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Study on Regulatory Authority Guidelines for Fostering Affordable Housing Clusters in the Northern Coastal Region of Tamil Nadu, India

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ABSTRACT

This study analyses the regulatory authority guidelines to establish affordable housing clusters in India. The methodology used in the research is a desk study on the prevailing guidelines and analyses them with a case study. The study and comparison of the Development Control Regulations (DCR) of developed states of India viz. Tamil Nadu, Maharashtra, and Gujarat were done based on five parameters, namely Floor Space Index (FSI), affordable housing size, minimum provision for affordable housing, open space, and parking requirements followed by a study on Coastal Regulation Zone (CRZ) guidelines. The differences in establishing affordable housing clusters beyond CRZ and within CRZ in the Northern coastal region of Tamil Nadu, India were discussed with a case study. This study concludes that minor changes in regulation restrictions may have a greater impact on affordable housing cluster projects, and the development beyond CRZ is always better than within CRZ for effective land utilization and reaching affordability.

1. INTRODUCTION

In India, the Central and State governments were focusing on developing affordable housing through various initiatives, but they were unable to reach their target due to high market demand. To address housing issues, the Government of India has been proposing several housing policies in every five-year plan [1]. However, the government could not satisfy the housing demand, without the support of private partners [2-4].

Affordable housing is a crucial issue on the global level too. Even developed countries are striving to offer affordable housing to their citizens [5].

Scant studies have been conducted in the past on the guidelines for affordable housing, and the constraints involved in the implementation of these guidelines by private developers [6, 7]. Parameters like Floor Space Index (FSI) and ground coverage were considered as constraints. It is inferred that various regulation restrictions affect the effectiveness of affordable housing projects developed by private developers.

An understanding of the existing regulatory authority guidelines of different states and the government of India is necessary for the successful implementation of affordable housing projects in an Indian context. The solution to the implementation constraints will lead to establishing a socio-economic viable community incorporating plans for sustainable use of energy for the long-term benefit of society and the country.

This study focuses on Tamil Nadu, one of the developed states in India. In particular, Chennai, the capital of Tamil Nadu (situated along the Southeast Coast of India) which is bursting at steam due to the migration of people within the state and from other states caused by rapid growth in the technology sector. Reports show that 18.6% of the population in the Chennai region reside in unauthorised communities, and accelerating urbanization makes the housing scenario critical [8].

This necessitates the creation of more affordable housing clusters along the Northeast Coast of Tamil Nadu in the Chennai – Pondicherry coastal corridor based on its locational advantage to accommodate the sprawling growth of the population in a sustainable way.

This study analyses the Development Control Regulations (DCR) of developed states viz Tamil Nadu, Maharashtra, and Gujarat, and Coastal Regulation Zone (CRZ), 2019 guidelines to understand and establish factors related to the creation of an affordable housing cluster. The constraints in implementing an affordable housing cluster within CRZ and beyond CRZ along the Northern coastal region of Tamil Nadu were also emphasised with a case study.

2. METHODOLOGY AND APPROACH

2.1 Methodology

The methodology framework of the research was divided into four phases to achieve the objectives. The desk study was adopted to understand the best and most feasible practices

followed in different states, and the central Government of India about establishing affordable housing clusters. In the first phase, a detailed study of the DCR of three developed coastal states in India - Tamil Nadu, Maharashtra, and Gujarat was done. These states were selected based on their comparable Gross Domestic Product (GDP) growth and similar geography (i.e., situated along the coast). The DCRs of the states were compared based on critical parameters pertaining to affordable housing cluster projects in coastal regions.

In the second phase, the study was conducted on the document of CRZ notification 2019. The classification and permissible activities related to affordable housing clusters were investigated. In the third phase, the nuances involved in implementing affordable housing cluster projects within CRZ and beyond CRZ in the coastal area of Tamil Nadu were studied. The impact of CRZ guidelines restriction for affordable housing cluster projects was investigated in comparison with the DCR of Tamil Nadu and salient recommendations were arrived. This can cater to the mass housing demand through cluster housing in the coastal region of North East Tamil Nadu by involving government and private partners. In the fourth phase, a case study was performed to understand the difference in implementing the affordable housing cluster within CRZ and beyond CRZ in the Northern Coastal region of Tamil Nadu.

Phase I: Study of DCR of Tamil Nadu, Maharashtra, and Gujarat

The DCR and general building requirements for establishing affordable housing clusters in the coastal region of India are discussed hereunder. The guidelines taken into consideration include the Tamil Nadu Combined Development and Building Rules [9], the Unified Development Control and Promotion Regulations for Maharashtra State [10], and Comprehensive General Development Control Regulations (Gujarat) [11] proposed by Tamil Nadu, Maharashtra, and Gujarat respectively, and DPR pertaining to CRZ of Ministry of Environment, Forest and Climate Change, 2019 [12].

Land regulations like FSI and Plot coverage restriction in urban India increases the land price to an enormous level. Due to these factors, the price of affordable housing projects increases [13], leading to suburbanization, and also reducing the density in the central city [14-18].

FSI is the ratio between the total area covered by all floors and the area of the plot. Higher FSI leads to higher densification. Table 1 represents the details of FSI in Tamil Nadu, Maharashtra, and Gujarat. In Tamil Nadu, for building heights up to 18.5 m, the permissible FSI is 2. Premium FSI is available based on their corresponding road width. Thus, it works to 50% premium FSI for road width of 18 m and above, 40% premium FSI for road width of 12 to 18 m and 30% premium FSI for road width 9 to 12 m. No premium FSI charges are levied for affordable housing.

In Maharashtra, the permissible FSI depends on road width, congestion, location, or type of housing, as represented in Table 1. FSI up to 2.5 is allowed for EWS / LIG housing, while discounts in premium FSI charges are available for affordable housing projects. A higher value of FSI can be used if correlated with road width, i.e., an additional 0.30 premium FSI is available for all road widths above 9 m. While non-congested municipal corporations are allowed a FSI value of 2, other remaining congested areas can enjoy FSIs ranging from 2.6 to 3.

In Gujarat, for an affordable housing, FSI is fixed at a base value of 1.8. However, based on the dwelling units built-up area (50 - 80 sq m), a maximum of 2.7 FSI is permitted by paying the premium FSI charges equivalent to 10 - 30% of Jantri rates.

From the above FSI values, it can be inferred that Tamil Nadu and Gujarat provide a blanket base FSI of 2 and 1.8 for all types of housing development projects, while Maharashtra provides a higher FSI of 2.5 only for EWS / LIG housing. Thus, the FSI provided by Tamil Nadu and Gujarat is comparatively less as compared to Maharashtra. On the other hand, Tamil Nadu provides premium FSI for free, and Gujarat fixed the FSI value at 1.8 for affordable housing, while Maharashtra offers discounts based on road width. Such FSI values suggest that Tamil Nadu and Gujarat shall bring suitable amendments to increase the FSI on par with other developed states like Maharashtra to foster the growth of affordable housing. This type of high-density occupancy will attract private firms to participate in the creation of affordable housing at a reasonable price for a common man.

Table 1. Details of FSI in Tamil Nadu, Maharashtra, and Gujarat [9-11]

Floor Space Index (FSI)	
Tamil Nadu	• For building heights up to 18.5 m, FSI- 2 • No premium FSI charges for affordable housing • Premium FSI varies depending on road width Road width: Premium FSI =>18 m: 50% >12 m and <18 m: 40% >9 m and <12 m: 30%
Maharashtra	• Housing for EWS / LIG – FSI up to 2.5 or FSI based on road width. • Additional 0.3 premium FSI available for all road widths above 9 m. • Discounts in premium FSI charges are available for affordable housing projects • For congested areas FSI based on road width are given below Basic FSI Road width: Municipal corporations: Remaining areas below 9 m: 1.5: 1.5 9 m and below 18 m: 2.0: 2.6 18 m and below 30 m: 2.0: 2.8 30 m and above: 2.0: 3.0
Gujarat	• For the affordable housing base FSI 1.8 is available • A maximum of FSI 2.7 shall be permitted by paying the premium FSI charges according to the dwelling units built-up area Residential dwelling units built up area: Additional FSI charge up to 50 sq m: 10% of Jantri rates* more than 50 sq m and up to 66 sq m: 20% of Jantri rates* more than 66 sq m and up to 80 sq m: 30% of Jantri rates* (*Jantri rates are the property value calculated by the state government)

Providing premium FSI tagged with discounts, as practised in Maharashtra and Gujarat also affects the establishment of affordable housing projects. Hence, provisions for higher baseline FSI (irrespective of road width) and free premium FSI (depending on road width) shall have a positive impact on affordable housing projects. In another context, Tamil Nadu provides a higher base FSI of 2 for all types of housing development compared to the other two states. This higher base FSI increases densification in the urban area and may reduce the availability of land for affordable housing projects. Since private investors may be interested in general housing development considering the patronage from the HIG group, the development of affordable housing with similar FSI will increase the price of the tenements, and the LIG/EWS categories may not afford this. Hence, the study recommends for normalization in the fixing of the minimum FSI or earmarking a percentage of land in the layout exclusively for affordable housing. Reaching higher densification due to a higher base FSI also eliminates the risk of people migrating from urban to suburban regions in search of shelter.

The size of affordable units is the most influencing factor which determines the cost of housing. Even MOHUA classifies different housing groups based on size and income. On the other hand, housing size also impacts the residents' satisfaction [19]. Thus, it is important to strike a balance between cost and resident satisfaction while planning for provision of housing with adequate size. The size of the housing influences the size of the habitable room, bathroom, and kitchen. Only for cluster planning, plot sizes below 30 sq m and up to 15 sq m are permitted, and higher density can be achieved using cluster planning as per NBC [20]. By achieving high densification, the cost of individual housing can be reduced. The emphasis shall be on establish a cluster form of development so that the lowest size of 15 sq m can be effectively used.

Figure 1 represents a comparison of the size of dwelling and base FSI among the three states according to the DCR of the respective states. In Tamil Nadu where the FSI is 2, the dwelling size shall be less than 40 sq m in the Chennai metropolitan area, and it is less than 60 sq m in the rest of the places. In Maharashtra, with FSI of 2.5, the dwelling size shall be between 30 sq m and 50 sq m of the built-up area of EWS/ LIG housing. In Gujarat, a dwelling unit of up to 80 sq m along with ancillary commercial use up to 10% of the total utilized FSI (FSI of 1.8) is permitted.

Based on the comparison, it can be noticed that Gujarat provides a larger housing size, and this larger size with low FSI may lead to an increase in the cost of housing. Due to the larger size, there is a chance that it may be fully occupied by the MIG. Tamil Nadu and Maharashtra provide smaller housing sizes compared to Gujarat, eliminating the risk of neither higher housing prices nor higher occupancy by MIG groups. So, we can use a housing size between the minimum value of 15 sq m and the maximum value according to the DCR of the corresponding state.

Earmarking a percentage of the landscape while developing a larger FSI or land area, as per DCR, is an important factor for developing affordable housing. Figure 2 shows the comparison of the minimum provision for affordable housing in Tamil Nadu, Maharashtra, and Gujarat. In Tamil Nadu, development with FSI area > 4000 sq m, shall provide LIG housing of 10% of FSI area with dwelling units not exceeding 40 sq m in carpet area, otherwise the developer shall pay the entire shelter charges.

In Maharashtra, for the plot of land => 4000 sq m - EWS/ LIG housing shall be provided for tenements for 20% of the basic FSI. This 20% shall not be included in permissible FSI. For EWS/ LIG housing projects additional 25% FSI is available, excluding basic FSI.

In Gujarat, no such provisions are available according to DCR.

From Figure 2, it is observed that in Tamil Nadu, there is no need to pay any shelter charges for carpet area of within 40 sq m due to provision of 10% FSI for LIG housing of 4000 sq m. This allows for tangible benefits for the developers of affordable housing. In Maharashtra, the affordable housing developer shall benefit from the additional 25% FSI available excluding basic FSI. Thus, the DCRs of both Tamil Nadu and Maharashtra benefit the developers of affordable housing. If Gujarat also provides these types of beneficiary provisions for affordable housing projects, it may improve the private developers' involvement in these types of projects and help the government tackle the housing shortage. This mandatory 20% provision in Maharashtra and the 10% provision to avoid shelter charges in Tamil Nadu are very beneficial for governments since they provide affordable housing apart from the exclusively affordable housing provided by the government and this indirectly promotes the social mix.

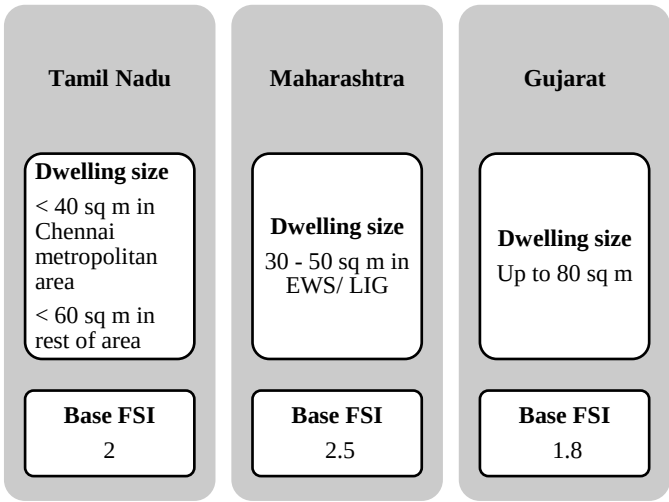

Figure 1. Comparison of dwelling size and base FSI in Tamil Nadu, Maharashtra and Gujarat [9-11]

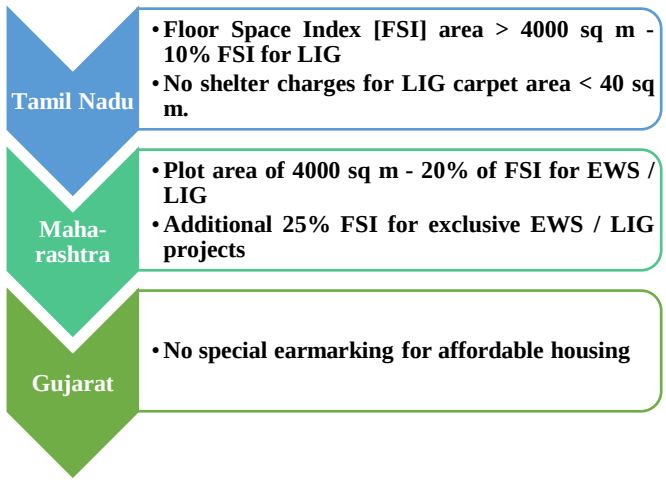

Figure 2. Comparison of minimum provision for affordable housing among Tamil Nadu, Maharashtra and Gujarat [9-11]

Open space is another important aspect of affordable housing which is provided for recreation purposes. This provision has both social and environmental benefits. Figure 3 shows the comparison of open space provision among Tamil Nadu, Maharashtra, and Gujarat. In Tamil Nadu, the provision of open space for community recreational purposes is based on the land size, i.e.,:

i. For the first 3,000 sq m - there is no requirements for provision of open space
ii. Between 3,000 sq m to 10,000 sq m - 10% of the area excluding roads shall be transferred to the local body or in the alternative shall pay the guideline value
iii. Above 10,000 sq m - 10 per cent of the area excluding roads with a minimum width of 10 meters shall be transferred to the local body.

In Maharashtra, the provision of open space for community recreational purposes is based on the land size as follows:

i. For land area of within 0.4ha - there is no requirements for provision of open space
ii. For land area between 0.4 - 0.8 ha - 10 per cent of the land area shall be transferred to the local body
iii. For land area exceeding 0.8 ha - 10 percent of the land area may be provided in one or two different locations and shall be transferred to the local body.

In Gujarat, for a plot size of an area of 2000 sq m or above, 10 percent of the area of the building unit shall be provided for the common plot.

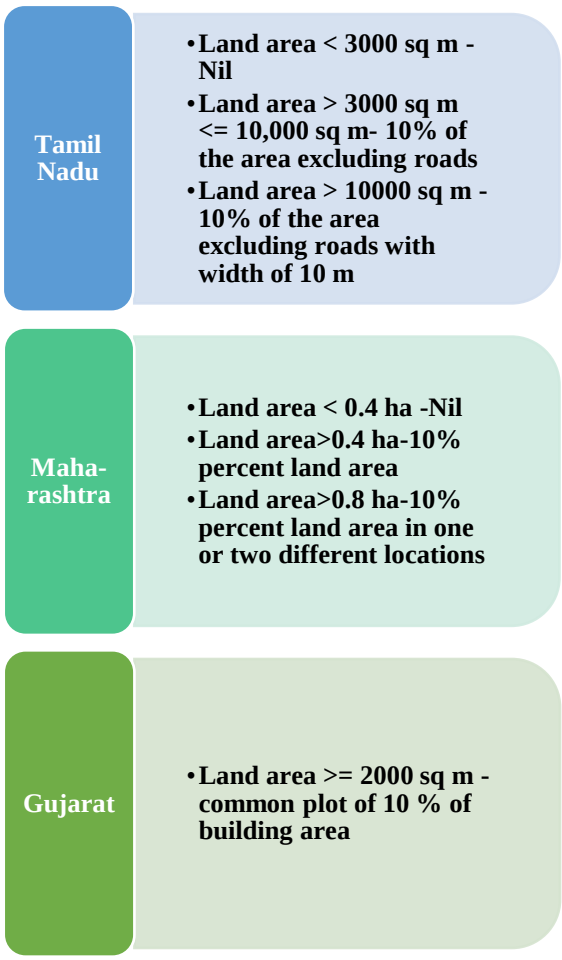

Figure 3. Comparison of open space provision among Tamil Nadu, Maharashtra, and Gujarat [9-11]

By comparing the open space provisions of the three states it can be inferred that 10% provision for open space for community recreation is common in all these states for large areas of development. According to NBC, if the project area exceeds 0.3 ha, community open space shall be provided [19]. The provision is based on factors *viz*., (i) 15% of the area of layout or 0.3 to 0.4 ha/1000 persons; (ii) For LIG housing, open space shall be 0.3 ha /1000 persons. The 10 percent provision is given in all three states to achieve 0.3 to 0.4 ha /1000 persons.

To promote affordable housing projects, the government shall explore (i) relaxing / giving exemption to the 10% open space criteria for providing community recreational purposes; and allotting the same to the owners of affordable housing for providing unique facilities (EWS/LIG) without affecting the social mix; (ii) reducing the percentage allotment of area for community facilities from 10% to a desired level for the benefit of developers / housing owners.

The provision of parking space in the layout is also an important factor for effective land utilization and satisfying the parking requirements. Table 2 represents the details of parking requirements in Tamil Nadu, Maharashtra, and Gujarat. In Tamil Nadu, parking provision is based on dwelling size. It varies further depending on the location i.e., municipal area / other area. In the municipal limits, for floor area up to 25 sq m there is no need for any parking provision; and for floor area above 25 sq m and up to 50 sq m, one two-wheeler space shall be provided. In the panchayat limits, for floor area up to 50 sq m, there is no need for parking provision; and for floor area above 50 sq m and up to 75 sq m, one two-wheeler space shall be provided. In addition, 10% visitor parking is available for all dwelling sizes.

In Maharashtra, parking provision is based on the carpet area of dwelling units. It varies further depending on the type of area i.e.; congested area / non-congested area. For every two tenements with each tenement having a carpet area less than 30 sq m; space for four two-wheelers shall be provided. For every two tenements, with each tenement having a carpet area between 30 sq m and 40 sq m, one two-wheeler, and one car space shall be provided. For every two tenements, with each tenement having a carpet area equal to or between 40 sq m and 80 sq m, four two-wheeler and one car space shall be provided. Parking spaces for more vehicles is permissible in non-congested areas, in addition to 5% visitor parking for all dwelling sizes.

In Gujarat, parking provision is based on the built-up area of dwelling units. For affordable residential apartments with a built-up area of up to 66 sq m, 10% of utilised FSI shall be allotted for provision of parking spaces. For those affordable residential apartments with more than 66 sq m built-up area, 20% of the utilised FSI shall be allotted. An additional 10%, of the required parking space shall be provided as visitor parking.

By analysing the above data, it can be inferred that Gujarat provides exclusive yardsticks for the provision of parking for affordable housing, whereas Tamil Nadu and Maharashtra provide provision that is common for all housing developments. In Tamil Nadu, no parking space is facilitated for very small sized dwellings. This needs to be modified to suit modern day requirements by providing at least one two-wheeler space for the benefit of the occupants. However, Tamil Nadu provides minimum parking provisions, which enhance effective land utilization. Whereas, Gujarat provides a slightly larger parking space, and Maharashtra provides comparatively more space than both Tamil Nadu and Gujarat.

Phase II: Study on CRZ (Coastal Regulation Zone) guidelines

The intersection of the ocean, atmosphere, and land generates a distinct ecosystem known as a coastal zone [21]. People have lived on the coast since ancient times for their livelihood, which is dependent on the environment, such as salt production, fishing, etc. Major trading from sea to land and vice versa is a routine in these locations. At present, these locations are well known for their fishing and tourism-related activities. The coastal-related issues of major concern include coastal erosion, sand deposition, storms, degradation of mangroves, anthropogenic processes, and so on [22]. Hence, while planning and designing affordable housing in CRZ, distress to structures due to the action of these deteriorative mechanisms need to be taken into account.

The Government of India declared the coastal stretch and water area up to its territorial water limit under the ambit of Coastal Regulation Zone (CRZ), excluding Andaman and Nicobar, Lakshadweep, and the islands surrounding these areas, in order to protect the coastal belt and promote sustainable development. Any activities in the CRZ area must adhere to CRZ guidelines. The first CRZ guideline was implemented in 1991 and was further amended in 2011. Currently, the latest version of CRZ 2019 is followed all over India [12, 23-25].

CRZ guidelines divide the coastal zone into four major categories: CRZ-I, CRZ-II, CRZ-III, and CRZ-IV. Table 3 presents the classification of the Coastal Regulation Zones according to CRZ notification 2019 including its permissible activities. To effectively use land in CRZ for establishing affordable housing clusters, understanding the classification of CRZ and its permissible activities are important. The areas that come under CRZ are:

i. Land area from the High Tide Line (HTL) to 500 m on the landward side along the seafront
ii. Land area between HTL to 50 m or the width of the creek
iii. Land area between HTL and Low Tide Line (HTL)
iv. Land area between LTL to twelve nautical miles of territorial water limit, including the water and the bed area.

In CRZ-I B, storm water drains are permissible, whereas there are no guidelines for the development of affordable housing clusters. CRZ-II deals with developed land areas up to or close to the shoreline. Land area that does not fall under CRZ-I and CRZ-II comes under CRZ-III, where all major activities relevant to affordable housing like construction or reconstruction of dwelling units with a building height lesser than 9 m and with only 2 floors, construction of other infrastructure facilities required for dwelling units, parks, playfields, agriculture, and gardens are permissible, but with territorial allocation as shown in Table 3. CRZ-IV is a water area and construction activities related to housing are not permissible in this zone.

Table 2. Details of parking requirements in Tamil Nadu, Maharashtra, and Gujarat [9-11]

Parking Requirements					
	Dwelling size	Two-wheeler parking slots	Car parking slots		
Tamil Nadu	Municipal areas				
	For floor area <= 25 sq m	0	0		
	For floor area >25 sq m <=50 sq m	1	0		
	For floor area >50 sq m <=75 sq m	1	1 for 2 dwelling units		
	For floor area >75 sq m	0	1		
	Panchayat Areas				
	For floor area <=50 sq m	0	0		
	For floor area >50 sq m <=75 sq m	1	0		
	For floor area >75 sq m <=100 sq m	1	1 for 2 dwelling units		
	For floor area >100 sq m	0	1		
	Additional 10% visitor parking for all dwelling size				
Maharashtra	Carpet area of dwelling units	Congested area		Non-congested area	
		Two-wheeler parking slots	Car parking slots	Two-wheeler parking slots	Car parking slots
	For every tenement of area >=150 sq m	2	2	3	2
	For every tenement of area >= 80 sq m <150 sq m	2	1	3	1
	For every two tenements with each tenement having area >= 40 sq m <80 sq m	4	1	5	1
	For every two tenements with each tenement having area >30 sq m <40 sq m	1	1	2	1
	For every two tenements with each tenement having <30 sq m	4	0	4	0
	Additional 5% visitor parking for all dwelling size				
Gujarat	Dwelling size				Parking provision
	Affordable residential apartments with dwelling units of built-up area up to 66 sq m				10% of utilised FSI
	Affordable residential apartments with dwelling units of built-up area more than 66 sq m				20% of utilised FSI
	Additional 10% visitor parking for all dwelling size				

Table 3. Classification of Coastal Regulation Zone [12]

Types	Description
1. CRZ-I 1.1.CRZ-I A 1.2.CRZ-I B	Environmentally most critical area • CRZ-I A- Ecologically sensitive area and geo-morphological features area • Permissible activities related to eco-tourism, public utilities, and roads for only defence and public utilities • CRZ-I B- Area between Low Tide Line (LTL) and High Tide Line (HTL) • Permissible activities related to land reclamation, bunding, foreshore facilities, stormwater drains, desalination plants, and weather radar
2. CRZ-II	• Developed land area up to or close to the shoreline • All activities mentioned in CRZ-I B are permissible • In addition, activities related to the construction of buildings on an existing structure or near the existing road, reconstruction, and tourism development projects, or beach resorts or hotels are permissible
3. CRZ-III 3.1.CRZ-III A 3.2.CRZ-III B	Land area that does not fall under CRZ-II and CRZ-I • CRZ-III A- Area up to 50 m from the HTL on the landward side- No Development Zone (NDZ) • CRZ-III B- Area up to 200 m from the HTL on the landward side-NDZ • In NDZ: All activities mentioned in CRZ-I B are permissible • In addition, activities related to the repair or reconstruction of the existing structure, parks, playfields, agriculture, gardens, infrastructure for local inhabitants, and temporary tourism are permissible • Beyond NDZ: Tourism development projects, construction, or reconstruction of dwelling units with height lesser than 9 m and with only 2 floors, construction of other infrastructure facilities required for dwelling units, and drawing of groundwater allowed between 200 to 500 m of the HTL are permissible
4. CRZ-IV 4.1.CRZ-IV A 4.2.CRZ-IV B	Water area • CRZ-IV A- Area between the LTL up to twelve nautical miles on the seaward side • CRZ-IV B- Area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank • Permissible activities related to fishing, land reclamation, bunding, foreshore facilities, and weather radar

Phase III: To discuss the differences in implementing affordable housing clusters within CRZ and beyond CRZ in Tamil Nadu

If development is proposed around / close to (beyond) CRZ in Tamil Nadu, it shall adhere to the DCR of Tamil Nadu. If development is proposed in (within) CRZ of Tamil Nadu then it shall adhere to both the CRZ and the DCR of Tamil Nadu. The salient parameters such as (i) Land use restriction, (ii) Building height restriction, (iii) Drawing of groundwater, and (iv) Accessibility to the shoreline as per CRZ and DCR of Tamil Nadu were compared to ascertain its impact on socio-economic benefits.

- **Land use restriction:** In CRZ, land use restrictions in each zone affect effective land utilization. From Table 3, it can be inferred that whenever the establishment of an affordable housing cluster in a large area of land is planned in Tamil Nadu, the only area of choice is CRZ-III (beyond NDC), where construction of dwellings and other major construction activities are permissible. The rest of the land under CRZ-I, CRZ-II, and CRZ-IV cannot be used. As per the guidelines, the parking area is permitted within CRZ-III NDZ for effective land utilization. It is basically impossible for dwelling occupants to use the parking provision if housing is located beyond CRZ-III, while parking is located within CRZ-III NDZ. If open space is facilitated in CRZ-III NDZ for effective land utilization, it should also comply with the open space provision requirements set forth by the Tamil Nadu DCR. So, it is practically not feasible to provide an open space exclusively in CRZ-III NDZ also. In this scenario, if affordable housing development is planned beyond the CRZ, then the land use restriction will not be applicable, so effective land utilization can be done.
- **Building height restriction:** As per CRZ guidelines, building height up to 9 m consisting of a ground floor and first floor is permissible, if construction is undertaken within CRZ and does not allow for maximum usage of the resources. On the other hand, the Tamil Nadu DCR provides much more allowance for a baseline FSI of 2 and building height reachable up to 18.5 m for non-high-rise buildings. High densification, and more dwelling units can be developed in the same land area, if an affordable housing cluster is developed beyond the CRZ by utilizing the leverage due to baseline FSI. It can be concluded that restrictions based on building height favour the establishment of affordable housing clusters beyond CRZ rather than within CRZ.
- **Drawing of groundwater:** In CRZ, housing construction is allowed from 50 m of the HTL on the landward side depending upon the zone, but the drawing of groundwater is only allowed between 200 m to 500 m of the HTL. If the development land area falls only between 50 m to 200 m of the HTL, a drawing of groundwater is not allowed, and complicates planning. The developer is forced to find an alternative solution like providing pipelines for water transportation from permissible areas to restricted zone, which in turn will affect the affordability of housing.
- **Accessibility to the shoreline:** Housing within CRZ will provide better access to the shoreline for fishermen, and the public associated with the fishing industry compared to housing developed beyond CRZ. Moreover, their affinity towards marine life and sense of possession may cause hardships due to the day-to-day difficulties of traveling, from beyond CRZ to coast, over a period of time. As a special case, the government shall explore providing affordable housing within CRZ for the local community, without compromising sustainability and ecology aspects.

Phase IV: A case study to understand the differences in implementing affordable housing clusters within CRZ and beyond CRZ in Tamil Nadu

A site plan was proposed in line with the DCR of Tamil Nadu to establish affordable housing beyond CRZ in Tamil Nadu. This plan was analysed as per CRZ guidelines to

understand its impact on affordability. Three EWS housing sizes were considered as per the DCR of Tamil Nadu:

i. Type 1 of 20 sq m unit size
ii. Type 2 of 25 sq m unit size and
iii. Type 3 of 30 sq m unit size

Among the three, Type 2 was selected for further analysis with the provision of selected amenities that include:

i. kitchen cum hall (13 sq m)
ii. bedroom (9 sq m)
iii. washroom (3 sq m)

Figure 4 illustrates an affordable housing plan block containing 16 dwelling units, each of which consists of ground floor plus two floors. A similar representation of the affordable housing plan of EWS (Type 2 of 25 sq m dwelling unit) for plot areas of 0.5-hectare, 2.5-hectare, and 5-hectare is shown in Figures 5 to 7, respectively. All the site plans and floor plans were prepared in accordance with the DCR of Tamil Nadu but beyond CRZ in Tamil Nadu. It can be seen that in a given area of 0.5, 2.5, and 5.0-hectares, the probable number of dwelling units accounts to 128,512 and 944, respectively.

Figure 4. Affordable housing plan of EWS – Type 2 – 25 sq m unit size

The provision open space for community recreation purposes is given in 2.5-hectare and 5-hectare site plans to meet the DCR guidelines of Tamil Nadu. Other basic utilities were also provided according to DCR in all three site plans. For affordable housing scheme with building height below 15 m, lift is not mandatory and hence not provided as a cost control measure.

2.1.1 Impact of CRZ and DCR guidelines of Tamil Nadu on cost of housing clusters

The affordable housing plan was prepared for a 2.5 sq m unit size, and proposed for implementation in 0.5-hectare, 2.5-hectare and 5-hectare housing development for EWS. The prepared housing schemes was analysed as per CRZ and DCR of Tamil Nadu under the parameters viz. (i) Building height and number of dwelling units, (ii) Land use restriction and number of dwelling units, and (iii) Floor Space Index.

- **Building height and number of dwelling units:** Building height can significantly affect the density and price of individual dwelling units. In this case study, the floor plan as per the DCR of Tamil Nadu can accommodate a total of 16 dwelling units per block spanning three floors, CRZ norms allow for only 12 dwelling units per block, as it spans only the ground plus one floor. This leads to a shortage of 4 dwelling units per block, as per Figure 5 for a 0.5-hectare site plan, 128 dwelling units can be built as per DCR of Tamil Nadu; but CRZ norms could accommodate only 96 dwelling units. As per Figure 6 for a 2.5-hectare site plan, 512 dwelling units can be built as per DCR norms, instead of only 384 dwelling units permissible under the norms of CRZ. Similarly, as per Figure 7 for a 5-hectare site plan, 944 dwelling units can be built following DCR, while only 708 dwelling units can be built as per CRZ. Thus, the reduction in the number of dwelling units considering the plans as per CRZ guidelines accounts to 32, 128, and 236 respectively in a given land area of 0.5-hectare, 2.5-hectare, and 5-hectare proposed for affordable housing scheme in this study. This reduction in the number of dwelling units would greatly impact the cost of individual dwelling units.

Figure 5. Affordable housing plan of 0.5-hectare housing development for EWS

Figure 6. Affordable housing plan of 2.5-hectare housing development for EWS

Figure 7. Affordable housing plan of 5-hectare housing development for EWS

- **Land use restriction and number of dwelling units:** CRZ norms allow housing construction only beyond NDZ within CRZ III. So, land area in NDZ within CRZ cannot be effectively used, which ultimately impacts the total number of dwelling units' development and the affordability of the project. Beyond CRZ, land use is not restricted in terms of NDZ.
- **Floor Space Index:** The permissible baseline FSI of 2 for the non-high-rise buildings of DCR, Tamil Nadu, is effectively used in this study for preparing all three site plans in order to establish the maximum number of dwelling units in a given area. However, the adoption of CRZ norms would not allow for effective utilization due to restrictions in building height and land use.

The analysis of the parameters viz. building height and number of dwelling units, land use restriction and number of dwelling units, and Floor Space Index exhibit that establishing an affordable housing scheme beyond CRZ in the coastal belt of Tamil Nadu led to an appreciable reduction in the cost of individual dwellings as compared to development within CRZ.

To understand the real time impact on the cost of affordable housing within CRZ and beyond CRZ zones, the plan of housing schemes in a given area of 0.5-hectare, 2.5-hectare, and 5-hectare plot area was virtually implemented in coastal hamlet, Salavankuppam which is 7 kilometres from Mahabalipuram, and projected as a future place of affordable housing development as per the objectives of this study. Table 4 gives the cost of construction of dwelling units in various housing development schemes, and Table 5 Estimated cost of dwelling units in various housing development schemes upon real time implementation. The cost of land was considered as INR 25 Lakhs / 240 square feet as per market guidelines, and 10% profit margin was fixed in cost of land and construction cost for developers. It can be seen that irrespective of the scheme, the cost of individual dwelling unit if constructed beyond CRZ exhibits an appreciable reduction as compared to construction cost for the same within CRZ. There is a reduction in the cost of individual units up to 17.50% which definitively fosters the affinity of local community and other migrated peoples from urban zone towards affordable housing.

Table 4. Cost of construction of dwelling units in various housing development schemes

S. No. (1)	Types of Housing Development (hectare) (2)	No of Dwelling Units as Per		Cost of Land (INR (Lakh)/USD (thousand)) (5)	Construction Cost for Per Dwelling (25 sq m) (INR (Lakh)/USD (Thousand)) (6)	Total Construction Cost of Dwelling Units (INR (Lakh)/USD (Thousand))	
		DCR (3)	CRZ (4)			DCR (7)	CRZ (8)
1	0.5	128	96	561 / 679	5.38 / 6.51	689 / 833	516 / 624
2	2.5	512	384	2803 / 3392	5.38 / 6.51	2755 / 3334	2066 / 2500
3	5	944	708	5606 / 6784	5.38 / 6.51	5079 / 6146	3809 / 4609

Table 5. Estimated cost of dwelling units in various housing development schemes

S. No. (9)	Total Cost of Project Including Profit (INR (Lakh)/USD (Thousand))		Cost Per Dwelling Unit (INR (Lakh)/USD (Thousand))		Percentage Increase from DCR -CRZ (14)
	DCR (5+7+10% (5+7) =10) (10)	CRZ (5+8+10% (5+8) =11) (11)	DCR (12)	CRZ (13)	
1	1374 / 1662	1185 / 1434	10.74 / 12.99	12.34 / 14.93	15.0
2	6113 / 7398	5356 / 6482	11.94 / 14.45	13.95 / 16.88	16.8
3	11753 / 14224	10357 / 12534	12.45 / 15.06	14.63 / 17.70	17.5

3. SUMMARY

Housing is a basic human need. Yet, many cannot afford to own a near-ideal house at a reasonable cost for varied reasons. Private developers find it difficult to provide affordable housing at a reasonable cost due to regulatory restrictions and hence their patronage towards these projects is comparatively low. The present study highlights the need for amendments in regulatory restrictions to create a major positive impact on affordable housing projects, and to enhance private developers' participation in these types of projects.

Studying and comparing the DCR of the three developed states of India namely Tamil Nadu, Maharashtra, and Gujarat, facilitated to understand the differences in regulatory restrictions among them. The most influencing parameters compared in this study were FSI, affordable housing size, minimum provision for affordable housing, open space, and parking requirements. The DCR's of these three states have provisions in support of affordable housing. The higher FSI, restricting the size of housing units, and earmarking EWS/LIG category in major housing schemes shall promote patronage from the target groups. The parking requirements and open space provisions shall be optimized to take advantage of cost of the project. The detailed study on the CRZ 2019 notification helped to identify the basis for zone classification and permissible activity in each zone which are important for effective planning of affordable housing clusters.

The issues in establishing an affordable housing cluster within CRZ and beyond CRZ were analysed with respect to the DCR guidelines of Tamil Nadu. The impediments involved in developing affordable housing clusters within CRZ viz. land use restrictions, building height restrictions, and drawing of groundwater restrictions were emphasised despite of its benefit in terms of better accessibility to the shoreline. The development of affordable housing clusters beyond CRZ was studied to achieve affordability by avoiding the regulatory restrictions of CRZ guidelines. The case study on establishing affordable housing clusters by adopting the DCR of Tamil Nadu; and as per CRZ proved greater economic benefits upon establishing beyond CRZ by following the DCR of respective

states.

Further, the affordability of the housing to the beneficiaries could be assured by appraising them with the benefits provided by the Government of India under PMAY schemes, (i) Assistance of Rs. 1.5 lakh per EWS housing under Affordable Housing in Partnership, (ii) Interest subsidies of 3%, 4%, and 6.5% on loans of up to Rs. 12 Lakh, Rs. 9 Lakh, and Rs. 6 Lakh under Credit Linked Subsidy etc [26].

The provision of higher FSI value for affordable housing (as per DCR of Maharashtra), and waiver of premier FSI charges (as per DCR of Tamil Nadu) can be explored for implementation across the states by the policymakers to foster affordable housing projects [27, 28]. This study is limited to the five most influencing parameters of affordable housing. The comparison of DCR's was made with only three developed states and CRZ. There are other parameters emphasizing environment and sustainability that may directly or indirectly influence the establishment of affordable housing can be addressed in future studies.

4. CONCLUSIONS

- Providing beneficiary-friendly regulations is considered a better approach, especially for affordable housing projects, to improve the involvement of private developers in resolving housing issues. The government may consider relaxing regulation restrictions of CRZ, especially for affordable housing projects, to benefit the inhabitants of CRZ.
- This study indicates that even minor modifications in the regulations will significantly influence the cost-to-benefit of the proposals for affordable housing.
- If affordable housing schemes are planned within CRZ, it shall follow both CRZ with respect to zonal classification, in addition, shall satisfy the DCR of the respective states. This could be a challenge for the project implementation process and developers.
- Although the CRZ area offers greater access to the shoreline, establishing affordable housing clusters just beyond CRZ is considered the better option for effective land utilization and achieving affordability.
- A case study on establishing an affordable housing scheme beyond CRZ in a coastal hamlet on the Northern coast of Tamil Nadu revealed up to 17.5% reduction in the cost of individual dwellings as compared to development in CRZ. Hence this advantage can be explored in cities with similar geography and demographic change in India, and in developing countries with similar regulatory authority guidelines.
- This study integrated the existing state and national guidelines with existing national-level beneficiary policies to establish the most predominant affordable housing cluster site plans for the coastal regions of Tamil Nadu, India.

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