TATA CONSULTING ENGINEERS LIMITED

LODHA DWELLERS PRIVATE LIMITED



PLANNING AND DETAIL ENGINEERING OF INFRASTRUCTURE FOR DEVELOPMENT OF 590 ACRES OF LAND UNDER DEVELOPMENT AT PALAVA NEAR DOMBIVALI

PRELIMINARY PLANNING NOTE

POWER SUPPLY

MAY 2013

REVISION STATUS SHEET

Issue	Date	Title	Prepared By (TCE)	Checked By (TCE)	Approval By (LODHA Dwellers)
R0	12-03-2013	Preliminary Planning Note – Power Supply	NMM	PKA	
R1	26-03-2013	Preliminary Planning Note – Power Supply	NMM	PKA	
R2	02-04-2013	Preliminary Planning Note – Power Supply	NMM	PKA	
R3	08-04-2013	Preliminary Planning Note – Power Supply	NMM	PKA	
R4	24-04-2013	Preliminary Planning Note – Power Supply	NMM	PKA	
R5	20-05-2013	Preliminary Planning Note – Power Supply	NMM	PKA	

Revision Notes:-

R0- For Client Approval
R1- Power Distribution alternatives from EHV to Zone 1 Block (With & without Switching Stations)
R2- Compact Substation Location Options suggested by architect (M/s KAPL)
R3- Transmission alternatives for different EHV substation location
Table – Technical comparison of 22kV & 11 kV
Schematic for EHV to Zone 1 Switching Station for new EHV location
R4- Revision in Total Power Demand for Palava considering Non Conventional Energy Sources
R5- Addition of One EHV Vs Two EHV Substation Comparison.

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ABBREVIATIONS

APFCR	-	Automatic Power Factor Correction
CSS	-	Compact Sub Station
EHV	-	Extra High Voltage
EWS	-	Economically Weaker Section
FSI	-	Floor Space index
HT	-	High Tension
KAPL	-	Kapadia Associates Pvt.Ltd.
kms	-	Kilometers
kV	-	Kilo Volts
kVA	-	Kilo Volt Amperes
LV	-	Low Tension
LV	-	Low Voltage
MLCP	-	Multi Level Car Parking
MSEDCL	-	Maharashtra State Electricity Distribution Company Ltd.
MVA	-	Mega Volt Ampere
m	-	Meters
mm	-	Millimeters
m.sq.ft	-	Million Square Feet
NBC	-	National Building Code
RMU	-	Ring Main Unit
ROW	-	Right of Way
Sq.mtr	-	Square Meters
TCE	-	Tata Consulting Engineers

PRELIMINARY PLANNING NOTE – POWER SUPPLY

FOR DEVELOPMENT OF 590 ACRES LAND OF PALAVA

1 INTRODUCTION

Lodha Dwellers Private Limited (Lodha) has appointed Tata Consulting Engineers Limited (TCE) to provide consulting engineering services for the “Planning and Detail Engineering of Infrastructure for development of 590 acres of land development”.

1.1 Project Background

Lodha has identified almost 2200 acres for planned development of the “Palava city”, about 8 kms south of Dombivli. Half of this land (near about 1100 acres) is marked as the first parcel of development out of which Lodha plans to take up 590 acres on priority. This land is to be developed by 2030 years in phases.

Following recent developments, the FSI of the area has increased to 1.7. New Master Plan for the 590 acres township has been prepared in January 2013.

A workshop in this regard was called by Lodha on 4th to 6th Feb 2013. Infrastructure goals, utility management philosophies, security and smart city intent for 590 acres (Palava) township were discussed. Preliminary inputs required for planning have been formulated on basis of this workshop. The Preliminary Planning Notes are prepared in this regard.

2 POWER SUPPLY

2.1 Development Phasing

The total power demand calculation for Palava is calculated as per raw data provided in data file **(2013-02-14 Palava 590 Delivery and Occupancy Estimate v2)** provided by Lodha. The phasing identified is as follows:

Table 2-1 Phasing

Phases	Year	Occupancy	Residential Population
Phase 1	2018	20%	47,443
Phase 2	2023	60%	138,375
Phase 3	2029	100%	230,953

The note includes the following:

- Total power demand for 590acres of development
- Power distribution alternatives based on B-block of Zone-1 (maximum load density for Zone-1)

2.2 Power Demand Calculations

The total power demand for Palava is estimated at 250MVA. The zone wise power demand is summarized in

Table 2-2. Detailed basis and estimates are provided in **Appendix 1**.

Table 2-2 Zone wise Power Demand Estimates for Palava

Sr.No	Zones	Total built up area/saleable area(m.sq.ft)	Total Power Demand(MVA)
1	Zone-1	7.80	69.83
2	Zone-2	9.88	34.01
3	Zone-3	10.55	33.58
4	Zone-4	9.45	34.14
5	Zone-5	7.82	26.38
6	Zone-6	8.62	26.78
7	Total Power Demand		224.72
8	Total Power Demand Considering 5% Contingency		235.95
	EHV Substation Installed Capacity		**250.00**

Zone-1 load is pre-dominantly from the commercial complex & residential blocks. The commercial power demand is 42.08MVA & for residential power demand is 27.75MVA (including EWS). Block B in Zone-1 has highest load density (approximately 2.81MVA).

3 TRANSMISSION PHILOSOPHY FOR ALTERNATIVE EHV SUBSTATION LOCATIONS

FOR transmission philosophy voltage level for EHV substation considered is 220kV. In EHV substation 220kV voltage level will be stepped down to 22kV as per MSEDCL standard voltage level for power distribution. M/s Lodha will have distribution franchisee at 22kV & metering will be done at 22kV.There are following two alternative locations of EHV substation:

3.1 Alternative-1(EHV sub-station at 1.5 kM south of site)

In this alternative EHV substation will be located 1.5kM away from proposed development. As mentioned in Table 2.2 total power required is 250MVA & this power will have to be brought till the site location by laying 22kV overheadlines as per MSEDCL requirements with maximum loading on single overheadline restricted to 8 MVA & if double circuit overheadlines are used then maximum loading will be restricted to 16MVA.Considering this constraint approximately 30 nos. single circuit overheadline will reach site and if double circuit lines are used then the quantity will be 15 nos. All these overhead lines will have to be converted to underground cables at single location of the plot & then will enter the plot to feed the switching stations of the respective zones. **Figure 3-1** shows the location of EHV substation

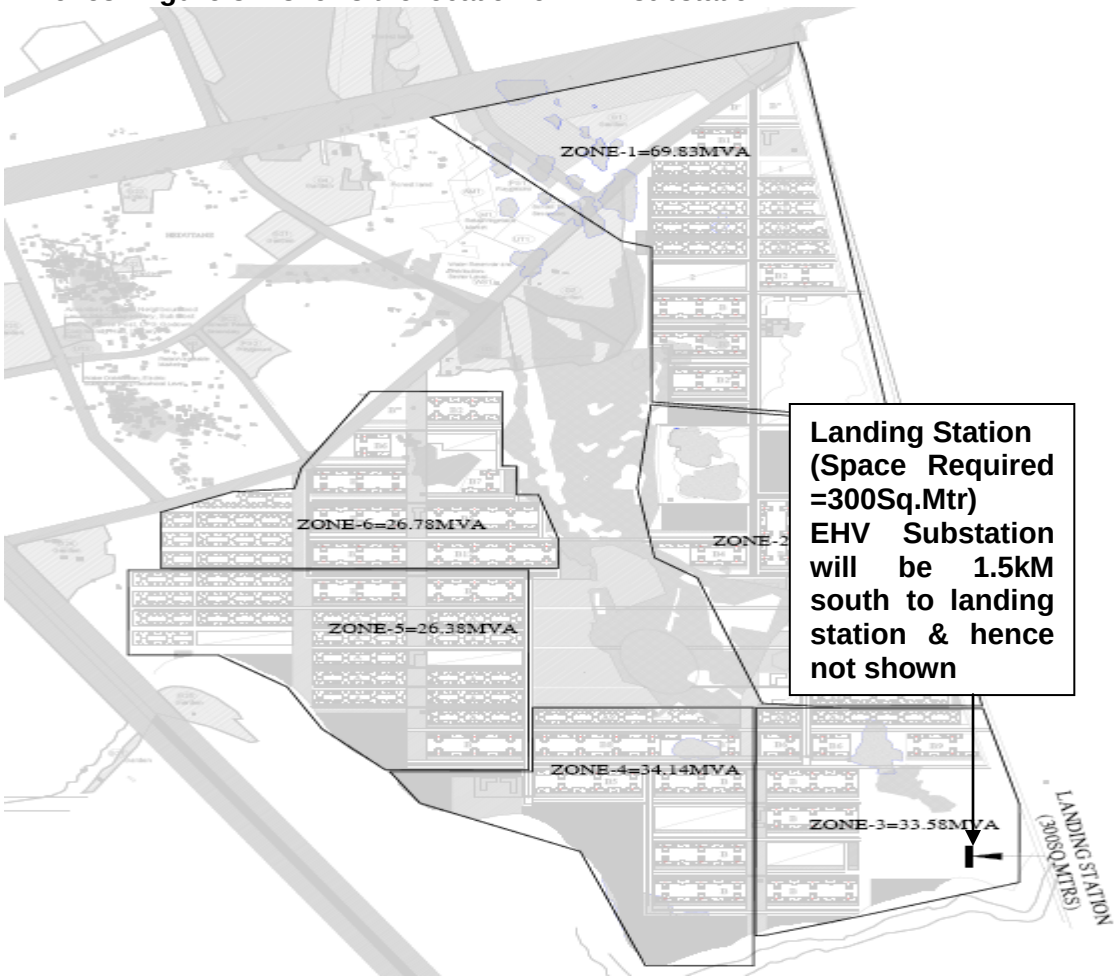


Figure 3-1 EHV Substation Location-1.5kM South of Site

3.2 Alternative-2(EHV sub-station adjacent to site)

In this alternative EHV substation will be located adjacent to proposed development as shown in the **Figure 3-2**. From EHV substation location 22kV underground cable networks will feed respective switching station of the zones inside the development.

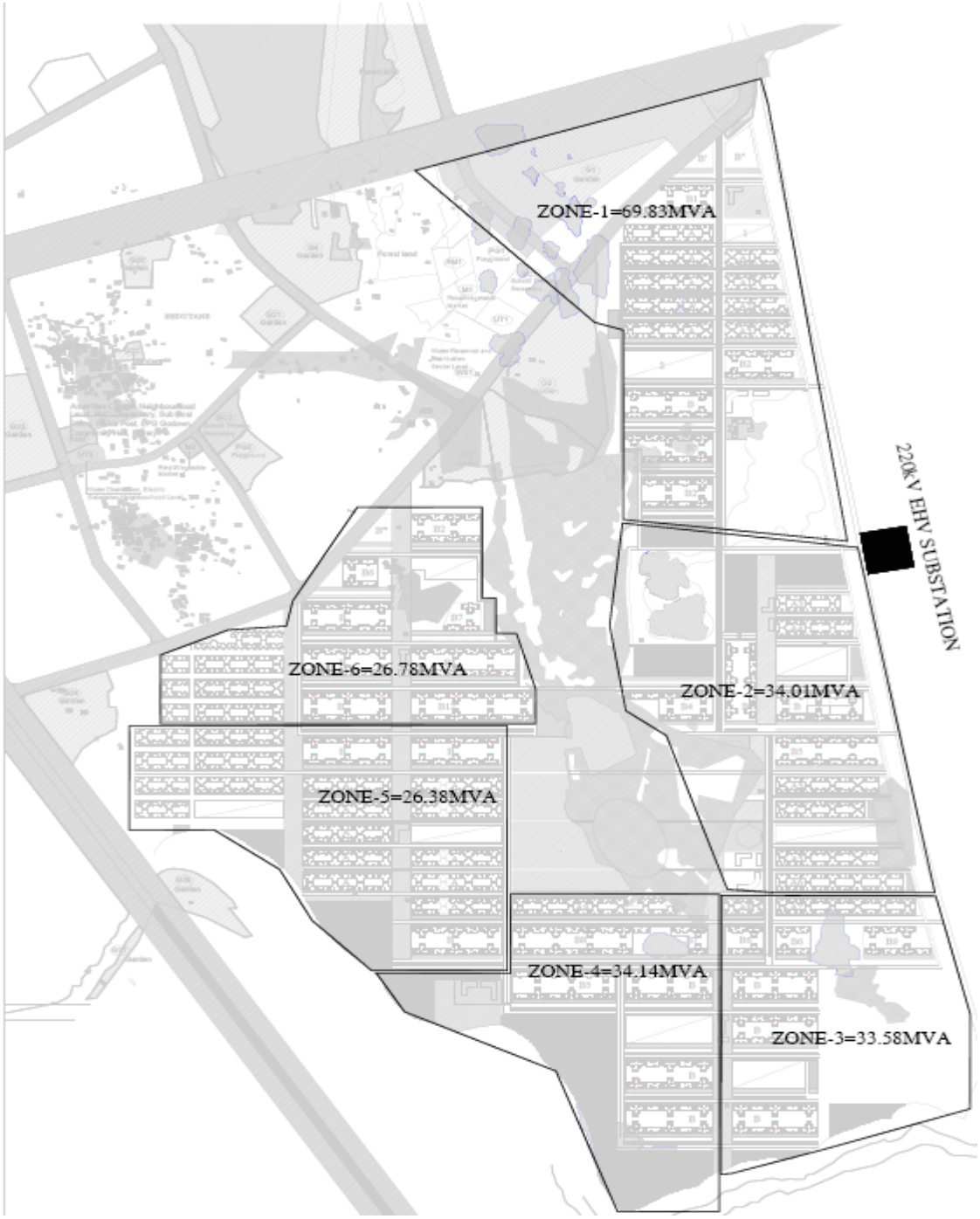


Figure 3-2 EHV Substation Location- Adjacent to Site

3.3 Alternative-3(EHV sub-station within site)

In this alternative EHV substation will be located within proposed development as shown in the **Figure 3-3**.From EHV substation location 22kV underground cable networks will feed respective switching station of the zones inside the development.

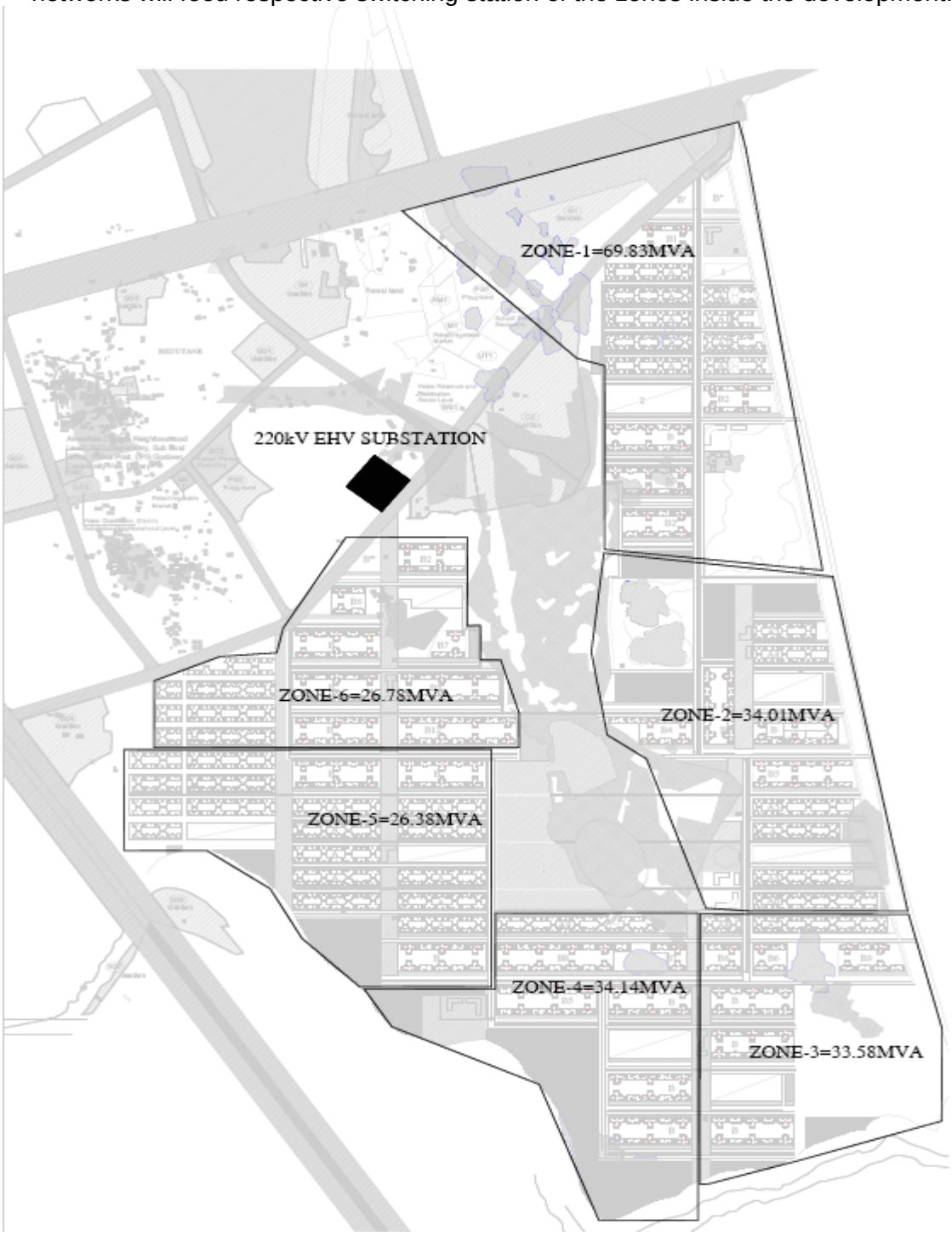


Figure 3-3 EHV Substation Location- Within Site

3.4 Technical comparison of EHV Substation Location Alternatives

The evaluation of following Alternatives is presented in this section:

- Alternative-1(EHV Substation Location 1.5kM south of site)
- Alternative-2(EHV Substation Location adjacent to site)
- Alternative-3(EHV Substation Location within site)

Sr.No.	Description	22kV ROW Required Outside Plot (Acres)	220kV ROW Required Outside Plot (Acres)	220kV ROW Required Inside Plot (Acre)	Space for 22kV Landing Station Near Site (Sq.mtr)	Maximum Power Evacuation per line (MVA)
1	Alternative-1	20	-	-	300	8 for 22kV
2	Alternative-2	-	13	-	-	150 for 220kV
3	Alternative-3	-	-	13	-	150 for 220kV

- In Alternative-1,maximum loading on 22kV single circuit overheadline is taken as 8MVA & that of double circuit line is 16MVA.To feed 250MVA power,22kV double circuit overheadline is considered as per MSEDCL standard practice & such 15nos. lines requiring approximately 2.5meter of ROW will be required to be laid from EHV substation location till the site location. The ROW for 22kV shown in above table is calculated considering 1meter clearance between 2.5meter ROW. Also when 22kV overheadlines enter the plot, it is necessary to convert them into underground cables & for this conversion landing station is required at the entry point of 22kV line to the plot which will mainly consist of 4 pole structures, not required in any other alternatives. As 22kV line length will be additional (1.5kM) in this alternative, voltage drop for this option will be maximum of all. Hence MSEDCL requirement of maintaining 5% voltage drop till the building metering point will have to be achieved by incurring extra cost on 22kV cables inside the plot area.
- In Alternative-2, since 220kV transmission line will be brought near the site, 35meters of ROW has to be acquired which will act as no development zone till the site boundary. As seen from above table the ROW required for Alternative-2 is less as compared to Alternative-1.
- ROW requirement for Alternative-2 & 3 is same but in case of Alternative-3 additional 35M ROW has to be allocated for bringing 220kV transmission line inside the plot which will again be no development zone & the distance inside the plot is considered as 1.5kM.
- 12Acres of land is required for 220kV EHV Substation.

3.5 Conclusions & Recommendations on EHV Substation Location Alternatives

- Alternative-1 is techno commercially unviable due to larger ROW. Alternatives 2 & 3 are techno commercially viable. Evaluation of both the alternatives has been provided considering the HT Cable cost optimization.
- HT cable network optimization is better for Alternative-3 as compared to Alternative-2. However 13 Acres ROW inside plot area & greater 220kV transmission line length will required in this alternative. Alternative 2 is considered as the preferred option.

3.6 Conclusions & Recommendations on EHV Substation based on meeting dated 09-04-2013.

- Alternative-3 is accepted for Centralized EHV substation location.
- Alternatives of one EHV substation Vs two EHV substation for EHV substation were discussed. Accordingly the two EHV substation locations are identified in option-2 as per Appendix-6.In case of one EHV substation (option-1) the location of EHV substation will be same as that of EHV substation-1 of option-2.
- Techno commercial Comparison for both the options is as per Appendix-7.
- Considering all the aspects as per Appendix-7, single EHV substation for entire plot (option-1) is acceptable.

4 POWER DISTRIBUTION PHILOSOPHY FROM EHV SUBSTATION TO BLOCK

4.1 Options Based on Alternative-2 of Section 3

Based on recommendation of Section 3 alternatives for power distribution philosophy from EHV substation to Block substations are worked out considering the Zone-1 as given below:

4.1.1 Option-1 (Power Distribution without Intermediate Switching Station)

All HT cables originating from the EHV substation will feed the block substations in a ring main configuration. This eliminates the necessity of intermediate switching stations. The maximum load in any ring will not exceed 8 MVA. The residential area power demand for Zone-1 is about 28MVA. 4 rings (8 outgoing feeders) will be required at the 22kV switchgear panel of the EHV substation for the load of Zone-1.The corridor requirement & power distribution layout for this option is shown in **Figure 3-4**. The 22kV cables originating from EHV substation are laid along the main road (identified by clouded portion in the figure).

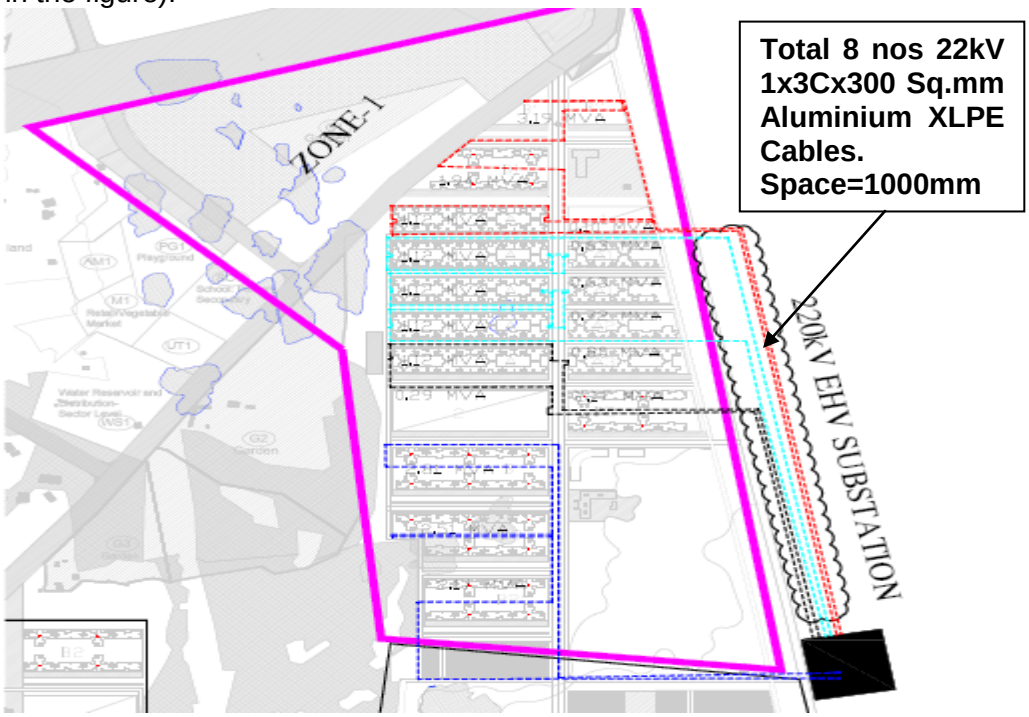


Figure 4-4 Power Distribution Philosophy from EHV SS to Block SS for Option-1

4.1.2 Option-2 (Power Distribution with Intermediate Switching Station)

A 22kV intermediate switching stations of capacity 28MVA is placed in the MLCP area of Zone-1. This optimizes the HT cable network length. The ROW required for the cable corridor along the main road (indicated by clouded portion in **Figure 3-5**) is also reduced to approximately half of that in Option-1.

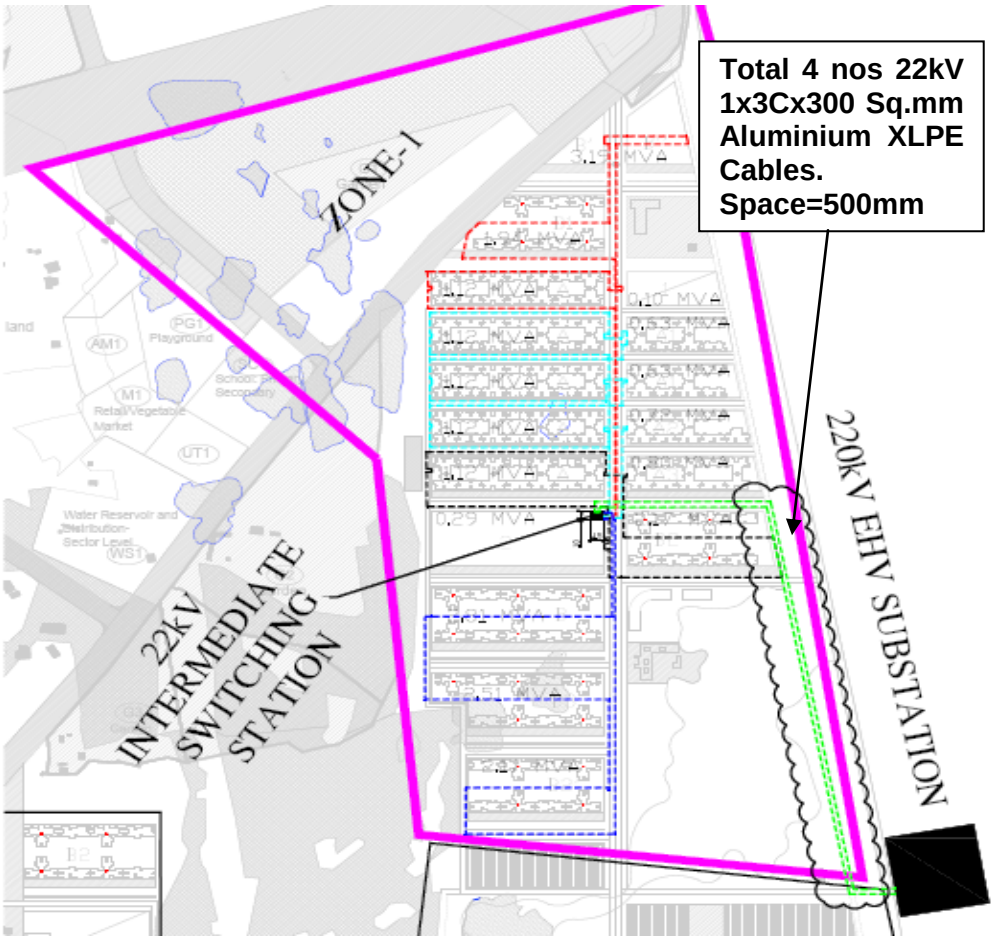


Figure 4-5 Power Distribution Philosophy from EHV SS to Block SS for Option-1

4.2 Options Based on Alternative-3 of Section 3

In event that the 220kV EHV substation can be located centrally within the site for optimized HT cable network, the EHV substation location may be considered as shown in **Figure 3-6** near Zone-1. Alternatives for power distribution philosophy from this EHV substation location to the block substation are prepared on following basis:

- Comparison is for Zone-1 (residential)
- The distribution voltage level considered is 22kV.
- All power distribution is proposed by 22kV cables laid along roads.

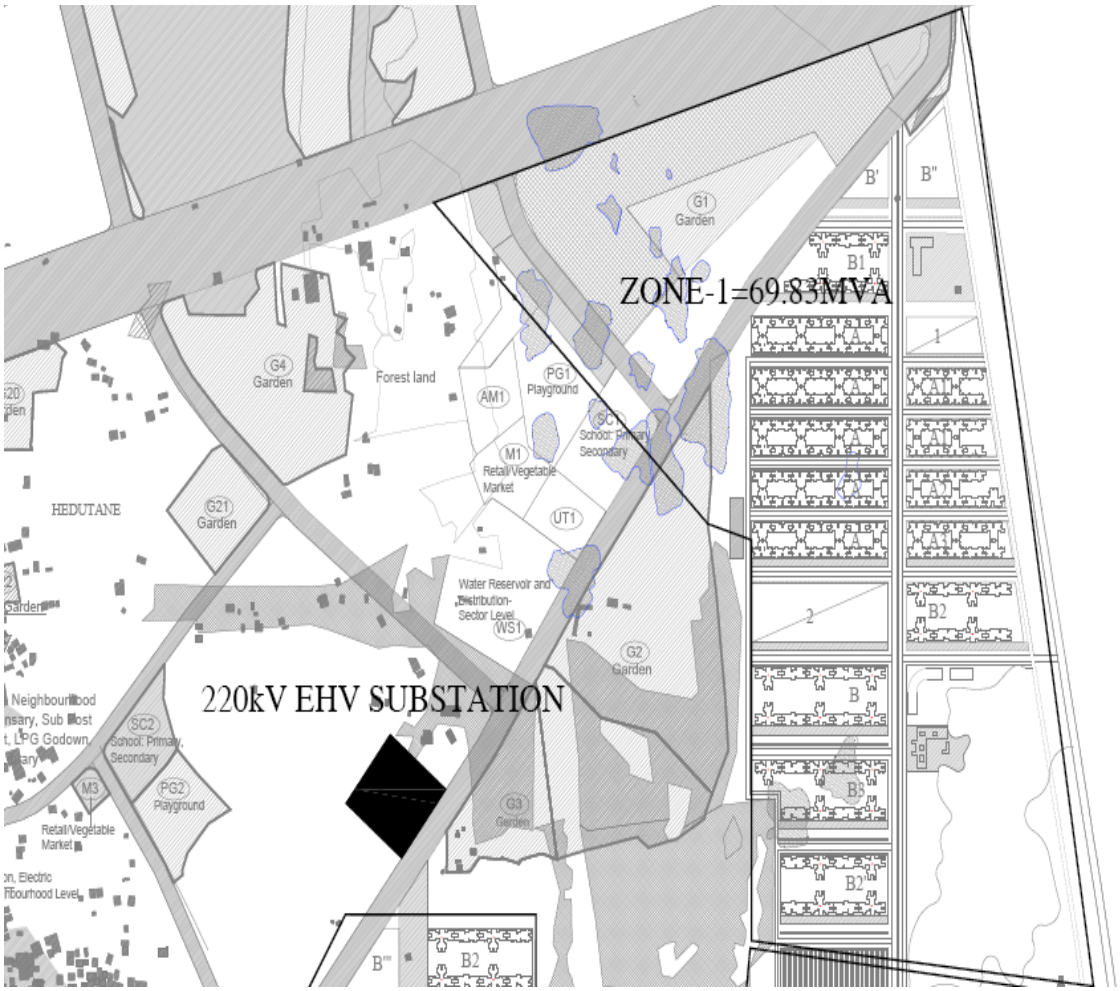


Figure 4-6 EHV Substation Location

4.2.1 Option-1 (Power Distribution without Intermediate Switching Station)

All HT cables originating from the EHV substation will feed the block substations in a ring main configuration. This eliminates the necessity of intermediate switching stations. The maximum load in any ring will not exceed 8 MVA. The residential area power demand for Zone-1 is about 28MVA. 4 rings (8 outgoing feeders) will be required at the 22kV switchgear panel of the EHV substation for the load of Zone-1.The corridor requirement & power distribution layout for this option is shown in **Figure 3-7**. The 22kV cables originating from EHV substation are laid along the main road (identified by clouded portion in the figure).

4.2.2 Option-2 (Power Distribution with Intermediate Switching Station)

A 22kV intermediate switching stations of capacity 28MVA is placed in the MLCP area of Zone-1. This optimizes the HT cable network length. The ROW required for the cable corridor along the main road (indicated by clouded portion in **Figure 3-8**) is also reduced to approximately half of that in Option-1.

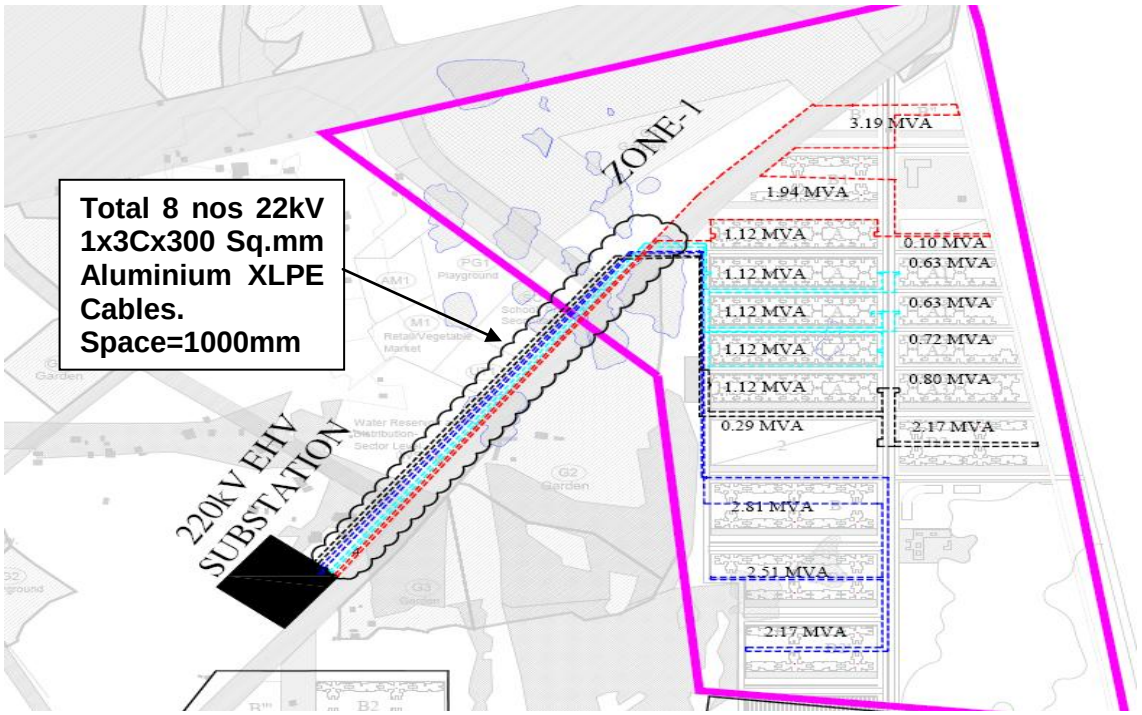


Figure 4-7 Power Distribution Philosophy from EHV SS to Block SS for Option-1

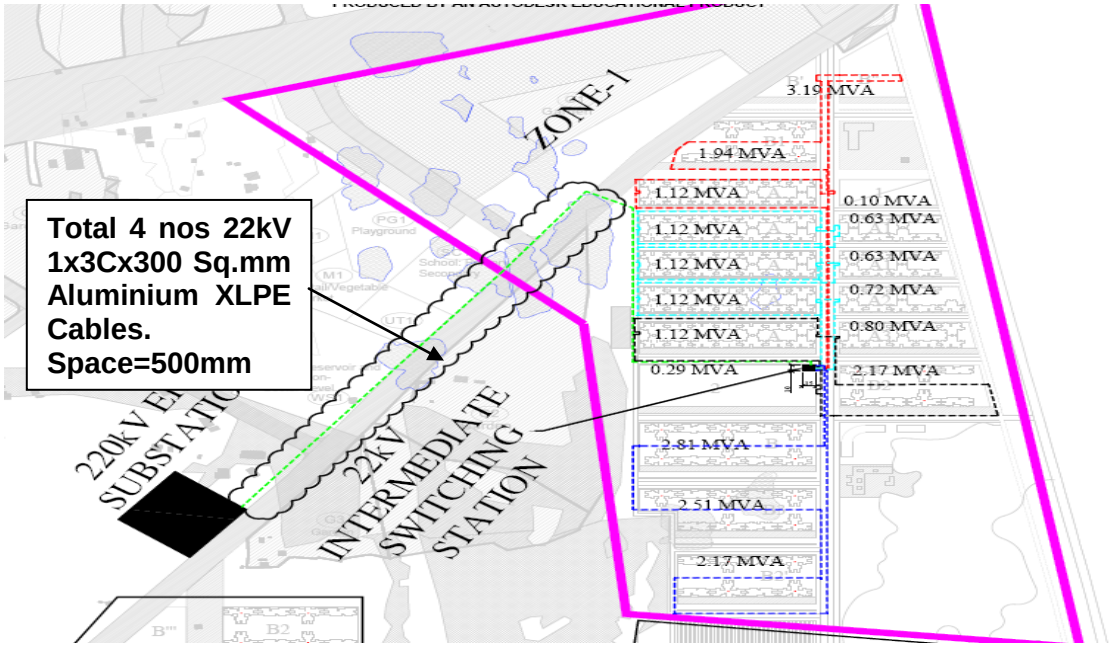


Figure 4-8 Power Distribution Philosophy from EHV SS to Block SS for Option-2

4.2.3 Techno-commercial evaluation of for Power Distribution Options

The evaluation of following options is presented in this section considering Alternative-2 & 3 of Section 3:

- Option-1(Power Distribution without Intermediate Switching Station)
- Option-2 (Power Distribution with Intermediate Switching Station)

Techno-commercial comparison of for Zone-1 Considering EHV substation Outside Plot i.e. Alternative-2 is given below:

Sr. No	Description	Cost for Cables (Crore)	Space Requirement along Main Road (Lx W X D) (m x m x m)	HT Cable Length (m)	Maximum Distribution Loss from EHV Substation to Building Substation (%)
1	Option-1	2.80	650 x 1x 1.2	13000	0.35
2	Option-2	2.50	650x 0.5x1.2	11500	0.70

Techno-commercial comparison of for Zone-1 Considering EHV substation Inside Plot i.e. Alternative-3 is given below:

Sr. No	Description	Cost for Cables (Crore)	Space Requirement along Main Road (Lx W X D) (m x m x m)	HT Cable Length (m)	Maximum Distribution Loss from EHV Substation to Building Substation (%)
1	Option-1	3.22	550 x 1x 1.2	15100	0.35
2	Option-2	2.89	550x 0.5x1.2	13500	0.70

- Cable costs are considered with 70% discount.
- The cost of civil works for laying of cables is not included.
- The cost for 22kV HT switchgear is not considered as this will be similar for both the options.
- Space requirement of EHV substation remains the same in both the options.
- Cable Corridor requirement of Option-1 is much more than Option-2, however in Option-2 approximate 15m x 10m space shall be allocated in each zone for accommodating the intermediate switching stations.
- The total voltage drop till the building metering point is considered as 3%.
- Options shown in above tables do not differ much since EHV substation location assumed is equidistant from Zone-1 one is at left & other is at right side of Zone-1.
- If the EHV substation location changes other than that mentioned in Alternative-2 & 3 of Section-3 the evaluation will change accordingly.
- It is recommended to go for Option-2 in Alternative-2 & 3 both due to following reasons:
  -Major utility corridor is not envisaged in Palava which is required in Option-1.

-Option-2 requires additional space for accommodating intermediate switching stations. However based on workshop dated 05-02-2013 space for intermediate switching stations will be considered by architects & master planners as required.

4.2.4 Conclusions on Power Distribution Options from Internal EHV Substation to Block

- Considering Option-2 in Alternativ-2 & 3 following conclusions can be drawn

Sr. No	Description	Cost for Cables (Crore)	Space Requirement along Main Road (Lx W X D) (m x m x m)	HT Cable Length (m)	Maximum Distribution Loss from EHV Substation to Building Substation (%)
1	Alternative-2 Option-2	2.50	650 x 0.5x 1.2	15100	0.35
2	Alternative-3 Option-2	2.89	550x 0.5x1.2	13500	0.70

- The cost for cables & space requirement along the main road is less for Option-2 of Alternative-2 as compared to Option-2 of Alternative-3 due to optimized HT cable network.
- It is concluded that Alternative-2 Option-2 is more feasible over Alternative-3 Option-2 due to cable cost & ROW for cable distribution.

4.2.5 Power distribution schematic based on recommended option in Section-4

Considering EHV substation outside the plot & adopting the option of switching stations the power distribution schematic has been worked out using 22kV underground cable networks as shown in Appendix-4.Following observations are made based on Appendix-4:

- The total cable corridor required at EHV substation entrance location will be approximately 10meters considering 400Sq.mm Al, Conductor, XLPE cable spaced one cable diameter apart from each other.
- The cable corridor will go on reducing in size as it feeds switching stations at different locations.
- Maximum 4 runs of 3Cx400 sq.mm 22kV cables are considered which can cater to 34MVA load required for Zone-4 & since power requirement of other zones are close to 34 MVA same runs of cables have been considered for the same.

5 SELECTION OF DISTRIBUTION VOLTAGE LEVEL

5.1 Franchise License Agreement

M/s Lodha will get distribution Franchisee for Palava project. MSEDCL prefers 22kV as a standard voltage for power distribution. Hence franchise license agreement will be done

for 22kV voltage level between M/s MSEDCL & M/s Lodha. This is a major reason for adopting 22kV distribution voltage level.

5.2 Options for Deciding Distribution Voltage Level

There are following two stages of power distribution as per the final distribution alternative adopted:

- Power Distribution from EHV to Switching Station.
- Power Distribution from Switching Station/ to Building Transformer.

As described above 22kV voltage level will be adopted for power distribution from EHV to Switching Station.

Following two options of power distribution from switching station/substation to building transformer are considered. It is to be noted that if 11kV voltage is used then substation with transformers will be installed to step down from 22kV to 11kV.

- 22kV power distribution using cables in ring main configuration from switching station: In this option the maximum load in a ring is restricted to 8MVA as per MSEDCL requirements. All cables will be laid underground till the building CSS in loop in loop out configuration. Transformation of voltage is not required in this option.
- 11kV power distribution using cables in ring main configuration from substation: In this option 22kV/11kV distribution transformers will be installed in Intermediate substations located in each of the zones & 11kV power cables will be laid underground till the building CSS. In this option the maximum load in a ring is restricted to 4MVA as per MSEDCL requirements.

5.3 Technical Comparison & Recommendations (11kV Vs 22kV)

The comparison is summarized as given in the table below:

Sr.No.	Voltage Level (kV)	Power Handling Capacity (MVA)	HT Switchgear Space Required at SS (mxm)	Transformer Space at SS (mxm)	Space for Cable Corridor outside SS
1	22	8	15x10	-	Less
2	11	4	30x10	30x5	More

- In 11kV distribution option 22kV will be converted to 11kV at intermediate substation level hence at this location 22kV switchgear will also be required to feed the 22kV/11kV transformers in addition to 11kV switchgear. Since power handling capacity of 11kV is half that of 22kV, more no of 11kV switchgear panels are required to feed the same amount of power as compared to 22kV.
- In 11kV option in addition to Ht switchgear, transformer space will also be required as compared to 22kV option.
- It has also to be noted that maximum rating of 22/11kV transformer available in market is 3MVA & the average power demand of switching stations is 30MVA.So.10nos. dry type transformers are required to be accommodated inside building (preferably MLCP) which will occupy huge space as mentioned in above table in addition to that of 22kV switching station option.

- Since 11kV cable corridor required will be more, the space planning around the buildings at block level will increase which may have implications at the time of allocating the utility corridors resulting in space crunch for utilities.
- The incremental cost of 22kV switchgear, as well as cables in 22kV option will be less as compared to incremental cost of transformers & 11kV switchgears in 11kV option.
- Considering all the technocommercial & tangible advantages & disadvantages of abovementioned options 22kV voltage level has been selected for power distribution inside Palava development.

6 POWER DISTRIBUTION FROM BLOCK SUBSTATION TO BUILDING METERING

Four alternatives for the power distribution from the building block substation to metering point of each building is envisaged considering space requirement, capital cost and feasibility of locating the substation for B block (highest load density in the Zone-1). The maximum transformer size approved from MSEDCL (1250 kVA) is considered for all the options.

6.1 Option-1 (Indoor Substation at ground floor with Dry Type Transformers)

As per load requirement 3 nos. of 1250kVA, 22kV/0.433kV transformers are required for B-Block. Since the substation has to be located inside building, dry type transformers are proposed as per NBC requirements. LV side of all three transformers will be connected to LT panel located in the vicinity using Aluminium sandwich busducts due to indoor nature of substation. The building substation will include the following:

- 3 Nos Dry type transformers
- HT switchgear(RMU)
- LT panel
- APFCR panel

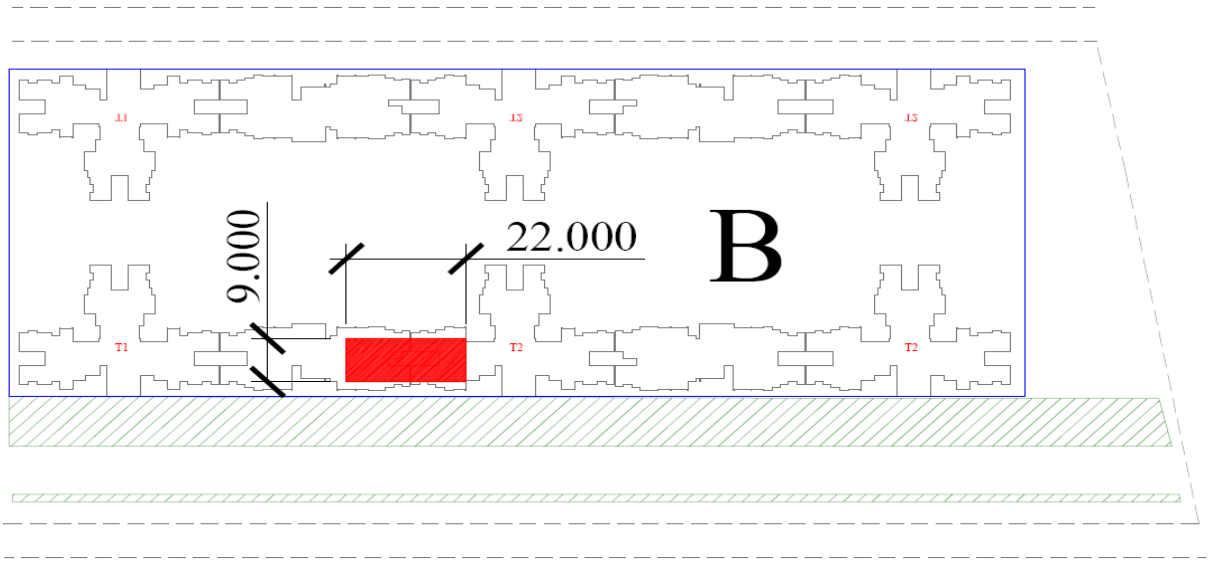


Figure 6-1 Substation Space Requirement for Option-1

Total space requirement for this option is about 200 Sq.mtr. Each building will require its own metering panel at the ground floor. The LT cables from LT panel of the substation will be laid till the metering point of each building inside B-Block.

6.1.1 Evaluation

Considering the connections of LT busducts to transformers as well as the transformer height including its foundation, normal height of 3 m will not be sufficient to accommodate the substation equipments. Ground floor height of minimum 5 m will be required to accommodate this option.

6.2 Option-2 (Outdoor Compact Substation with Oil Type Transformers)

CSS will be installed in the open space available between different buildings, as near the load centre as possible (in order to optimize the LT cabling network).

The Compact Substation will include:

- RMU with two incomers & one outgoing
- 1 No.1250kVA Oil type transformer
- LT switchgear with APFCR panel

3 nos of 1250kVA CSS are required can be placed as shown in the **Figure 3-2.**

The total space requirement is about 105 Sq.mtr. (half of that for Option-1).

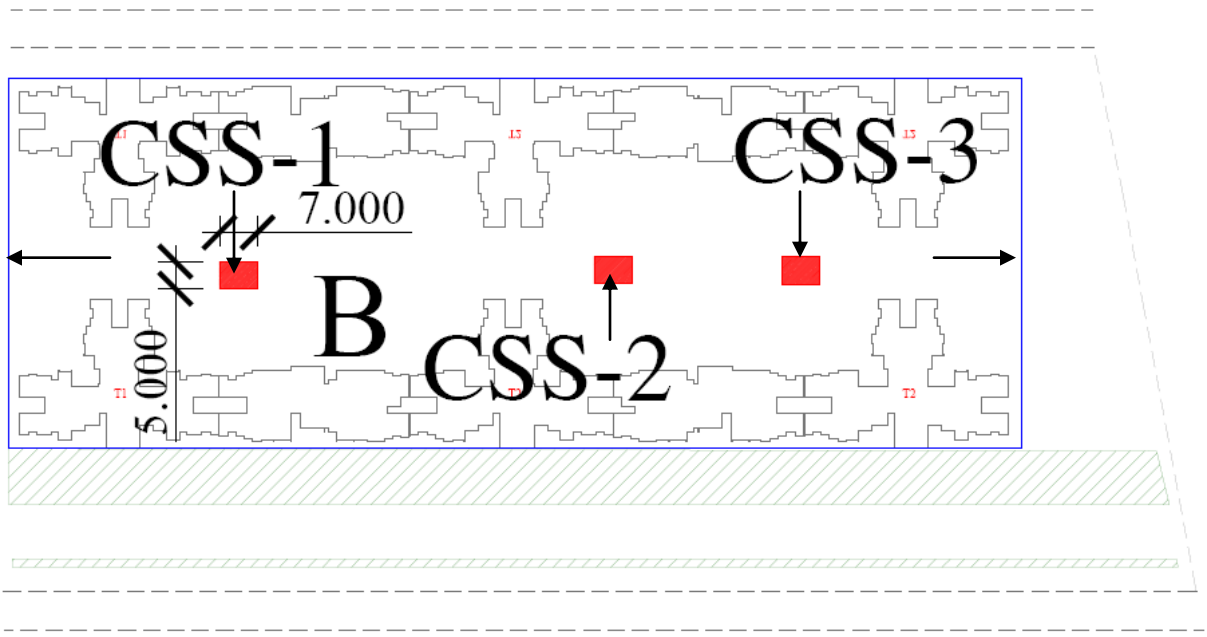


Figure 6-2 Substation Space Requirement for Option-2

6.2.1 Technical Evaluation

- In this option CSS requires access from outside the block as shown by arrows in Figure 3-2 so that in case of maintenance the CSS can be taken out as feasible.

6.3 Option-3 (Open Type Substation outside Block with Oil Type Transformers)

Oil type transformers including all electrical equipment will be installed in open (outside the block) including outdoor weatherproof enclosure. The equipments used are same as that of Option-1. The proposed location of the substation is in a narrow stretch of

landscape area as shown in **Figure 3-3**. Total space requirement is about 320 Sq.meter. This accounts for the fire walls, required safety clearances and the availability of landscape parcel.

6.3.1 Technical Evaluation

The substation is located away from the load centers & hence the voltage drop in cables is greater. To optimize the voltage drop a higher size or more runs of cables will be required. The green space in which the B-Block substation is located in **Figure 3-3** is not available for all types of blocks in the master plan. Required space may not be available for the substation in other type of blocks with less ROW availability. Also, busducts cannot be used for connection between LT panel & transformers as this is an outdoor substation.

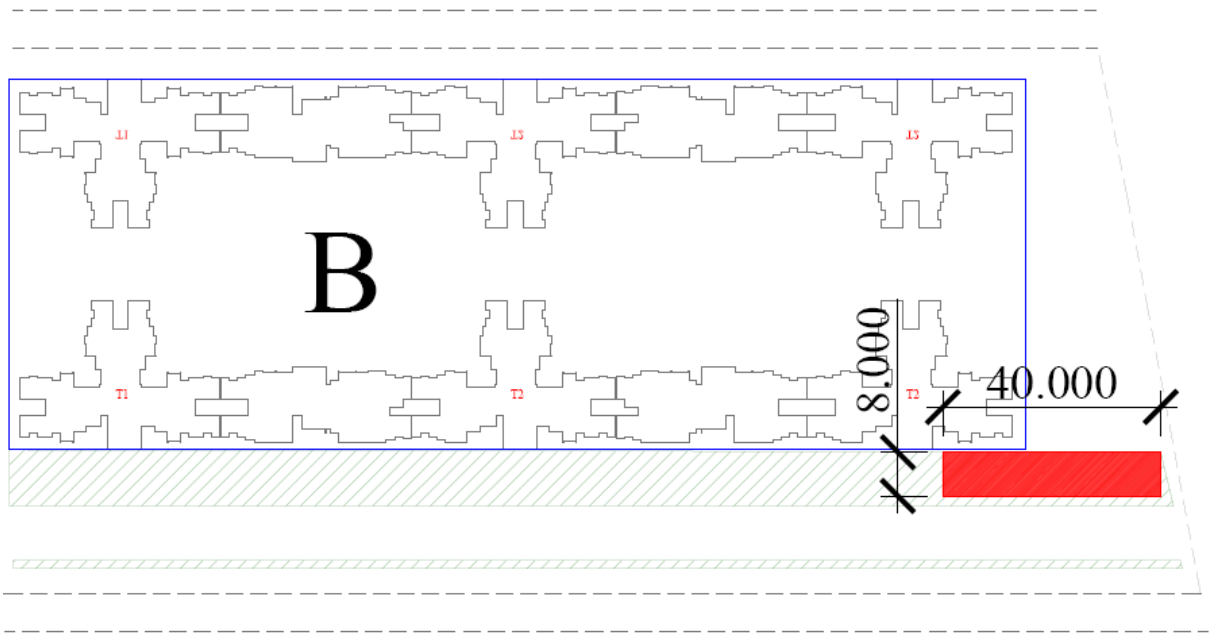


Figure 6-3 Substation Space Requirement for Option-3

6.4 Option-4 (Compact Substation located outside block with Oil Type Transformers)

Addressing the constraints regarding access to the compact substation for operation & maintenance in Option-2, it is proposed that the CSS can be located outside the building block as shown in **Figure 3-4** where the block is closed in all directions. The space requirement of this option remains same as that of Option-2 i.e.105 Sq.meter.

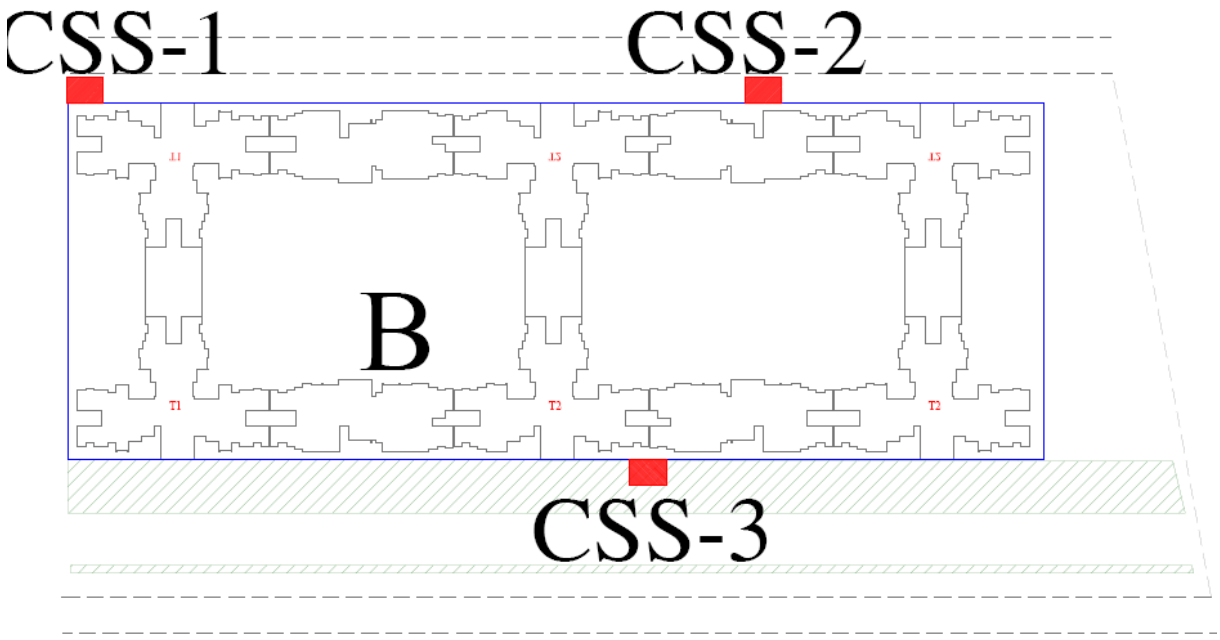


Figure 6-4 Substation Space Requirement for Option-4

6.4.1 Technical Evaluation

Since CSS are located outside the block to reach the electrical room of particular block at some locations cables may cross the buildings footprint.

6.5 Comparison for power distribution from Block Substation to Building Metering

6.5.1 The evaluation of following options is presented in this section:

- Option-1(Indoor Substation at ground floor with Dry Type Transformers)
- Option-2 (Compact Substation located outdoor with Oil Type Transformers)
- Option-3 (Open Type Substation located outside block with Oil Type Transformers)
- Option-4 (Compact Substation located outside Block with Oil Type Transformers)

Sr. No	Option	Cost for Electrical Equip. (Crore)	Space Requirement of Substation Block L(m) x W(m)	Total Space Requirement of Substation Block (Sq.mts)	HT Cable Length (m)	LT Cable Length (m)	Distribution Loss from EHV Substation to Building Metering Panel (%)
1	Option-1	2.27	22x9	200	1000	3700	2.129
2	Option-2	1.97	3x(7x5)	105	1250	680	1.370
3	Option-3	2.94	40x8	320	750	6000	2.097
4	Option-4	2.11	3x(7x5)	105	1500	1240	2.194

- Cable costs are considered with 70% discount.
- EHV substation location is assumed in Zone-1.
- The cost of civil works for electrical equipments & substation buildings is not considered.
- Option 2 is most economic, requires less space, less LT cable lengths and least expected % of distribution loss. However access for maintenance of CSS in blocks closed from all sides is a constraint.
- Option-3 is expensive due to increased length of LT cables. Space requirement for this option is the greatest.
- The constraints of Option-2 are removed in Option-4 with a slight increase in the capital cost due to increased HT & LT cable lengths
- Space requirement of substation, HT cable length, LT cable length, distribution loss of Option-1 is in between other options. The ground floor height requirement of 5 m is a constraint.

6.5.2 Recommendations based on meeting dated 12-03-2013

- Option-1 is not acceptable as raising the height 5 meter leads to loss of apartments in both ground and first floor. Additionally structural changes would be required in the building for minimum clear spacing and access.
- Option-2 is acceptable for B (G+19) type of blocks where there is access to take CSS in & out of the building blocks.
- Option-3 is not acceptable.
- Option-4 is acceptable and will be used for A (G+7) type of blocks.

6.5.3 Separate LT panel space provision for larger blocks

For blocks that have a greater number of buildings but less power demand (especially for A type of blocks), it may not be possible to accommodate all the feeders in a single CSS. In such cases an additional LT Panel space (approximately 6Mx6M) will be required in addition to metering room of the buildings as follows :

- For blocks having no. of buildings ranging from 12-18,LT panel will be required at one centralized location of the block as shown in **Figure 4-1** below:

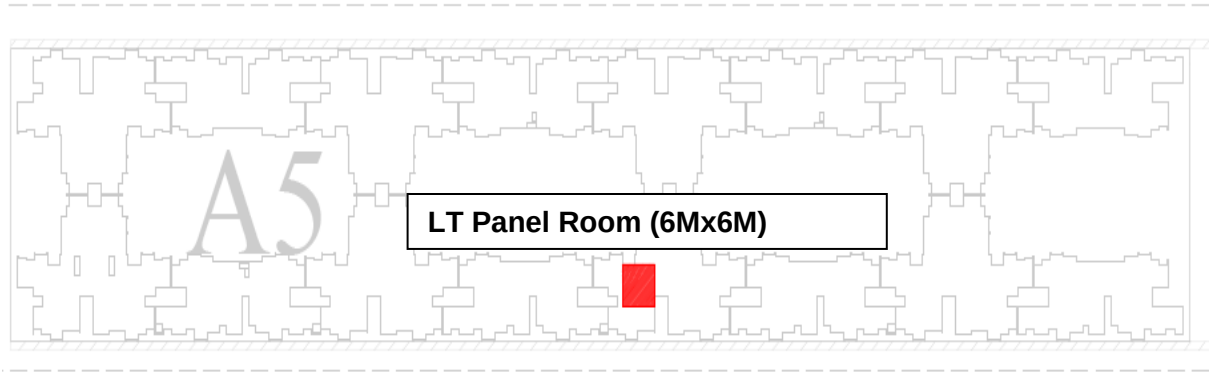


Figure 4-1 LT Panel Space Requirement for 12-18 buildings

- For blocks having no. of buildings ranging from 19-24,LT panel will be required at two centralized locations of the block as shown in **Figure 4-2** below:

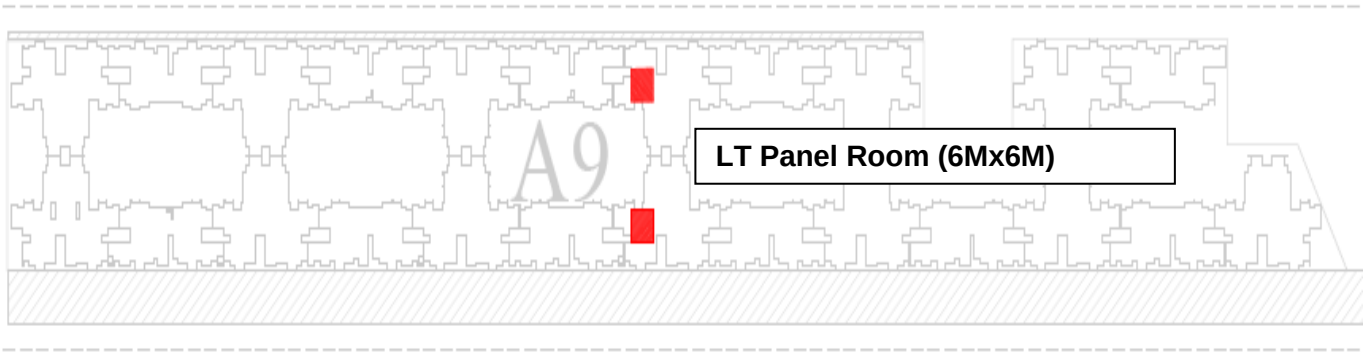


Figure 4-2 LT Panel Space Requirement for 19-24 buildings

6.6 CSS Location Options Suggested by KAPL

Appendix-3 shows the possible locations of the CSS in & around the building block as suggested by architects (M/s KAPL) which leads to finalization of following options:

- Option-2 & 3 given in Appendix-3 are acceptable. Option-1 is not acceptable since the space allocated is insufficient to accommodate the CSS.
- KAPL proposed Option 2 & 3 are similar to Option-2 suggested in section 4.2 of this report.

7 POWER DEMAND ANALYSIS USING ALTERNATE ENERGY SOURCES

If alternate energy sources like solar power, gas etc. are used in place of conventional energy sources then total power demand will be reduced as shown in Apendix-5.
Solar power will be used mainly for following entities/utilities:

- STP
- MLCP
- School
- Air Conditioning Load Of Commercial Center

Gas power will be utilized for water heating purpose which will reduce the electrical power consumption by Geysers.

Considering gas based water heating system for entire Palava development the total load is 200MVA & if the solar power is used this load will further reduce & will range from 165MVA to 200MVA.

8 SUMMARY OF RECOMMENDITIONS

- Location of EHV Substation:Alternative-2,Refer Section:3
- Number of EHV Substation:1,Refer Section:3
- Power Distribution Philosophy from EHV Substation to Building Transformer: Option-2, Refer Section-4.
- Distribution Voltage Level: 22kV, Refer Section-5.