1. Design Principles and Technical Guidelines

APSFL envisages to connect maximum GPs and all Mandals in ring architecture to create a carrier grade and resilient network. Below are the guidelines for creation of GP and Mandal ring.

1.1 Guideline for creation network architecture

i. All GPs in a Mandal should be connected in ring architecture. Any deviation from this (GP with linear connectivity) will be considered on a case-by-case basis.

ii. GP rings can be designed in two architecture as mentioned below, depending on availability of electric poles.
   a. Ring starting and culminating at same Mandal
   b. Ring starting from a Mandal and culminating at another Mandal

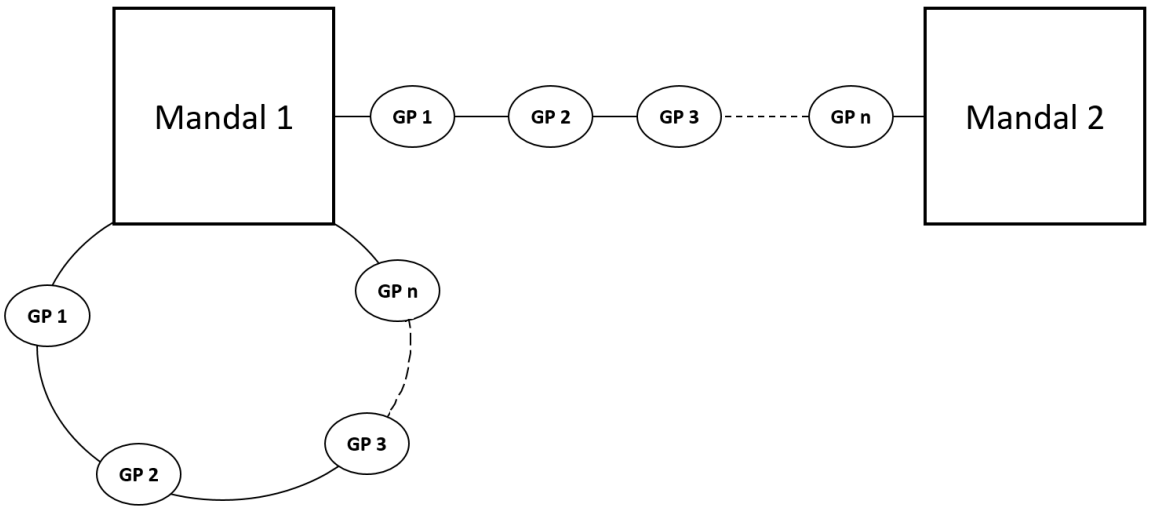

Figure 1: Types of ring architecture

iii. All the Mandals in the scope should have at least one GP ring which should start from one Mandal and culminate at adjacent Mandal. Network must be designed such that the distance of the GP ring connecting two Mandals should not exceed 40 km. Any deviation from this will be considered on a case-by-case basis.

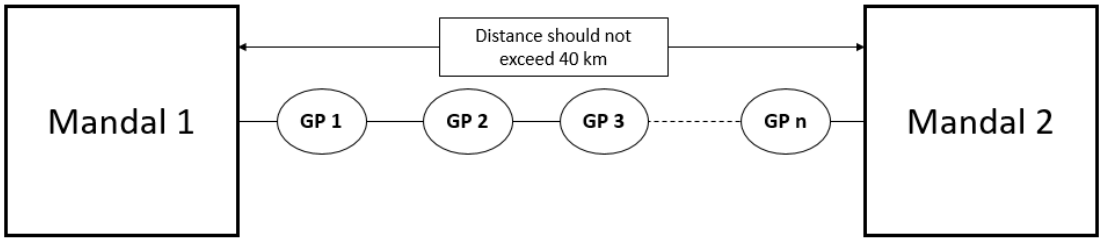

Figure 2: Mandal-to-Mandal connectivity

iv. 6 cores of fiber in a GP ring, should be left for Mandal to Mandal connectivity and should not be dropped at any GP in the ring.These will be used for creating nx100G Mandal/ Master Mandal ring network.

v. 2 cores of dark fiber should be dropped at all the GPs in physical ring and logical ring from the Mandal. However, GPs connected in spur (linear architecture) will have dark fiber available from the nearest GP in ring.

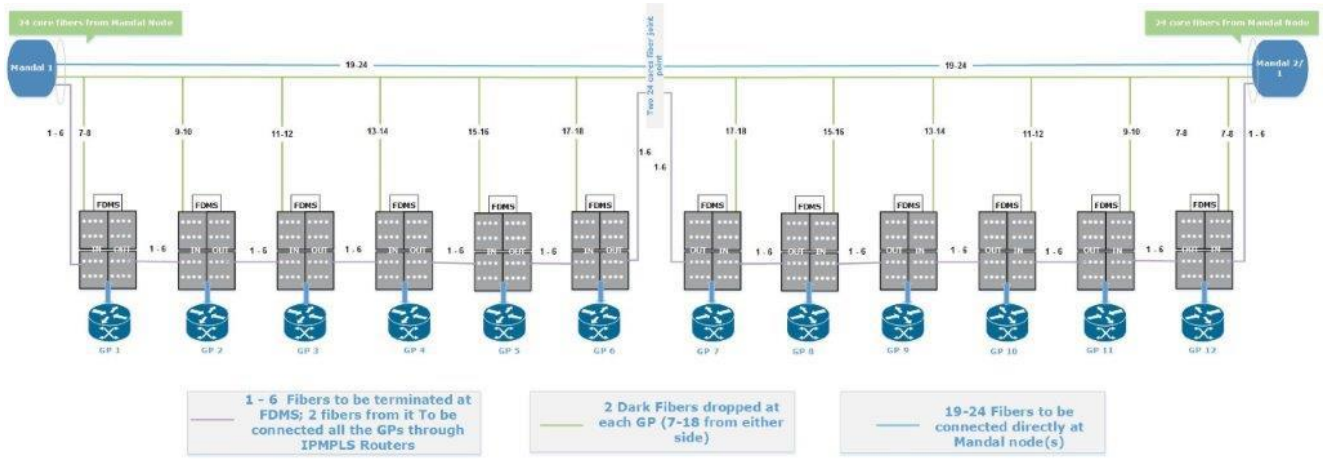

Figure 3: Dropping of 2 cores at each GP

For example, in the figure 3, it can be seen that 2 cores from either side are being dropped at each GP. Fiber core numbers are depicted in the above figure. These fiber pair will act as a dark fiber and can be used for leasing purposes, etc. In the above example, Mandal 1 is Originating Mandal and Mandal 2 is Terminating Mandal for GP 1 to GP 6. Similarly, Mandal 2 is Originating Mandal and Mandal 1 is Terminating Mandal for GP 7 to GP 12.

vi. As depicted in point v, 2 cores of fiber needs to be dropped at each GP in ring from the Mandal. Hence, a maximum 12 GPs (6 GPs from either side of the ring) can be connected in ring architecture.

vii. If a GP is not situated on the main fiber route and is situated in either side of the route, then that particular GP should be connected in a logical ring architecture. This will ensure port level redundancy at the router deployed in this GP. Logical ring architecture is depicted in figure 5.

In logical ring architecture, a 24F fiber cable has to be stringed to connect the GP away from the fiber route with the fiber route connecting two GPs in a ring. The fiber cores of 24F cable, connecting GP away from the fiber route will be divided logically facing east and west direction.

For example, in the below figure 4, it can be seen that a single 24F cable is used to connect GP3. The first 12 cores of the 24F cable are for connecting to GP1 and the remaining 12 cores of the 24F cable are for connected to GP2.

Out of the 12 cores for GP1, 8 cores are patched to the 24F cable connecting GP1. Out of the 8 cores, 2 cores are connected to the router deployed at GP3, 4 cores has to be left at FDMS for future expansion purposes and 2 cores will be dropped at FDMS as dark fiber from Mandal.

Similarly, 6 cores from the second set of 12 cores has to be patched with cable going towards GP2. The remaining cores available are to be used as dark fiber from junction point till GP3.

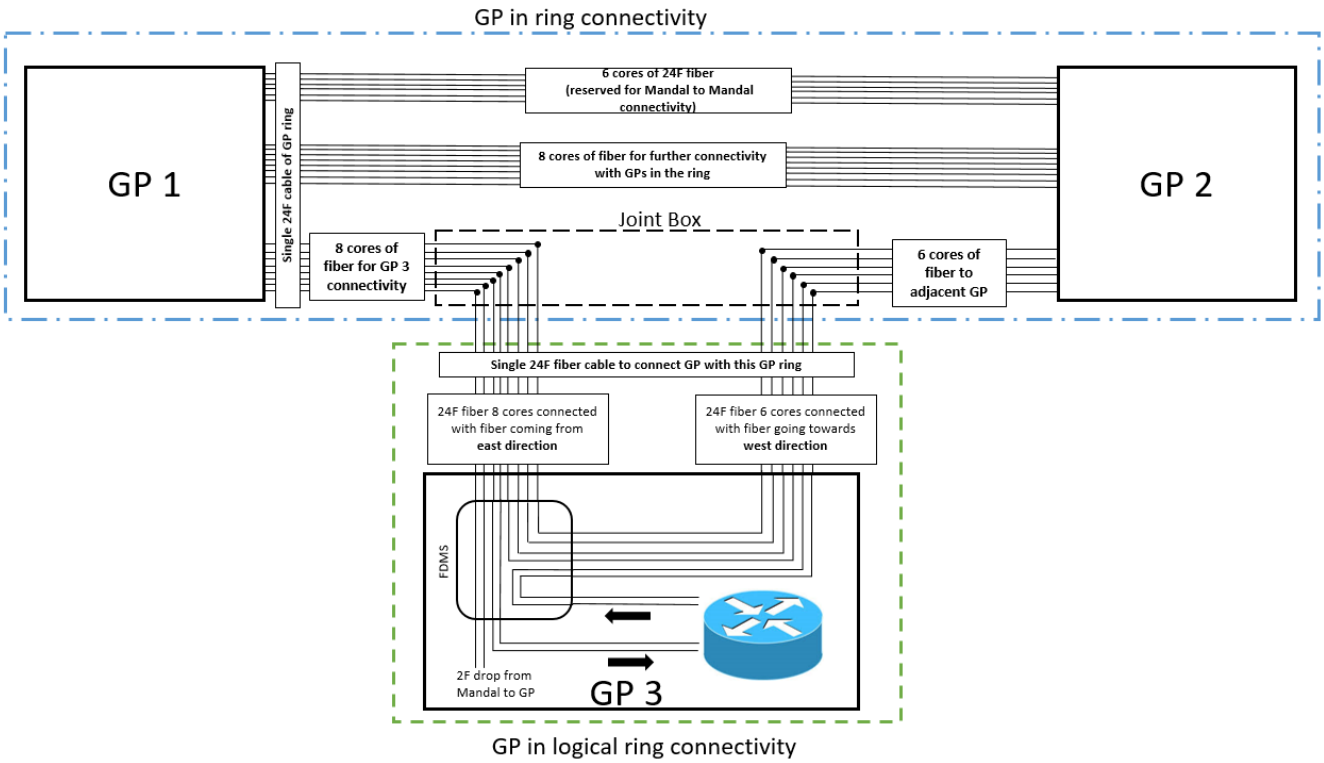

Figure 4: Logical ring architecture

viii. If the no. of GPs in a GP ring is less than 12, then in such the no. of GPs in originating and terminating Mandal should be as per table below:

S. No.	No. of GPs in a ring	No. of GPs in which 2 cores to be dropped from Mandal 1 (Originating Mandal)	No. of GPs in which 2 cores to be dropped from Mandal 1/ 2 (Terminating Mandal)
1	4	2	2
2	5	3	2
3	6	3	3
4	7	4	3
5	8	4	4
6	9	5	4
7	10	5	5
8	11	6	5

ix. The splicing in the joint enclosure box should be done as per the following:
   a. Fiber cores 1 - 6 and 19 - 24 should be spliced in the joint box
   b. Fiber cores 7 - 18 should not be spliced in the joint box and left without connecting

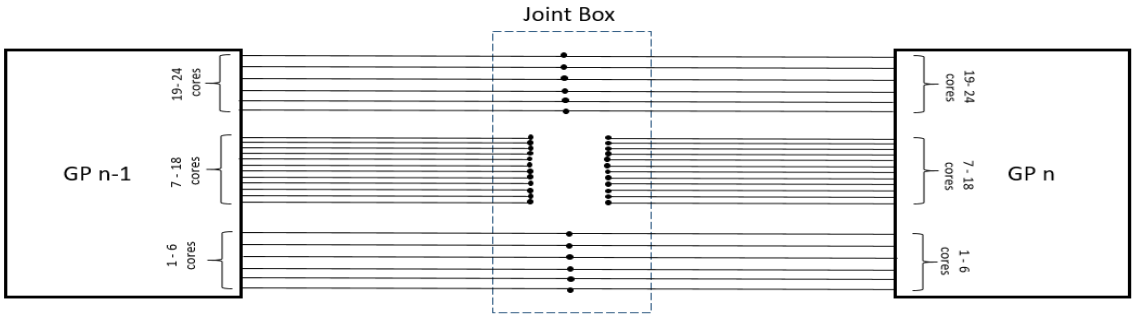

Figure 5: Splicing guidelines

x. Dependency on a linear path should not be created for more than 2 GPs. If the dependency is more than 2 GPs, then an alternate route should be identified to connect the 3rd GP. Any deviation from this, will be considered on a case-by-case basis.

For example, as shown in figure 6, GP3 is connected in logical connectivity with GP 1 and GP2. In such case, only one GP (i.e. GP4) can be connected with GP3 in linear architecture. Hence, connecting GP5 with GP 4 is not permissible and an alternate route must be identify to connect GP5.

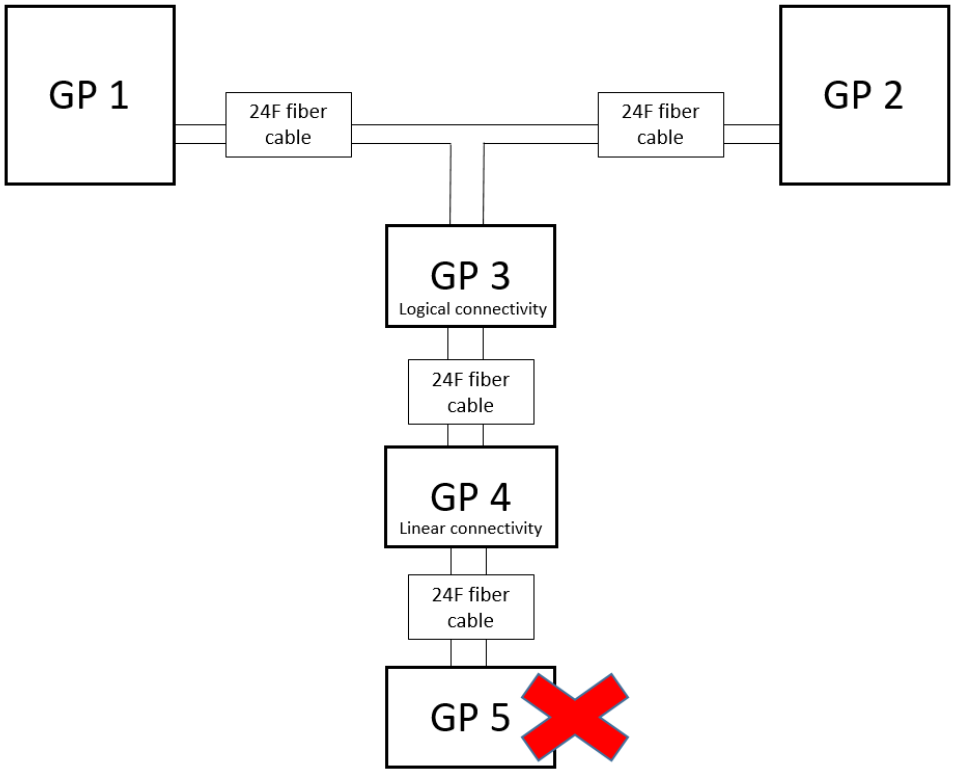

Figure 6: Guideline for linear connectivity from GP

xi. The maximum number of 24F cables on a single pole / path can be three (3). No deviation from this should be planned in the network.

xii. Fiber cores to be utilized for connectivity in a ring architecture (from one side of the ring and considering 12 GPs connected in the ring):

S. No.	Ring type	Tube no.	Fibre core no.
1	2 cores dropping at GP1 / GP12 from Mandal	2	7-8
2	2 cores dropping at GP2 / GP11 from Mandal	3	9-10
3	2 cores dropping at GP3 / GP10 from Mandal	3	11-12
4	2 cores dropping at GP4 / GP9 from Mandal	4	13-14
5	2 cores dropping at GP5 / GP8 from Mandal	4	15-16

S. No.	Ring type	Tube no.	Fibre core no.
6	2 cores dropping at GP6 / GP7 from Mandal	5	17-18
7	2 cores for connecting routers in the ring	1	1-2
8	Reserved for future expansion of router capacity	1 and 2	3-6
9	Mandal to Mandal connectivity (without dropping at GP)	5 and 6	19-24

xiii. Colour coding of 24F ADSS cable

Tube No.	Colour of Tube	Fiber core colour	Fiber No.
1	Blue	Blue	1
		Orange	2
		Green	3
		Natural	4
2	Orange	Blue	5
		Orange	6
		Green	7
		Natural	8
3	Green	Blue	9
		Orange	10
		Green	11
		Natural	12
4	Brown	Blue	13
		Orange	14
		Green	15
		Natural	16
5	Slate	Blue	17
		Orange	18
		Green	19
		Natural	20
6	White	Blue	21
		Orange	22
		Green	23
		Natural	24

xiv. Fiber cores to be utilized for connecting a GP in logical ring:

S. No.	Ring type	Direction	Fibre core no.
1	2 cores dropping from Mandal	East/ West	Depending on the physical position of the GP in the ring
2	Connectivity with router (In)	East	1-2
3	Reserved for future expansion	East	3-6
4	Connectivity with router (Out)	West	19-20
5	Reserved for future expansion	West	21-24