311.9
4	Annual Maintenance Charges (@5% of Net Capital Cost) for 15 years	233.93
5	Total Project Cost	545.83
6	Per Km cost of submarine cable along with all other associated components	0.45 (rounded off to 0.5)

[23] Derived from the capital cost of connecting six islands as given in Table 3, after deduction the Licence fee and bank guarantee of NLD licence.

Annexure 2.2

Survey report of Gandhi Nagar Village (North Andaman) – To examine the feasibility of providing telecom connectivity

1. Location: This village is located in **North Andaman** with a population of 502.
2. Transport facilities: There is no road facility to reach Radhanagar which is terrestrially nearer to Gandhi Nagar village. But this village can be reached through boat service from Aerial Bay Jetty by an aerial distance of 9.5 KMs. The speed boat service is available in the morning and evening daily for passengers and the cargo facility is not available. All the material has to be transported through pantoon service from Aerial Bay Jetty which involves higher expenditure.
3. No regular water supply is available for construction activities and the water is to be transported from Aerial Bay.
4. Power Supply: Three phase power is being supplied by the State owned Electricity department
5. Communication facilities: The nearest point of telecom facility is available at Aerial Bay with services like GSM, CDMA, Land line & Broad band.
6. <u>Proposed BTS:</u>

   60 Meter GBT is proposed for this village. After commissioning of the BTS, small hamlets around this village will be covered.

   The media for connecting this BTS to BSC at Port Blair is as follows:

   Gandhi Nagar to Aerial Bay BTS : Mini Link Microwave

   Aerial Bay BTS to Port Blair : Through OFC on Linear path (Existing)
7. Cost: The cost is arrived at taking all these parameters which includes infra like Engine Alternator, Power Plant, batteries and does not include operational expenditure of the staff.

i) Capital Cost for setting up of the BTS : Rs 0.83 Cr
(Details in Table A)

ii) Operational Expenditure : Rs 8 Lakhs per Year
(Details in Table B)

Table A: CAPEX details of proposed BTS

Sl. No.	Item	Cost (in Rs)
1	BTS Equipment	661237
2	Tower Material (60 meter GBT)	1600000
3	Tower Mat. Transport	200000
4	Tower Construction	3500000
5	Prefab Shelter	150000
6	Air Conditioners	120000
7	Earthing & Electrical items	200000
8	Pre Cooling System	50000
9	Power Plant – 200 Amps	120000
10	Battery Sets 400 AH X2	400000
11	D G Set	800000
12	Digital Microwave – Mini Link from Aerial Bay BTS	100000
13	Unforeseen – Special transport	400000
	Grand Total	83,01,237

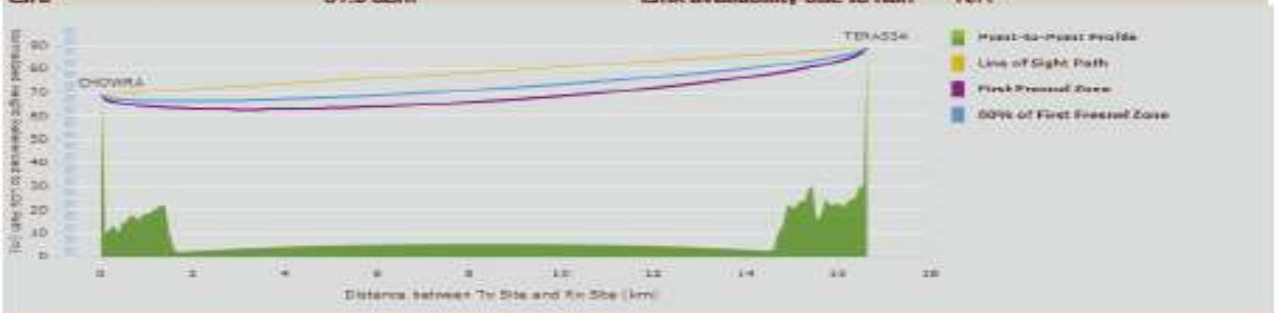
Table B: OPEX details for proposed BTS

Sl. No.	Item	Cost per Annum
1	Electricity Charges	Rs. 120000
2	Rent for the site	Rs. 70000
3	Diesel	Rs.100000
4	Infra Repair	Rs.100000
5	Infra replacement	Rs. 200000
6	AMC of BTS	Rs. 30000
7	OFC fault repair	Rs. 100000
8	Misc	Rs. 80000
	Total	**Rs. 800000**

Annexure 3.1

Survey Report submitted by BSNL to study the feasibility of MW connectivity of Chowra Island from Teressa Island

Site Information			
Tx Site Name	CHOWRA	Rx Site Name	TERASSA
Radio Type	LigoPTP 5-23 UNITY	Radio Type	LigoPTP 5-23 UNITY
Latitude	8° 27' 8.34 N (8.452317)	Latitude	8° 18' 44.66 N (8.312406)
Longitude	93° 2' 51.31 E (93.047586)	Longitude	93° 6' 4 E (93.101111)
Tx Power	21.5 dBm	RX Threshold	-70 dBm
Ant. Gain	30 dBi	Ant. Gain	30 dBi
Ant. Height	60 meters	Ant. Height	60 meters
Parameter			
Frequency	7700 MHz	Climate	Maritime Temperate, Over Sea
Ant. Polarization	Vertical	Measurement	Metric System
Misc. Loss	0 dBm	Rain Rate	0 mm/hr
Results			
Total Path Loss	134.67 dBm	Total Fade Margin	16.83 dBm
RX Signal Level	-53.17 dBm	Distance between sites	16.64 km
EIRP	51.5 dBm	Link availability due to rain	N/A



MAP

Annexure 3.2

Uncovered villages in Andaman & Nicobar Islands planned to be provided 2G mobile coverage

Serial No.	Name of District	Name of Sub- District	Town /Village Code	Name of District/ Sub District/ Town/ Village	Name of Island
1	Nicobars	Car Nicobar	645012	Mus	Car Nicobar
2	Nicobars	Car Nicobar	645014	Sawai	Car Nicobar
3	Nicobars	Car Nicobar	645016	Kimois	Car Nicobar
4	Nicobars	Car Nicobar	645020	Perka	Car Nicobar
5	Nicobars	Car Nicobar	645022	Kinyuka	Car Nicobar
6	Nicobars	Car Nicobar	645023	Chuckchucha	Car Nicobar
7	Nicobars	Car Nicobar	645024	Tapoiming	Car Nicobar
8	Nicobars	Car Nicobar	645027	Kinmai	Car Nicobar
9	Nicobars	Nancowry	645028	Tahaila	Chowra
10	Nicobars	Nancowry	645029	Chongkamong	Chowra
11	Nicobars	Nancowry	645030	Alhiat	Chowra
12	Nicobars	Nancowry	645031	Kuitasuk	Chowra
13	Nicobars	Nancowry	645032	Raihion	Chowra
14	Nicobars	Nancowry	645036	Enam	Teressa
15	Nicobars	Nancowry	645037	Luxi	Teressa
16	Nicobars	Nancowry	645039	Chukmachi	Teressa
17	Nicobars	Nancowry	645043	Kalasi	Teressa
18	Nicobars	Nancowry	645080	Upper Katchal	Katchal
19	Nicobars	Nancowry	645081	Meenakshi Ram Nagar	Katchal
20	Nicobars	Nancowry	645082	Japan Tikri	Katchal
21	Nicobars	Nancowry	645083	E-Wall	Katchal
22	Nicobars	Nancowry	645091	Tapong incl. Kabila	Katchal
23	Nicobars	Nancowry	645100	Itoi*(HITUI)	Nancowry
24	Nicobars	Nancowry	645104	Pilpilow	Kamorta
25	Nicobars	Nancowry	645111	Daring	Kamorta

Serial No.	Name of District	Name of Sub- District	Town /Village Code	Name of District/ Sub District/ Town/ Village	Name of Island
26	Nicobars	Nancowry	645125	Munak incl. Ponioo/Moul	Kamorta
27	Nicobars	Nancowry	645129	Berainak/Badnak	Kamorta
28	Nicobars	Nancowry	645131	Kakana	Kamorta
29	Nicobar	Great Nicobar	645150	Pulloullo/Puloulo	Little Nicobar Island
30	Nicobar	Great Nicobar	645158	Pulopanja	Little Nicobar Island
31	Nicobars	Great Nicobar	645166	Afra Bay	Little Nicobar
32	Nicobars	Great Nicobar	645193	Laxmi Nagar	Great Nicobar
33	Nicobars	Great Nicobar	645194	Vijoy Nagar	Great Nicobar
34	Nicobars	Great Nicobar	645195	Joginder Nagar	Great Nicobar
35	N&M Andaman	Diglipur	645212	Shyam Nagar (RV)	North Andaman
36	N&M Andaman	Diglipur	645214	Swarajgram (RV)	North Andaman
37	N&M Andaman	Diglipur	645215	Milangram (RV)	North Andaman
38	N&M Andaman	Diglipur	645232	Nabagram (RV)	North Andaman
39	N&M Andaman	Diglipur	645233	Paranghara (RV)	North Andaman
40	N&M Andaman	Diglipur	645235	Madhyamgram (RV)	North Andaman
41	N&M Andaman	Diglipur	645236	Nischintapur (RV)	North Andaman
42	N&M Andaman	Diglipur	645238	Jagannath Dera (RV)	North Andaman
43	N&M Andaman	Diglipur	645239	Ramnagar (RV)	North Andaman
44	N&M Andaman	Diglipur	645242	Sagar Dweep (RV)	Smith
45	N&M Andaman	Diglipur	645246	Elezabeth Bay (EFA)	North Andaman
46	N&M Andaman	Diglipur	645249	Bandhan Nallaha (EFA)	North Andaman
47	N&M Andaman	Diglipur	645252	Ganesh Nagar (EFA)	North Andaman
48	N&M Andaman	Diglipur	645253	Amber Chad (EFA)	North Andaman
49	N&M Andaman	Diglipur	645254	Santi Nagar (EFA)	North Andaman
50	N&M Andaman	Diglipur	645256	Gandhi Nagar (Forest Beat)	North Andaman

Serial No.	Name of District	Name of Sub- District	Town /Village Code	Name of District/ Sub District/ Town/ Village	Name of Island
51	N&M Andaman	Diglipur	645258	Burmachad (EFA)	North Andaman
52	N&M Andaman	Diglipur	645259	Haran Nallaha (EFA)	North Andaman
53	N&M Andaman	Diglipur	645261	Paschimsagar (EFA)	North Andaman
54	N&M Andaman	Diglipur	645262	Tal Bagan (EFA)	North Andaman
55	N&M Andaman	Diglipur	645266	Lamiya Bay (WLS)	North Andaman
56	N&M Andaman	Diglipur	645271	Srinagar (EFA)	North Andaman
57	N&M Andaman	Diglipur	645273	Narayan Tikri (EFA)	North Andaman
58	N&M Andaman	Diglipur	645277	Bara Dabla (EFA)	North Andaman
59	N&M Andaman	Diglipur	645278	Hoari Bay (EFA)	North Andaman
60	N&M Andaman	Diglipur	645279	Pilone Nallaha (FDCA)	North Andaman
61	N&M Andaman	Diglipur	645281	Ganna Dabla (EFA)	North Andaman
62	N&M Andaman	Diglipur	645286	Hara Tikry (EFA)	North Andaman
63	N&M Andaman	Mayabunder	645298	Karmatang (RV)	Middle Andaman
64	N&M Andaman	Mayabunder	645305	Hanspuri (RV) (including JPP Camps)	Middle Andaman
65	N&M Andaman	Mayabunder	645309	Profullya Nagar (RV)	Middle Andaman
66	N&M Andaman	Mayabunder	645322	Karmatang X (EFA) incl.Bihari Plot (EFA)	Middle Andaman
67	N&M Andaman	Mayabunder	645323	Paiket Bay (EFA)	Middle Andaman
68	N&M Andaman	Mayabunder	645325	Buddha Nallaha (EFA)	Middle Andaman
69	N&M Andaman	Mayabunder	645326	Chuglum Gum (EFA)	Middle Andaman
70	N&M Andaman	Mayabunder	645339	Birsa Nagar (EFA)	Middle Andaman
71	N&M Andaman	Mayabunder	645342	Lauki Nallaha (EFA)	Middle Andaman
72	N&M Andaman	Rangat	645348	Panchawati (RV)	Middle Andaman
73	N&M Andaman	Rangat	645349	Amkunj (RV)	Middle Andaman
74	N&M Andaman	Rangat	645360	Shyamkund (RV)	Middle Andaman
75	N&M Andaman	Rangat	645361	Vishnupur (RV)	Middle Andaman

Serial No.	Name of District	Name of Sub- District	Town /Village Code	Name of District/ Sub District/ Town/ Village	Name of Island
76	N&M Andaman	Rangat	645363	Urmilapur (RV)	Middle Andaman
77	N&M Andaman	Rangat	645366	Saktigarh (RV)	Middle Andaman
78	N&M Andaman	Rangat	645370	Santanu (RV)	Middle Andaman
79	N&M Andaman	Rangat	645375	Bejoygarh (RV)	Middle Andaman
80	N&M Andaman	Rangat	645382	Nayagarh (RV)	Middle Andaman
81	N&M Andaman	Rangat	645383	Rajatgarh (RV)	Middle Andaman
82	N&M Andaman	Rangat	645385	Khatta Khari (RV)	Baratang
83	N&M Andaman	Rangat	645386	Cutbert Bay (EFA)	Middle Andaman
84	N&M Andaman	Rangat	645391	Panchawati (EFA)	Middle Andaman
85	N&M Andaman	Rangat	645409	Macarthy Valley (EFA)	Middle Andaman
86	N&M Andaman	Rangat	645413	Porlobjig No. 3 (JPPC, APWDC & ANIFPDC)	Middle Andaman
87	N&M Andaman	Rangat	645426	Lorrojig (FC) & Vishnu Nallaha (APWDC)	Baratang
88	N&M Andaman	Rangat	645429	Sanker Nallaha (PWDC)	Middle Andaman
89	N&M Andaman	Rangat	645434	Raglachang (Nayadera) (FC)	Middle Andaman
90	N&M Andaman	Rangat	645436	Wrafter's Creek (EFA)	Baratang
91	South Andaman	Ferrargunj	645457	Herbertabad (RV)	South Andaman
92	South Andaman	Ferrargunj	645465	Caddlegunj (RV) (incl. Sona Pahar & Hazari Bagh (JPPC)	South Andaman Island
93	South Andaman	Ferrargunj	645475	Muslim Basti (RV)	South Andaman Island
94	South Andaman	Ferrargunj	645478	Badmash Pahar (RV)	South Andaman Island
95	South Andaman	Ferrargunj	645485	Hashmatabad (RV)	South Andaman Island
96	South Andaman	Ferrargunj	645494	Between Middle Strait (JPPC) & Jirkatang (JA)	South Andaman Island
97	South Andaman	Ferrargunj	645512	Hashmatabad (EFA)	South Andaman Island
98	South Andaman	Ferrargunj	645513	Manglutan (EFA)	South Andaman Island
99	South Andaman	Port Blair	645518	Bejoy Nagar (RV)	Havelock Island

Serial No.	Name of District	Name of Sub- District	Town /Village Code	Name of District/ Sub District/ Town/ Village	Name of Island
100	South Andaman	Port Blair	645539	Chidiyatapu (RV)	South Andaman Island
101	South Andaman	Port Blair	645540	Rutland	Rutland Island
102	South Andaman	Port Blair	645543	Chidiyatapu (WLS)	South Andaman Island
103	South Andaman	Port Blair	645546	Bamboo Nallaha incl. Kichad Nallaha	Rutland Island
104	South Andaman	Port Blair	645547	Bada Khari (FC)	Rutland Island
105	South Andaman	Little Andaman	645552	Dugong Creek (OS)	Little Andaman
106	South Andaman	Little Andaman	645559	Harmender Bay (NS)	Little Andaman
107	South Andaman	Little Andaman	645567	Butler Bay Forest Camp 4-IV (FDCA)	Little Andaman
108	South Andaman	Little Andaman	645568	Red Oil Palm (Nursery Camp)	Little Andaman
109	South Andaman	Little Andaman	645569	Butler Bay Forest Camp 4-II (FDCA)	Little Andaman

Annexure 5.1

Telecom Regulatory Authority of India

File No.106-1/2014-NSL-II **Dated: 11th June 2014**

Minutes of the meeting held in TRAI with officials of ISRO and BSNL on 28th May 2014 at 11.00 Hrs in TRAI Office

To discuss the feasibility of augmentation of satellite bandwidth in Andaman & Nicobar Islands (ANI) and Lakshadweep and related issues, a meeting with ISRO and BSNL was held in TRAI at 1100 hrs. on 28th May 2014. The meeting was chaired by Shri Sudhir Gupta, Secretary, TRAI. The following officers attended the meeting:

TRAI Officers

1. Shri Sudhir Gupta, Secretary ... In chair
2. Shri Sanjeev Banzal, Advisor (NSL-II)
3. Shri Jaipal Singh Tomar, Joint Advisor (NSL)

ISRO Officers

1. Shri N. Prahlad Rao, Director (SCNP)
2. Shri V. Raghu Venkataraman, Associate Director

BSNL Officers

1. Shri M.C. Chaube, ED (CN)
2. Shri P.K. Pandey, GM (Radio)

2. Sh. Sanjeev Banzal, Advisor (TRAI) initiated the discussion by giving background of the matter. He informed that the DoT has asked TRAI to give its recommendations on comprehensive telecom plan for the Union Territories of ANI and Lakshadweep. To have an assessment of the existing telecom services and to have a discussion with UT administration, a team of TRAI officers had visited both ANI and Lakshadweep. It was observed that low availability of satellite bandwidth is a major constraint in the development of telecom infrastructure network in these islands. Therefore, this meeting has been called to examine the feasibility of the augmentation of the satellite bandwidth.

3. Director (SCNP), ISRO informed that as on date, BSNL is using about 20 number of C-band transponders in the entire country. He also stated that nearly one year back, BSNL has been offered 1.5 transponders in lower Ext-C band (3600 to 3655 MHz) in GSAT-10 Satellite. Additional 4.5 transponder capacity (3425 to 3600 MHz,) which has been identified for terrestrial use, can also be allotted to BSNL subject to clearance from the DoT. However, till date, BSNL has not accepted even 1.5 transponder capacity allotted to it.

4. GM(R), BSNL responded that the existing bandwidth assigned to BSNL is in C- band. Therefore, to utilise the lower extended-C band capacity, separate ground segment equipments are required, which will require minimum 6-8 months of procurement and installation time with approximately Rs. 25 crore of expenditure.

5. ED (CN), BSNL added that creation of new earth segment equipment for utilization of only 1.5 transponder capacity may not be justified. However, BSNL will examine the possibility for utilization of all the 6 transponder capacity in the lower Ext-C band. He wanted to know the longevity of the availability of this capacity. Director (SCNP), ISRO stated that the life of these transponders is 15 years and ISRO ensures replacement of transponders in the same band on the expiry of their life.

6. Director (SCNP), ISRO also informed that:

i. In future, following additional capacity will also be available:

Sl. No.	Satellite	Time frame	Capacity (no. of transponders)
1.	GSAT-16	3rd quarter of 2014	C band: 6 transponder (for allocation)+18 for mandatory spare; Upper Ext C Band : 12 Ku Band : 12
2.	GSAT-11	2016-17	Ku Band: 32 spot beam with 10 Gbps throughput.
3.	GSAT-17	24-30 months after cabinet approval	Replacement of INSAT-3A capacity
4.	GSAT-18	24-30 months after cabinet approval	Replacement of INSAT-3C capacity

ii. GSAT-11 will have 32 number of Ku band user beams with corresponding gateway links operating in Ka band and will be very suitable for broadband communication.

iii. BSNL has surrendered 7 transponders in MEASAT and 6 Transponders in INSAT-3C in last year.

iv. BSNL has been assigned 201 MHz in INSAT 3C in lieu of 302 MHz in INSAT-3E, w.e.f. 23rd March 2014.

7. GM(R) BSNL told that the possibility can be explored to provide coverage to Lakshadweep through O3b satellite network as the single beam will be covering Lakshadweep and Ernakulam. O3b is a foreign company and has launched Medium Earth Orbit (MEO) constellation of satellites which operates in Ka-band and offers high bandwidth /

throughput with less than 150 msec latency. Thus it will be suitable for internet / broadband services.

8. GM(R) BSNL confirmed that BSNL has surrendered some transponders last year which were rendered excess due to better optimization of network and deployment of Carrier-in-Carrier (CnC) type modems. However, total capacity of bandwidth in terms of throughput has not been compromised.

9. GM(R) BSNL stated that after the sudden decommissioning of INSAT-3E, BSNL requires another satellite for A&N for redundancy purposes. Therefore, BSNL may be provided capacity either in INSAT-4 series of satellites or in any foreign satellite with competitive rates. He further informed that MEASAT (Malaysian Satellite) or Thaicom were willing to negotiate at a rate of about $1.15 million per transponder per annum, which was marginally higher than what BSNL was paying earlier (about $1 million). Director (SCNP), ISRO responded that ISRO has also communicated to BSNL that it may be possible to get 2 transponders from MEASAT, if firm demand is placed by BSNL immediately.

10. The issue of hiring satellite bandwidth directly by Telecom Service Providers (TSPs) was also discussed. Director (SCNP), ISRO, informed that as per present policy, the TSPs have to approach ISRO for their requirement of satellite capacity.

11. After deliberation on the possible alternatives to augment the satellite bandwidth in ANI and Lakshadweep in short run, following options emerged:

    i. BSNL may be allocated 6 transponders of C-band in GSAT-16 Satellite.

    ii. BSNL may hire 2 transponders from MEASAT. ISRO will take needful action once the firm demand is received from BSNL.

    iii. If BSNL hires C-band transponders from Thaicom, BSNL will be required to set up new ground segment equipments because existing antennas and RF equipment will be utilized for INSAT-3C and MEASAT (if hired). Further, there will be need to procure RF and base band equipment for utilizing additional capacity. Alternatively, BSNL may use 6 transponders in lower Ext-C band in GSAT-10 whose life is 15 years and that are lying unutilized for a year or so, if the clearance for 4.5 transponders is given by DoT. However, it is to be noted that spectrum in the band 3400-3600 MHz has been identified for IMT applications by WRC 2007. As per National Frequency Allocation Plan (NFAP) 2011, *the requirement of IMT including Broadband Wireless Access (BWA) in the frequency band 3400-3600 MHz may be considered for coordination on a case by- case basis subject to availability of spectrum in this band and appropriate protection from out of band emission to the networks in the FSS in the frequency band 3600- 4200 MHz..*

In view of above, there can be two options:

(a) The DoT can be requested to explore utilisation of this band as per NFAP-2011 for mainland and for satellite communication only for the ANI and Lakshadweep islands. This will require that one of the earth stations in the main land may also be allowed to use this band for satellite communication. Some adjoining areas around the earth station will also have to be excluded from IMT services to avoid interference.

(b) BSNL may take bandwidth from Thaicom in C-band.

12. ED (CN), BSNL assured the chair that BSNL shall actively explore the above options.

The meeting ended with the vote of thanks to the Chair.

11/06/14

(Jaipal Singh Tomar)
Joint Advisor (NSL)

To

1. Sr. PPS to Secretary, TRAI
2. Director (SCNP), ISRO, Bengaluru
3. ED (CN), BSNL

Copy for information to:

Advisor (NSL-II)

Annexure 5.2

Satellite Bandwidth utilisation by TSPs in ANI

Sl. No.	Name of Service Provider	Name of Link	Satellite Bandwidth (MHz)	Throughput of the link (Mbps)	Type of Modulation used	Whether C-n-C Used
1	Reliance	DAKC HUB - Diglipur	0.56	0.4	QPSK	No
2	Reliance	DAKC HUB - Ranghat	0.56	0.4	QPSK	No
3	Reliance	DAKC HUB - Mayabandar	0.56	0.4	QPSK	No
4	Reliance	DAKC HUB - Portblair	3.7	6.15	8PSK	No
5	BSNL	Port Blair - Kolkata 1	24	34	8PSK	Yes
6	BSNL	Port Blair - Kolkata 2	24	34	8PSK	Yes
7	BSNL	Port Blair - Kolkata 3	24	34	8PSK	Yes
8	BSNL	Port Blair - Kolkata 4	24	34	8PSK	Yes
9	BSNL	Port Blair - Kolkata 5	24	34	8PSK	Yes
10	BSNL	Port Blair - Kolkata 6	24	34	8PSK	Yes
11	BSNL	Port Blair - Yeur	24	34	8PSK	Yes
12	BSNL	Port Blair - Hutbay 1	12	8	8PSK	No
13	BSNL	Port Blair - Hutbay 2	12	8	8PSK	No
14	BSNL	Port Blair - Carnicobar 1	12	8	8PSK	No
15	BSNL	Port Blair - Carnicobar 2	7	8	8PSK	Yes
16	BSNL	Port Blair - Havelock 1	7	8	8PSK	Yes
17	BSNL	Port Blair - Havelock 2	7	8	8PSK	Yes
18	BSNL	Port Blair - Campbellbay	7	8	8PSK	Yes
19	BSNL	Port Blair - Diglipur	7	8	8PSK	Yes
20	BSNL	Port Blair - Mayabunder	7	8	8PSK	Yes
21	BSNL	Port Blair - Rangat	7	8	8PSK	Yes
22	BSNL	Port Blair - Kamorta	12	8	8PSK	No
23	BSNL	Port Blair - New Delhi	7	8	8PSK	Yes
24	BSNL	Port Blair - Kolkata	12	8	8PSK	No
25	BSNL	Port Blair - Teressa 1	3	2	8PSK	No

Sl. No.	Name of Service Provider	Name of Link	Satellite Bandwidth (MHz)	Throughput of the link (Mbps)	Type of Modulation used	Whether C-n-C Used
26	BSNL	Port Blair - Teressa 2	3	2	8PSK	No
27	BSNL	Port Blair - Kachal 1	3	2	8PSK	No
28	BSNL	Port Blair - Kachal 2	3	2	8PSK	No
29	BSNL	Port Blair - Neil 1	3	2	8PSK	No
30	BSNL	Port Blair - Neil 2	3	2	8PSK	No
31	BSNL	Port Blair - Long Island 1	3	2	8PSK	No
32	BSNL	Port Blair - Long Island 2	3	2	8PSK	No
33	BSNL	Port Blair - New Delhi	2	2	8PSK	Yes
34	BSNL	Carnicobar - New Delhi	2	2	8PSK	Yes
35	BSNL	Carnicobar - Kolkata	3	2	8PSK	No
36	Airtel	Portblair - Asansol 1	2.72	2	8PSK 2/3	No
37	Airtel	Portblair - Asansol 2	2.72	2	8PSK 2/3	No
38	Airtel	Portblair - Asansol 3	2.72	2	8PSK 2/3	No
39	Airtel	Rangat - Portblair	1.36	1	8PSK 2/3	No
40	Airtel	Baratang - Portblair	1.36	1	8PSK 2/3	No
41	Airtel	Portblair - Havelock	2.04	1.5	8PSK 2/3	No
42	Airtel	Portblair - Mayabhunder	1.36	1	8PSK 2/3	No
43	Airtel	Diglipur - Portblair	2.72	2	8PSK 2/3	No
44	Airtel	Portblair - Asansol 4	2.72	2	8PSK 2/3	No
45	Airtel	Portblair - Asansol 5	2.72	2	8PSK 2/3	No
46	Airtel	Portblair - Murshidabad 1	1.36	2	8PSK 2/3	Yes
47	Airtel	Portblair - Murshidabad 2	1.36	2	8PSK 2/3	Yes
48	Airtel	Portblair - Murshidabad 3	1.36	2	8PSK 2/3	Yes
49	Airtel	Portblair - Murshidabad 4	1.36	2	8PSK 2/3	Yes
50	Airtel	Portblair - Hutbay	2.72	2	8PSK 2/3	No
51	Vodafone	Asansol-Portblair	3.35	6.272	8PSK	No

Sl. No.	Name of Service Provider	Name of Link	Satellite Bandwidth (MHz)	Throughput of the link (Mbps)	Type of Modulation used	Whether C-n-C Used
52	Vodafone	Portblair-Kerelapuram	0.3	0.5	8PSK	No
53	Vodafone	Portblair-Hutbay2	0.8	0.88	QPSK	No
54	Vodafone	Portblair-Mayabandar	0.2	0.224	QPSK	No
55	Vodafone	Portblair-Rangat	0.14	0.224	8PSK	No
56	Vodafone	Portblair-Havlok2	0.3	0.5	8PSK	No
	Total		**356.07**	**406.45**		

Annexure 5.3

Satellite Bandwidth utilisation by TSPs in Lakshadweep

Sl. No.	TSP	Name of Link	Satellite BW (in MHz)	Through-put of the link in Mbps	Type of Modulation used	Whether CnC modems used?
1	BSNL	Ernakulam- Kavaratti	24	34	8PSK	NO
		Kavaratti- Ernakulam	24		8PSK	
2	BSNL	Ernakulam- Agatti Agatti- Ernakulam	7	8	QPSK	YES
3	BSNL	Bangalore - Agatti	2	2	QPSK	NO
		Agatti- Bangalore	2		QPSK	
4	BSNL	Ernakulam- Amini Amini - Ernakulam	7	8	QPSK	YES
5	BSNL	Bangalore - Amini	2	2	QPSK	NO
		Amini- Bangalore	2			
6	BSNL	Ernakulam- Minicoy	6	8	8PSK	NO
		Minicoy-Ernakulam	6		8PSK	
7	BSNL	Bangalore-Minicoy	2	2	QPSK	NO
		Minicoy-Bangalore	2		QPSK	
8	BSNL	Ernakulam-Kiltan	6	8	8PSK	NO
		Kiltan-Ernakulam	6		8PSK	
9	BSNL	Ernakulam-Kadmat	6	8	8PSK	NO
		Kadmat-Ernakulam	6		8PSK	
10	BSNL	Ernakulam-Kadmat Kadmat-Ernakulam	1.8	2	QPSK	Yes
11	BSNL	Ernakulam-Androth 1	2	2	QPSK	NO
		Androth-Ernakulam 1	2		QPSK	
12	BSNL	Ernakulam-Androth 2	1.8	2	QPSK	YES
		Androth-Ernakulam 2			QPSK	
13	BSNL	Bangalore-Androth 1	2	2	QPSK	NO
		Androth-Bangalore 1	2		QPSK	
14	BSNL	Bangalore-Androth 2	2	2	QPSK	NO
		Androth-Bangalore 2	2		QPSK	
15	BSNL	Ernakulam-Chetlat	1.8	2	QPSK	YES
		Chetlat-Ernakulam				
16	BSNL	Bangalore-Chetlat	2	2	QPSK	NO
		Chetlat-Bangalore	2		QPSK	
17	BSNL	Ernakulm-Kalpeni	1.5	2	8PSK	NO

		Kalpeni-Ernakulam	1.5		8PSK	
18	BSNL	Bangalore-Kalpeni	2	2	QPSK	NO
		Kalpeni-Bangalore	2		QPSK	
19	BSNL	Ernakulam-Bitra	1.5	2	8PSK	NO
		Bitra-Ernakulam	1.5		8PSK	
20	BSNL	Bangalore-Bitra	2	2	QPSK	NO
		Bitra-Bangalore	2		QPSK	
21	Airtel	Ernakulam-Kavaratti	0.68	1	8PSK 2/3	NO
		Kavaratti- Ernakulam	0.68		8PSK 2/4	NO
22	Airtel	Ernakulam-Agatti	0.34	0.5	8PSK 2/5	NO
		Agatti-Ernakulam	0.34		8PSK 2/6	NO
	TOTAL		**147.44**	**103.5**		

Abbreviations Used

S.No.	Abbreviation	Expansion
1.	2G	Second Generation
2.	3G	Third Generation
3.	ANI	Andaman & Nicobar Islands
4.	ANIIDCO	Andaman and Nicobar Islands Integrated Development Corporation
5.	APSK	Amplitude and phase-shift keying
6.	BBNL	Bharat Broadband Network Limited
7.	BSNL	Bharat Sanchar Nigam Limited
8.	BTS	Base Transceiver Station
9.	BW	Bandwidth
10.	BWA	Broadband Wireless Access
11.	CDMA	Code Division Multiple Access
12.	CLS	Cable Landing Station
13.	CnC	Carrier-in-Carrier
14.	CSC	Common Service Centers
15.	DG	Diesel Generator
16.	DHQ	District Head Quarter
17.	DMW	Digital Microwave
18.	DoS	Department of Space
19.	DoT	Department of Telecommunications
20.	DPR	Detailed Project Report
21.	DWDM	Dense Wavelength Division Multiplexing
22.	DXC	Digital Cross Connect

Abbreviations Used

S.No.	Abbreviation	Expansion
23.	EEZ	Exclusive Economic Zone
24.	EFC	Expenditure Finance Committee
25.	Gbps	Giga bit per second
26.	GBT	Ground Based Tower
27.	GSAT	Geo-Stationary Satellite
28.	GSM	Global System for Mobile Communications
29.	IDR	Intermediate Data Rate
30.	IMT	International Mobile Telecommunications
31.	INSAT	Indian National Satellite System
32.	IRU	Indefeasible rights of use
33.	ISRO	Indian Space Research Organisation
34.	LSA	Licensed Service Area
35.	Mbps	Megabit per second
36.	MW	Microwave
37.	NFAP	National Frequency Allocation Plan
38.	NH	National Highway
39.	NIC	National Informatics Centre
40.	NTP 2012	National Telecom Policy 2012
41.	OADM	Optical Add-Drop Multiplexer
42.	OFC	Optical Fibre Cable
43.	OTM	Optical Terminal Multiplexer
44.	PSK	Phase Shift Keying
45.	PSU	Public Sector Undertaking
46.	QoS	Quality of Service

Abbreviations Used

S.No.	Abbreviation	Expansion
47.	QPSK	Quadrature Phase Shift Keying
48.	RFP	Request for Proposal
49.	ROW	Right Of Way
50.	RTT	Roof Top Tower
51.	SAARC	South Asian Association for Regional Cooperation
52.	SDHQ	Sub District Headquarter
53.	STM	Synchronous Transport Module
54.	SWAN	State Wide Area Network
55.	TCL	Tata Communication Ltd
56.	TRAI	Telecom Regulatory Authority of India
57.	TSPs	Telecom Service Providers
58.	USOF	Universal Service Obligation Fund
59.	UT	Union Territory
60.	VSAT	Virtual Satellite Aperture Terminal
61.	WLL	Wireless Local Loop