



**Government of Andhra Pradesh**  
**Panchayati Raj Engineering Department**

*World Bank Assisted*  
*National Cyclone Risk Mitigation Project*  
*(NCRMP)*



**Investment Proposal (Part I)**  
**For**  
**Multi Purpose Cyclone Shelters**  
**Proposed Cost: Rs.131. 83 Crores**

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**PR, NABARD**  
**PRED, Hyderabad**

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<b>1</b>	<b><i>Need and rationale for construction of cyclone shelters .....</i></b>	<b><i>3</i></b>
<b>2</b>	<b><i>Proposed Cyclone shelters under NCRMP .....</i></b>	<b><i>8</i></b>
<b>3</b>	<b><i>Proposed benefits and outcomes.....</i></b>	<b><i>10</i></b>
<b>4</b>	<b><i>Project Assumptions and Design Parameters .....</i></b>	<b><i>11</i></b>
<b>5</b>	<b><i>Project Costing, Funding &amp; Time Frame .....</i></b>	<b><i>18</i></b>
<b>6</b>	<b><i>Environmental and Social Impact.....</i></b>	<b><i>24</i></b>
<b>7</b>	<b><i>Applicable regulations and required clearances.....</i></b>	<b><i>25</i></b>
<b>8</b>	<b><i>Implementing Arrangements .....</i></b>	<b><i>26</i></b>
<b>9</b>	<b><i>Operations &amp; Maintenance of Proposed Cyclone Shelters .....</i></b>	<b><i>35</i></b>
<b>10</b>	<b><i>Annexures.....</i></b>	<b><i>40</i></b>

# 1 Need and rationale for construction of cyclone shelters

Every year during the period of April-May and September-December, cyclonic situations set in to the Bay of Bengal. While historically it was observed that the cyclones mercifully passed away from the Andhra coast, over the last few years, cyclonic storms have been crossing the mainland more frequently. These cyclonic storms are usually accompanied by tidal waves which, on occasions, enter the land up to a distance of 20 kms. Heavy rains and winds with speeds exceeding 150 kmph prevail during these cyclonic periods.

People residing in habitations within a distance of 10 Kms from the sea coast are generally the worst affected with the inundation (varying between approximately 2.5 to 5 mts) lasting for over 5-6 days. Further, the tidal surge accompanying the cyclone is a major cause for the loss of lives. A large number of people in these areas do not have access to safe shelters that are able to withstand the cyclonic fury. As per the analysis conducted by the revenue authorities within the State, the estimated vulnerable population within a distance of 10 Kms from the coast is 6.55 lakhs across 731 habitations. There are only few habitations beyond 10 kms from the coast which are vulnerable to cyclone / storm surge effects. Usual precautionary measures are typically adequate to protect these habitations.

It is essential to provide safe residential accommodation to the vulnerable population during any eventuality or disaster due to natural calamities such as cyclones and associated tidal waves and storm surges. Further, an uninterrupted road network to facilitate continuous supply of relief materials and equipments as well as provide a means of evacuation to safer places for the affected people will need to be deployed.

Therefore, the following are proposed for construction under Component B of the National Cyclone Risk Mitigation Project (NCRMP):

1. **Construction of Cyclone Shelters including approach roads** to the nearest road network to provide a safe sanctuary for the vulnerable population during emergencies such as cyclones and accompanying storm surges and high velocity winds.
2. **Construction of missing road links and bridges** with all weather roads to ensure uninterrupted connectivity of existing cyclone shelters and habitations during the disaster/ Cyclonic periods.

The project area comprises nine coastal districts of A.P. that are cyclone prone viz., Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam, Nellore. Each of the coastal districts has been divided as follows:

- |            |                      |                |
|------------|----------------------|----------------|
| • Zone-I   | ( Most Severe Risks) | 0 to 2.5 Km    |
| • Zone-II  | ( Severe Risks )     | 2.5 to 5.0 Km  |
| • Zone-III | ( Moderate Risks)    | 5.0 to 10.0 Km |

The proposed project is to be executed by the Chief Engineer, Nabard, Panchayat Raj Engineering Department (PRED), through the administrative Panchayati Raj (PR) & Rural Development (RD) departments at State level. The Revenue Department, which

provides and coordinates the relief operations, is consulted at the district level in formulating the project proposals.

The project is formulated based on experiences of Government of Andhra Pradesh in mitigating such disasters during the past and also keeping in view the existing facilities available in the project area in Andhra Pradesh. For this purpose, a detailed analysis of the existing infrastructure in each of the coastal districts has been performed by the PRED field staff. It has been assumed that the existing public buildings such as Schools, Health care centers and other pucca buildings will be utilized as Cyclone Shelters in an emergency. Table I below depicts the results of such an analysis performed:

**Table 1: Gap analysis determining the vulnerable population without access to any safe/pucca shelters during cyclones in the project area (0-10 kms)**

	[1]	[2]	[3]		[4]	[5]
District	Total Vulnerable Population in coastal areas	Presently Available shelter Area (School+ Health center+2 - Storied pucca buildings+ .....)				GAP ( Population-Vulnerable and with out access to shelters) = [1] -[4] Nos
		Buildings	Numbers	Area (Sq.M)	Population that can be sheltered here (Nos.)	
Srikakulam	85858	Healthcare:	3	180	158	
		School	43	1980	1742	
		Cyclone Shelters :	139	10976	59051	
		Others	2	80	70	
Sub-Total	<b>85858</b>		<b>187</b>	<b>13216</b>	<b>61022</b>	<b>24836</b>
Vizainagaram	25341	Healthcare:	1	40	215	
		School	5	330	1775	
		Cyclone Shelters :	42	3276	17625	
		Others	0	0	0	
Sub-Total	<b>25341</b>		<b>48</b>	<b>3646</b>	<b>19615</b>	<b>5726</b>
Vishakapatnam	70399	Healthcare:	1	120	646	
		School	21	1452	7812	
		Cyclone Shelters :	127	9975	51025	
		Others	1	30	161	
Sub-Total	<b>70399</b>		<b>150</b>	<b>11577</b>	<b>59644</b>	<b>10755</b>
East Godavari	93520	Healthcare:	5	350	1883	
		School	26	1716	9232	
		Cyclone Shelters :	159	12499	65026	
		Others	4	125	673	
Sub-Total	<b>93520</b>		<b>194</b>	<b>14690</b>	<b>76814</b>	<b>16706</b>

District	Total Vulnerable Population in coastal areas	Presently Available shelter Area (School+ Health center+2 - Storied pucca buildings+ .....)				GAP (Population-Vulnerable and with out access to shelters) = [1] -[4] Nos
		Buildings	Numbers	Area (Sq.M)	Population that can be sheltered here (Nos.)	
West Godavari	36787	Healthcare:	1	80	430	
		School	8	594	3196	
		Cyclone Shelters :	49	4535	22747	
		Others	2	65	350	
Sub-Total	<b>36787</b>		<b>60</b>	<b>5274</b>	<b>26723</b>	<b>10064</b>
Krishna	47948	Healthcare:	2	140	753	
		School	11	792	4261	
		Cyclone Shelters :	99	7650	34858	
		Others	4	145	780	
Sub-Total	<b>47948</b>		<b>116</b>	<b>8727</b>	<b>40652</b>	<b>7296</b>
Guntur	54906	Healthcare:	2	110	592	
		School	12	726	3906	
		Cyclone Shelters :	98	8254	42370	
		Others	2	90	484	
Sub-Total	<b>54906</b>		<b>114</b>	<b>9180</b>	<b>47352</b>	<b>7554</b>
Prakasam	56797	Healthcare:	4	640	3443	
		School	21	1650	8877	
		Cyclone Shelters :	89	6922	37477	
		Others	5	210	1130	
Sub-Total	<b>56797</b>		<b>119</b>	<b>9422</b>	<b>50927</b>	<b>5870</b>
Nellore	90581	Healthcare:	5	380	2044	
		School	36	2178	11718	
		Cyclone Shelters :	173	13301	68680	
		Others	6	280	1506	
Sub-Total	<b>90581</b>		<b>220</b>	<b>16139</b>	<b>83948</b>	<b>6633</b>
Grand Total	<b>562137</b>	Healthcare:	24	2040	10165 52519 398858 5155	
		School	183	11418		
		Cyclone Shelters :	975	77388		
		Others	26	1025		
		<b>Total:</b>	<b>1208</b>	<b>91871</b>	<b>466697</b>	<b>95440</b>

The National Building Code (NBC) envisages a floor space of 0.6 Sq.m/ person with fixed seating and 1.5 Sq.m/ person other wise. However, under this project, keeping in view the temporary and emergency nature of accommodation to mitigate the risk of cyclone and associated storm surges, **2 Sft/person** is considered to assess the need and requirement of floor space/ number of cyclone shelters.

The following is a break up of the existing cyclone shelters across the three zones within each district:

**Table 2: Zone wise break up of existing cyclone shelters**

S.No.	District	Total no. of Cyclone Shelters	0 to 2.50 Km (Zone-I)	2.50 to 5.00 Km (Zone-II)	5.00 to 10.00 Km (Zone-III)
1	Srikakulam	139	105	25	9
2	Vizainagaram	42	20	8	14
3	Vishakapatnam	146	72	33	22
4	East Godavari	170	61	32	66
5	West Godavari	66	20	13	16
6	Krishna	166	20	33	46
7	Guntur	120	31	28	39
8	Prakasam	90	50	24	15
9	Nellore	191	81	56	36
	<b>Total</b>	<b>975</b>	<b>460</b>	<b>252</b>	<b>263</b>

The table below presents a break up of the existing cyclone shelters based on ownership by the respective agencies within the State:

**Table 3: Agency-wise break up of existing cyclone shelters**

Sl.no.	District	PR Dept	R&B Dept	Indian Red Cross Society	Other Voluntary Organisations	Total Shelters
1	Srikakulam	9	105	25	0	139
2	Vizianagaram	2	36	4	0	42
3	Visakhapatnam	10	104	28	4	146
4	East Godavari	46	73	34	17	170
5	West Godavari	32	29	5	0	66
6	Krishna	1	12	80	73	166
7	Guntur	4	52	41	23	120
8	Prakasam	20	55	13	2	90
9	Nellore	19	118	49	5	191
10	Khammam	6	0	0	0	6
	<b>Total</b>	<b>149</b>	<b>584</b>	<b>279</b>	<b>124</b>	<b>1136</b>

A further analysis of the existing cyclone shelters in the project area (i.e. for 975 shelters within distance of 10 kms from the sea coast) also revealed the usability of these shelters in times of cyclone. While most cyclone shelters are in good working condition, a few shelters require repairs. These repairs however, shall be undertaken via the funds of the State Government and are not proposed under Component B of NCRMP. The table below summarises the current status of existing cyclone shelters:

**Table 4a: Current status of existing cyclone shelters**

Particulars	Zone-I (0to2.5Km)	Zone II (2.5to5 KM)	Zone III (5to10 Km)	Total	Total Floor Area / Planned Floor Area	Total Capacity (Total no. of people that can be sheltered)
Shelters in Good Working Condition	419	220	237	876	68718	369703
Shelters in Repairable Condition	41	32	26	99	7856	42265
Sub-total	460	252	263	975	76574	411968
Nature of damage:						
a) Severely damaged	-	-	2		7856	42265
b) Partially damaged	-	8	14			
c) Needing Minor repairs	26	24	25			
Shelters being constructed / Proposed to be constructed by other available funds	NIL					

**Table 4b: Proposed works for meeting the gap**

Total no. of cyclone shelters (0-10 kms)	975
Total no. of other structures	233
Total serviceable area (in sq m)	91871
Total vulnerable population (0 -10 kms)	562137
Total population that can be protected	466697
Gap to be addressed	95440
Total no of cyclone shelters proposed in project area (0 – 10 kms)	148
Area being proposed under shelter (sq mt)	17140
Population to be protected	95439

## 2 Proposed Cyclone shelters under NCRMP

The existing number of cyclone shelters and space available in public buildings such as Schools, Health care centers and other pucca buildings for use as shelters in an emergency in Andhra Pradesh is not sufficient to accommodate the vulnerable population in coastal areas. The number of cyclone shelters to be built largely depends on the number of vulnerable populations to be sheltered during cyclones that do not have access to existing safe accommodation during such times.

Under this project, priority is accorded to all habitations within 0-2.5 km from the sea coast and habitations where inundation could be for a height of 2.5 – 5 meters or more. Estimated vulnerable population (nearly 60% of total population in the habitations) as per GOI guidelines is taken into consideration for calculating adequacy of floor space in the shelter. The rest of the population is assumed to have *pucca* accommodation/ and or their own mode of risk mitigation. A total of 148 new shelters are proposed to be constructed in this region.

The following table highlights the number of cyclone shelters being proposed under NCRMP.

**Table 5: Zone wise break up of proposed cyclone shelters**

Particulars	Zone I	Zone II	Zone III	Total
Existing shelters (in good condition)	419	220	237	876
Area covered under the shelters (sq mt)	32994	17160	18564	68718
Population being serviced	177508	92321	99874	369703
New CS	148	0	0	148
Repairs	0	0	0	0
Others	0	0	0	0
Total	148	0	0	148
Area being proposed under shelter (sq mt)	17140	0	0	17140
Population that can be serviced*	95439	0	0	95439
Total project cost (in Rs Lakhs)	<b>13183.00</b>			

A location wise break up of the proposed cyclone shelters has been summarized in the table below. A detailed listing of locations has been included in Annexure I.



**Table 6: District wise break up of existing and proposed cyclone shelters**

District	Existing Number of cyclone shelters	Gap Addressed	
		NCRMP	Other Projects
Srikakulam	139	37	-
Vizainagaram	42	4	-
Vishakapatnam	146	18	-
East Godavari	170	20	-
West Godavari	66	6	-
Krishna	166	9	-
Guntur	120	8	-
Prakasam	90	17	-
Nellore	191	29	-
Khammam	6	-	-
	<b>1,136</b>	<b>148</b>	<b>-</b>

### 3 Proposed benefits and outcomes

The Cyclone Shelters in the project area are proposed as risk mitigation investment with the following objectives:

- To build adequate cyclone shelters so as to ensure physical safety of people who have no access to safe shelters;
- To save human lives and livestock and to ensure their sustenance during a disaster;
- To safeguard basic assets needed by people to survive after disaster; and
- To provide a facility for basic medical relief during and after disaster.

#### 3.1 Social and economic benefits

While the cyclone shelters are proposed to mitigate the risk of cyclones and associated disaster situations, it is vital that these shelters are used by the community during normal periods as well, so as to ensure that the constructed shelters do not dilapidate over time due to non-use.

The following social uses are therefore proposed during normal times for these cyclone shelters:

- Schools;
- Community Centers for functions on a rental basis;
- Anganwadi centres;
- Artisan Complexes;
- An integrated service delivery center for the activities like training programmes, group meetings of youth, men and women;
- Health Camps;
- Veterinary Camps; and
- Welfare hostels.

The secondary utility of the cyclone shelter will be decided in consultation with the community through means of Gram Sabhas and based on the need and location of the shelter (Refer chapter 10 for details). The following are the tangible outcomes and assumed economic benefits from the proposed investment:

- Minimization of loss of lives, property and livestock; It is expected that a total of approx 95,000 numbers of the vulnerable population can be protected by means of these shelters during cyclonic periods.
- Nodal point for receipt and dissemination of cyclone warnings;
- Safekeeping of essential stocks/ items for post disaster usage;
- Nodal point for carrying out post disaster response and relief activities;
- Provides temporary protection from the monsoon and the summer to the shelter less people;
- Provides a place for providing basic health services like immunization programmes etc

## 4 Project Assumptions and Design Parameters

### 4.1 Design Criteria

60% of the present population (as per 2001 census) of the cyclone prone habitations is taken as vulnerable population and also as design population for arriving floor and carpet areas required in the cyclone shelters. The shelter is proposed to be located within or closest to the habitation at the highest ground level to the extent possible for quick and easy accessibility for all habitants with in reasonable time in case of a disaster. The location of the shelters is also based on the availability of free of cost land (either Government owned or privately contributed) within the village.

The National Building Code (NBC) envisages a floor space of 0.6 Sq.m/ person with fixed seating and 1.5 Sq.m/ person other wise. However, under this project, keeping in view the temporary and emergency nature of requirement of accommodation to mitigate the risk of cyclone and associated storm surge and also to keep the financial investments within affordable limits, **2 Sft./ person** is considered to assess the need and requirement of floor space/ number of cyclone shelters. People are expected to carry their minimum personal belongings like important documents of properties assets, insurance papers, medical reports valuable ornaments/ cash etc with them, accordingly shelves at lintel level are proposed in each room to keep these articles safely.

#### 4.1.1 General Design Criteria

- Based on the storm surge data collected from the field during the initial site survey investigations, it was noted that the average storm surge level in the coastal districts is expected to be 1.2 meters. The plinth level is therefore considered as 0.6 meters and the ground floor proposed as a stilt with height of 3 meters. In the eventuality that the storm- surge level is noted to be more than 1.5 meters and less than 4.5 meters, then, the plinth level is considered at 1.5 meters and the ground floor proposed as stilt with a height varying from 2.5 meters to 4.5 meters.
- To make use of the space provided as stilt on the ground floor during secondary utility, temporary partitions will be erected and concrete benches will be provided which are easy to maintain and clean after a cyclone.
- Rain water harvesting technique will be adopted so as to make drinking water available to people in the cyclone shelter at the time of cyclone/storm-surge.
- In general the shelters are in RCC frame with non-load bearing, laterally supported filler walls and deeper foundation on elevated ground so as to avoid submergence of the main structure during cyclonic events. Building specifications which are currently in use and specified in the National Building Code (NBC) will be adopted in all the proposed works.
- Ramp with a slope of 1:8 for easy access to the Cyclone Shelter for aged and children is also proposed.
- Proposals also include drinking water supply (minimum two tanks to cater drinking water as well as for the toilets), sanitary blocks for men & women including bath facilities as well as required drainage, electrical connections, solar power arrangements, generators, compound walls for protection against

misuse ramp, access roads, flood protection works, waste disposal provisions, bunkers, earthen mound for protection of domestic cattle population etc.

Probable secondary utilities of the shelter are also taken in to consideration while planning the size, dimensions and locations of the shelter, mostly in consultation with the user community. Connectivity of the shelter to the nearest all weather road is proposed under road component of this project.

#### **4.1.2 Plinth Level of Shelter**

The plinth of shelter is proposed well above the previous or expected storm/surge tidal waves to avoid inundation in the event of cyclone /Tsunami. A Free board of 1.50 Mtr. is proposed above expected/ occurred tidal wave height and the plinth is fixed at 1.0Mtr., above freeboard level as specified in the Guidelines. For each shelter plinth level will be fixed accordingly.

#### **4.1.3 Stilt/ Ground Floor**

The stilt/ ground floor will be left open (where storm-surge is more than 1.50m and less than 4.50metres) without any partitions/ walls below first floor slab to avoid hydrostatic pressure on wall in case of inundation. In Secondary utility this floor can be used without partitions for any purpose by the community. Permanent and hard flooring with M20 grade will be provided in the ground floor to avoid any erosions, uplift of soils due to hydrostatic pressure during inundation.

The over all structure would however be in M30 grade concrete. Reinforcement steel would be corrosion resistant.

#### **4.1.4 Lighting and Ventilation**

For good ventilation minimum aggregate area of openings excluding doors shall not be less than 1/12 of floor area in cold climate. The height of window sill level for rooms sitting on floors is 0.40M. Accordingly the size and number of windows is fixed. Ventilators are provided above all doors and windows.

#### **4.1.5 Civic Amenities**

Water closets, urinals, ablution taps, wash basins, baths are calculated as per norms laid down in the NBC for utility like Hostel with an exception that only 50% of numbers of units are proposed since large gatherings at the designed level are limited to only during an emergency & exceptional use and for a few days, to make the project economical. In normal times it will be used for non residential purpose and hence providing half the number of utility will be sufficient.

Separate storage tanks are proposed for drinking and general purpose usage over roof top of kitchen and toilets. Rain water collected from roof tops will be stored in 'two' different tanks of which 'one' will be used for general purpose and 'another' for drinking, cooking etc. Rain water harvested will be filtered simultaneously by sedimentation before storing in tanks. Further chlorination will be done in clear water portion of the tank.

Water connection from regular PWS scheme if functioning in the habitation will also be provided and connected to Sump in ground floor. Water would be pumped to tanks on roof top in normal course and also prior to occupation in case of a disaster warning. Bore well with Hand pump will be provided near shelter in villages having no piped water supply scheme.

#### 4.1.6 Access

For easy and quick accessibility to the shelter, a ramp with a slope of 1:8 is proposed up to First floor level and staircase are proposed right up to roof top. All the dimensions of stair cases and landings are proposed as per NBC. The width of stair and landings are to be 1.50M, with a rise of 15cm and tread of 30cm. Each stair case of 1.50m wide is sufficient for 200 persons in case of assemblies. A maximum travel distance of 22.50mtr, for educational institutions and 30mtr for Assemblies is specified by NBC and we have proposed 15.0 mtrs.

#### 4.2 Structural Specifications

Following guidelines have been considered to make the cyclone shelters structurally safe.

- i. At least 5 millimeters extra cover to that normally specified in IS 456 is to be provided to all steel reinforcement.
- ii. **Loads-** The shelter is to be designed for a basic wind speed taken 40% higher than that specified for the sea coast areas in IS: 875 (Part –3 1987). Floor and roof are to be designed for live load 500 kg/sqm as per IS: 875-1964 so as to cater for crowding in the shelter.
- iii. **Foundations-** The shelters may be supported by under – reamed pile foundation with the top of the pile cap at 2 ft below ground level to keep the piles free from scouring action. The pile and pile caps are to be designed as per IS: 2911-1973 (giving minimum 5 millimeters extra cover to the reinforcement for corrosion protection.) Depending up on the site specific condition of the ground strata, suitable foundations will be adopted as: footings/ piles.
- iv. **Plaster-** Where plastering of RCC elements has to be carried out, use of Recron 3S fibers may be considered to achieve tougher non-cracking surface providing extra safety against corrosion.
- v. **Design Criteria-** The RCC members are to be designed on the basis of limit state design as recommended in IS-456 –2000. RCC frames may be analyzed by using any standard elastic method. The concrete grade to be adopted is M 30. Blended cement may be used for improved durability. The structures will also be designed taking in to account earthquake resistance and tsunami effects.
- vi. **Steel-** High yield strength deformed bars of corrosion resisting quality (epoxy coated) with a minimum guaranteed yield stress of 500 MPa may be used.
- vii. Sufficient openings in walls will be provided to avoid hydrostatic pressure in case of possible inundation.

Accordingly, the following is a summary of the structural specifications adopted:

- Floor Load : 500 Kg/ Sqm
- Wind Velocity: 78 m/sec with modification factors as per IS- 875.
- Plain: Min M20, Cement: min 250Kg/Cum
- RCC: min M30, Cement: min 320Kg/Cum
- Min. Cover: Slabs- 20mm; Beams- 30mm; columns- 40mm.
- Terrace: should have same floor load as that of the first floor.
- For earthquake safety, floor load would be half and the roof load will be considered zero.
- Earthquake loading will not be considered simultaneously as that of unloading. 1.8 would be used as an EQ factor. Rest would be from IS code.
- Live loading + EQ loading will be combined only with normal use load of the building
- Vents all along the walls to avoid static/ dynamic pressures of water and winds.
- Shelves should be provided much above the floor to keep the things above the wet line.
- Ramp with a slope of 1:8.
- No Hydrostatic /dynamic pressures to be considered on the first floor walls of the cyclone shelter as it is understood that the pressures would be equated from all the sides.

In worst case scenario, hydrostatic pressures on the walls are considered of the first floor wherever the water level is likely to increase beyond the ground floor.

The architectural drawings and site plans for each type design have been included in Annexure III and Annexure IV respectively. A list determining the zones of each of the cyclone shelters has also been included in Annexure VI.

### 4.3 Type Designs

Four type designs are being proposed under this project with the following specifications:

**Table 7: Summary of Type Designs**

Type Design	Capacity During Emergencies (No of Persons)	Built up Area (Sq.Mts.)			Carpet Area (sq m)	Carpet Area (Sq ft)
		Stilt area	First Floor area	Second Floor area		
<b>Type A</b> (Stilt with 2 rooms of 5.5 x 5.5m size and Kitchen)	325	246.80	172.90	Un built up area (172.90Sqm)	60.5	651
<b>Type B</b> (Stilt with 2 Halls of 6.705 x 6.705m size with Kitchen)	484	269.60	202.16	Un built up area (202.16 Sqm )	89.91	967
<b>Type C</b> (Stilt with 2 rooms of 5.5 x 7.0m size with Kitchen in 2 floors)	829	258.46	180.46	180.46	154.00	1657
<b>Type D</b> (Stilt with 2 rooms of 6.705 x 6.705m size with Kitchen in 2 floors)	967	269.60	198.40	198.40	179.82	1935

The cost of each type design is illustrated in the table below. The rate per type design has been arrived at by dividing the total actual cost by the number of cyclone shelters for each type design.

**Table 8: Cost break up for each type design**

Sl.No	Description	Type A			Type B			Type C			Type D		
		Total floor Area (Sq .M)/ Nos	Rate (Rs.in lakhs)	Amount (Rs. In lakhs)	Total floor Area (Sq .M)/ Nos	Rate (Rs.in lakhs)	Amount (Rs. In lakhs)	Total floor Area (Sq .M)/ Nos	Rate (Rs.in lakhs)	Amount (Rs. In lakhs)	Total floor Area (Sq .M)/ Nos	Rate (Rs.in lakhs)	Amount (Rs. In lakhs)
1	Cost of Construction of Cyclone Shelters with stilt floor. Open foundation (Civil Works Only) including Approach road and Compound wall	419.70/41	68.20	698.15	471.76/43	71.33	782.55	619.38/27	93.82	2152.25	666.4/37	96.72	1742.00
2	Electrical Installation such as Fixing of all Fixtures including cost of external electrical connection.	41 Nos	0.76	31.16	43 Nos	0.76	32.68	27 Nos	1.26	34.02	37 Nos	1.26	46.62
3	Internal sanitary installation, Water supply, fitting of required fixtures. external sewerage such as septic tank water harvesting pit ,sock pit etc.,	41 Nos	1.04	42.64	43 Nos	1.08	46.44	27Nos	1.55	41.85	37 Nos	1.60	59.20
4	Providing tube well 1 Nos. one deep tube well and one shallow tube well in each Cyclone shelters.	41 Nos	0.28	11.48	43 Nos	0.28	12.04	27Nos	0.28	7.56	37 Nos	0.28	10.36
5	Providing Installation of photo voltaic solar panel one number in each cyclone shelters	41 Nos	1.37	56.17	43 Nos	1.37	58.91	27Nos	1.98	53.46	37 Nos	1.98	73.26
	Total		71.65	839.60	Sub-Total	74.82	932.62	Sub-Total	98.89	2289.14	Sub-Total	101.84	1931.44



The district-wise cost for each type and number of cyclone shelter is produced below

**Table 9: District wise cost for Type Designs**

		Type of Cyclone Shelter In No.				Est. Cost in lakhs				Total	
	Type Design	A	B	C	D	A	B	C	D	No.	Cost in lakhs
S.No	District	No of units per district				No. of units *Rate per type					
1	Srikakulam	9	12	8	8	666	947	821	848	37	2650
2	Vizainagaram	3	1	0	0	222	80	0	0	4	245
3	Vishakapatnam	5	4	4	5	365	314	405	525	18	1337
4	East Godavari	4	3	3	10	303	231	317	1010	20	1620
5	West Godavari	3	1	0	2	228	76	0	212	6	423
6	Krishna	3	2	3	1	232	161	315	104	9	673
7	Guntur	1	3	3	1	75	240	317	114	8	612
8	Prakasam	1	6	2	8	76	457	205	815	17	1288
9	Nellore	12	11	4	2	904	858	412	214	29	1944
	<b>Total</b>	<b>41</b>	<b>43</b>	<b>27</b>	<b>37</b>	<b>3074</b>	<b>3368</b>	<b>2795</b>	<b>3846</b>	<b>148</b>	<b>13183</b>

## 5 Project Costing, Funding & Time Frame

### 5.1 Project Costing

The following table depicts the overall project cost for the investment. The costs have been broken down by planning, implementation and monitoring stages:

**Table 10: Project Cost – Item wise details**

S.No	Description	Unit	Amount (Rs.in Lakhs)	Note Reference	NCRMP Component
<b>A.</b>	<b>Planning</b>				
A.1	State survey and soil exploration	0	0.00	Note 1	NA
A.2	Designing fees for consultants for preparation of designs drawings, Estimates, BoQ's and Bid documents etc.,	148	119.63	Note 1	Component D
<b>B.</b>	<b>Implementation</b>				
B.1	Cost for site clearance and leveling	148	148.0	Note 2	NA
B.2	Cost of construction	148	12109.00	Note 3	Component B
B.3	Fees for agencies/ consultants for coordination, supervision and monitoring	0	0.00	Note 4	NA
B.4	Fees of agencies / consultants for quality control and assurance	148	62.96	Note 5	Component D
B.5	Value Added Tax @ 4%	148	484.34	Note 6	Component B
B.6	Environmental Compliance Cost	0	0.00	Note 7	NA

S.No	Description	Unit	Amount (Rs.in Lakhs)	Note Reference	NCRMP Component
B.7	Society orientation of community and formation of CSMMC, Development of IEC Materials, Training of CSMMC	0	0.00	Note 8	NA
B.8	Contingencies @ 2%	148	251.86	Note 9	Component D
B.9	Procurement Charges @ 0.24%	148	3.02	Note 10	Component D
B.10	Insurance charges	148	125.93	Note 11	Component D
B.11	<b>Grand Total :</b>		<b>13183.98</b>		

*Schedule of rates used: 2009-2010 (This has been arrived at by escalating the 08-09 Schedule of rates by 15%)*

#### Notes

1. Soil explorations/ Geo-technical investigations have been conducted by the Design & Proof Consultants hired. The cost towards these is included in line item A.2 i.e. 'Designing fees for consultants for preparation of survey .designs drawings estimates preparation of BoQ's and Bid documents etc.
2. Cost of site leveling and clearance has been budgeted as a lump sum of Rupees 100,000 per cyclone shelter. This cost has been included in the cost of construction in line item B2.
3. The cost of construction included is a summation of the actual costs for each cyclone shelter. A detailed break up of the construction cost is enclosed as Annexure II.
4. Coordination, Supervision and monitoring of works will not be outsourced and will be the responsibility of the field staff responsible for execution of works
5. While Quality Control and Assurance is the responsibility of the in-house quality control wing as well as the respective field personnel of the line department, a provision of 0.5% of the construction cost has been made towards any QC charges that may be applicable on account of procedures and quality control tests etc, that may need to be conducted in external laboratories.
6. Value Added Tax as per the prevailing rate of 4% of cost of construction for works has been provided for.

7. The cost of environmental compliance includes cost for hiring environmental consultants for performing the environment and social screening, conducting the environmental and social assessments, where applicable as well as preparing the Environment Management Plans and Resettlement Action Plans, where applicable. Environment Protection Training and Research Institute have been appointed as the external consultants to conduct these tasks for all line departments associated with NCRMP. The costs towards these are borne by the Disaster Management Department, Government of AP, and therefore have not been budgeted when computing the project cost for Cyclone Shelters.
8. These tasks will be the responsibility of the State Disaster Management Authorities/ Revenue Department. Cost towards these activities will be included separately in the costs for set up of the Project Implementation Unit (PIU)
9. Nominal contingency charges of 2% of construction cost have been provided as contingency charges. These shall be used towards any site specific costs that may be required to be incurred and have not been budgeted above.
10. Procurement charges have been budgeted at 0.24% of construction cost as per the Government Order issued by Govt of AP for e-procurement charges. In the event that e-procurement is not allowable, these would be used towards costs for advertising and other procurement related procedures of the Bank.
11. Insurance charges have been budgeted at the rate of 1% of the construction cost

## **5.2 Project Funding**

The cost of cyclone risk mitigation investments as proposed under Component B of NCRMP will be shared on a 75:25 basis; where in 75% funds will be provided by the Central Government as a grant to Project States and the rest 25% matching resources will have to be provided by the States for taking up the NCRMP Project.

The funds required will be staggered across the period of the project depending on the number of cyclone shelters taken up for construction every year. Keeping in mind the proximity of proposed cyclone shelters with the Coastal Regulatory Zone and associated clearances, it is proposed that 55 shelters will be taken up in Year I. These shelters do not fall within the purview of the Coastal Regulatory Zones or Environmentally Sensitive Areas, and do not require any regulatory clearances. The remaining 93 shelters however require certain clearances, without which construction cannot be commenced. It is envisaged that these clearances will be obtained in Year I, and construction of these shelters will therefore commence only Year II.

If 55 Cyclone shelters are taken up after accordance of Bank clearance expected by August 2009, the tender process will be commenced and works will be entrusted within a period of four months. The construction of works for the first 55 cyclone shelters will therefore take place in the 15 months between January 2010 and March 2011. For the second phase of construction of 93 shelters, an additional time period of 8 – 10 months will be required for environmental and social screening and obtaining of the required regulatory clearances. Therefore, construction of these shelters is proposed to be completed in the 15 months between January 2011 and March 2012.

The funding requirements for all costs other than that of the Design & Proof Consultants have been summarized in the table below based on the following principles:

- Year I: Estimates include 40% of the cost for the 55 shelters proposed for construction in Phase I.
- Year II: Estimates include 60% of the cost of 55 cyclone shelters to be constructed in phase I and 70% of the cost of 93 shelters to be constructed in phase II.
- Year III: Estimates include 30% of the cost of 93 shelters to be constructed in phase II.

80% of the consultants cost is expected to be incurred in Year I and 20% in Year II.

The following tables present a summary of funds required

**Table 11a: Summary of funds required**

Tendering					Expenditure			
	Yr I	Yr II	Yr III	Total	Yr I	Yr II	Yr III	Total
No. of Cyclone Shelters	55	93	-	148				
Amount (Cr) excl overheads and taxes	45.56	80.37	-	125.93	18.22	83.59	24.11	125.93
Overhead & Taxes (Cr)	2.137	3.77	-	5.907	0.85	3.92	1.13	5.90
<b>Total</b>					<b>19.07</b>	<b>87.51</b>	<b>25.24</b>	<b>131.83</b>

**Table 11b: Estimated Funding Schedule**

*(All costs are in Rupees Lakhs)*

S.No	Description	Year I	Year 2	Year 3	Total
1.	Designing fees for consultants for preparation of survey .designs drawings estimates preparation of BoQs and Bid documents	96.00	24.00	0.00	120.00
2	Cost of construction (excluding overheads and taxes)	2286.00	6227.00	2016.00	10529.00
3	Fees of agencies / consultants for quality control and assurance	9.11	41.79	12.05	62.96
4	Likely escalation in cost at various stages @ 15%	228.58	1048.44	302.4	1579.42
5	Contract Tax / other taxes as applicable VAT @ 4%	70.09	321.51	92.73	484.33

<b>S.No</b>	<b>Description</b>	<b>Year I</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Total</b>
6	Contingencies	36.45	167.19	48.22	251.86
7	Procurement	4.37	20.06	5.78	30.22
8	Insurance charges	18.22	83.58	24.11	125.91
	Grand Total :	<b>2748.82</b>	<b>7933.57</b>	<b>2501.29</b>	<b>13183.68</b>

### 5.3 Project Time Frame

Project is proposed to be implemented in 3 years. The following table presents a schedule of activities to be performed:

Sl no	Description of Activity	Time lines																																							
		Month - 1	Month - 2	Month - 3	Month - 4	Month - 5	Month - 6	Month - 7	Month - 8	Month - 9	Month - 10	Month - 11	Month - 12	Month - 13	Month - 14	Month - 15	Month - 16	Month - 17	Month - 18	Month - 19	Month - 20	Month - 21	Month - 22	Month - 23	Month - 24	Month - 25	Month - 26	Month - 27	Month - 28	Month - 29	Month - 30	Month - 31	Month - 32	Month - 33	Month - 34	Month - 35	Month - 36	Month - 37	Month - 38	Month - 39	
Planning																																									
1	Alignment finalisation, Soil exploration, Designs finalisation, Preparation of drawings, Preparation of Estiamates, Submission of specific work DPR																																								
2	Acceptance of DPR by DPR by Nodal Agency, Issue of Tender notice, Receipt of Tenders, Finalisation of bids, Entrustment of work																																								
Implementation																																									
3	Required environmental clearances																																								
4	Fixing of alignment, Procuremnt of material, Mobilisation of labour																																								
5	Foundations																																								
6	Stilt Floor Slab																																								
7	First Floor Slab																																								
8	Second floor slab																																								
9	Brick Masnory																																								
10	Water Supply and Sanitary Fixings																																								
11	Flooring, Painting and fixing of doors and windows etc																																								
12	Cleaning and handing over to																																								
<div><div>Denotes Planning activities</div><div>Denotes activities for 55 shelters to be taken up in Year I</div><div>denotes plan for 93 shelters to be taken up in year II</div></div>																																									

## 6 Environmental and Social Impact

For the purpose of the environmental and social impact assessments, specific screening forms have been prepared with the following objectives:

1. To assess applicability of coastal regulations
2. To assess proximity to environmentally safe areas
3. To assess extent to displacement of personnel and rehabilitation that may required on account of the proposed construction works

The Environment Protection Training & Research Institute (EPTRI) has been hired to conduct the screening and assess the applicability of the CRZ regulations. Based on the results of the screening, if the proposed sites are outside of 1 km distance from the environmentally safe areas, a generic Environmental Management Plan will be updated in the Detailed Project report along with the updated screening form. If however, it is determined that the proposed location is within 1 km distance of the environmentally sensitive areas, an environmental impact assessment would need to be conducted, based on which site specific Environmental Management Plans will be developed by the consultants (EPTRI). Similarly, based on the results of the social screening, a social impact assessment would be performed and adequate resettlement action plans will be documented and included in the Detailed Project Reports, where required.

Based on the CRZ screening already performed by the agency, 55 cyclone shelters are free of CRZ regulations. These are also beyond 1 km of the environmentally sensitive areas. This was also confirmed by the Design & Proof Consultants (Desscon associates) while performing the geo-technical investigations. These investigations also confirmed that all 148 proposed sites do not require any land acquisition and therefore will not involve any displacement of people or have any significant social impacts. However, necessary remedial steps will be taken for safe disposal of the solid waste, proper ventilation of kitchen to avoid circulation of smoke in the shelter, etc. All these aspects will be updated in the site specific environmental and social screening forms and the environment management plans that will be enclosed in the individual Detailed Project Reports.



## 7 Applicable regulations and required clearances

Based on the CRZ screening results determined by EPTRI (a third party consultant hired by the Disaster Management Department, Govt of AP), the following has been established:

- 55 Cyclone shelters are free from CRZ requirements and do not fall within 1 km of any environmentally sensitive area. These have been bundled into 27 packages, construction for which will commence in Year I of the implementation period
- 93 cyclone shelters need to comply with CRZ requirements as they fall within the CRZ Zones. Of these:
  - o 15 shelters fall within CRZ I
  - o 14 shelters fall within CRZ II
  - o 32 shelters fall within CRZ III
  - o 32 no of shelters fall within the CRZ III - No Development Zone

The District maps indicating the proposed investments along with the CRZ line superimposed are included in Annexure V.

As Construction of Cyclone Shelters is considered a permissible activity, the department will be obtaining the necessary clearances required for these shelters, including those which are in the No Development Zone. Any other clearances that are required for these shelters will be determined during the screening process by EPTRI.

## 8 Implementing Arrangements

The National Cyclone Risk Mitigation Project (NCRMP) is a program for construction and improvements to the infrastructure connecting Cyclone Risk areas for mitigation of hazardous during calamities/cyclones and to safeguard the valuable lives of many innocent people, live stock and belongings of the people.

The Panchayati Raj Department (PRED) came into existence in the year 1965. The main functional role of the Department is the construction and maintenance of rural Roads, bridges, buildings and Minor Irrigation tanks in the rural areas of Andhra Pradesh.

The PR Department is also vested with the responsibility of construction and maintenance of public works pertaining to other Government Departments. Other Government Departments requiring services from the PR Dept with respect to a rural road, bridge, building or MI tank deposit the estimated cost of the works to the PR Department through the concerned Administrative Department. All the technical and planning issues and execution of the work is carried out by the PR Dept. On completion of the work, the same is handed over to the original department for further maintenance.

There is an in house Design and Planning wing headed by Chief Engineer (CE), PR Design with all supporting staff and necessary design software for design and preparation of estimates for all major works to accord necessary approval of designs.

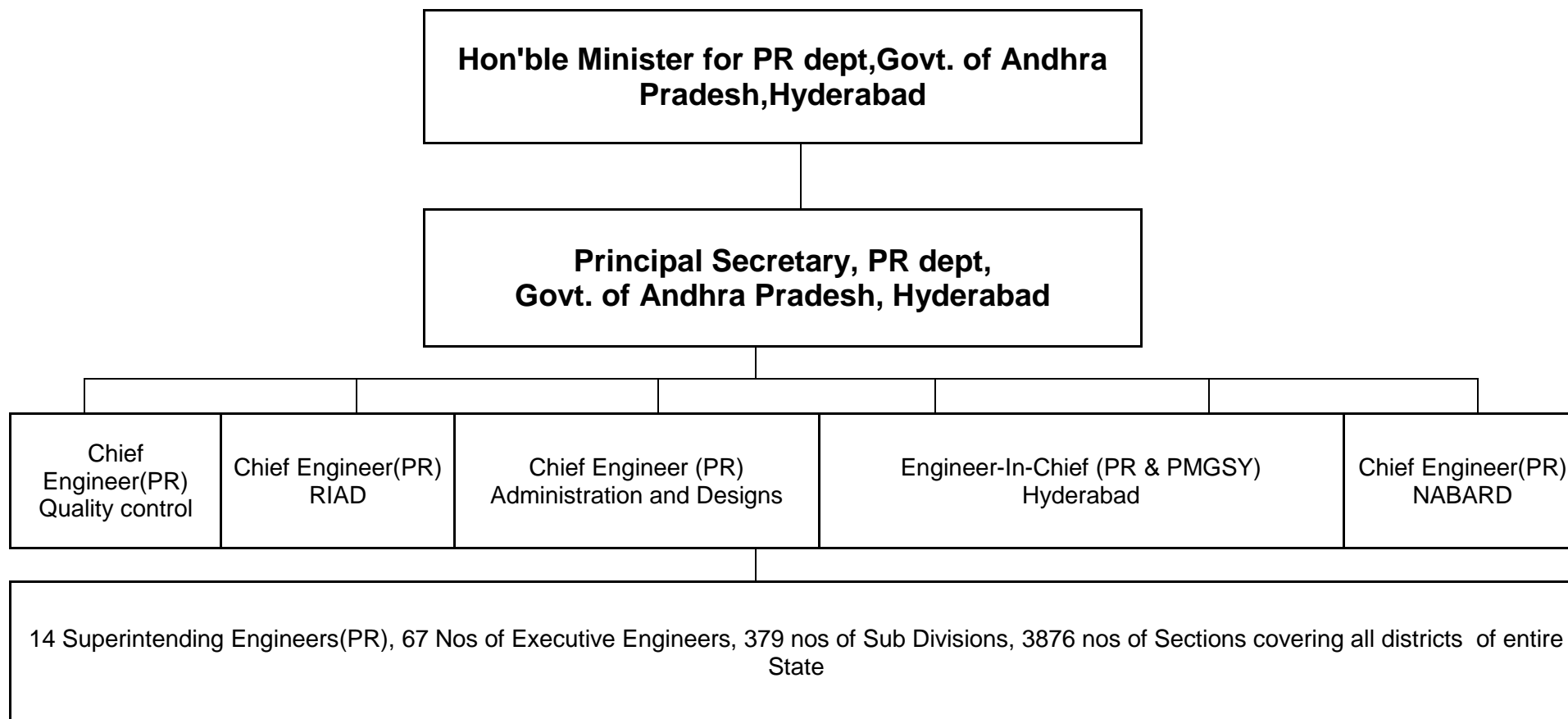
There is also an in house Quality Control wing headed by a Chief Engineer with all supporting staff and required quality control laboratories with necessary equipment for undertaking quality control tests during inspections and to see that the works are carried out as per the quality control standards fixed.

Further, to reconstruct the rural roads, bridges, building, MI tanks and water supply schemes ravaged by the fury of 1990 Cyclone, a separate wing i.e. the Cyclone Emergency Reconstruction Project (CERP) headed by a Chief Engineer was created in year 1990. This wing, on completion of the assigned programme was converted to other wings. Thus, PR Dept has successfully completed Cyclone related construction projects and is well aware of the related procedures in executing such projects.

With the financial assistance of the World Bank, works were also taken up and completed in three pilot project districts of Andhra Pradesh (i.e. Warangal, Karimnagar, Adilabad) by PRED under rural road component in Andhra Pradesh Economic Reconstruction Project (APERP)

Further PR Department has a set hierarchy of Engineer-In-Chief, PR department (Independent Heads of the Department), Chief Engineers (Independent Heads of the Department), Superintending Engineers, Executive Engineers, Deputy Executive Engineers and Assistant Executive Engineers/ Assistant Engineers and other non technical Staff. An organization structure of the department is given below.

## **ORGANIZATION FLOW CHART OF PANCHAYATI RAJ (PR) DEPARTMENT**



The Primary Stakeholders for the Project are

1. Nodal Agency – Ministry of Home Affairs, Govt of India
2. Project Implementation Unit – State Disaster Management Wing
3. Executing Agency- Panchayati Raj Engineering Department(PRED)
4. Monitoring Agency- Engineer-In-Chief (PR) State PR Dept
5. Agency for Quality Control Assurance- Chief Engineer (PR) QC, of PR Dept

The following table summarises the implementation arrangements at the State for effective implementation of the proposed investment. Detailed flow of activities is also enclosed thereafter.

Task	Responsibility
<b>Investment Proposals</b>	
Preparation of proposals	Line Department (PRED)
Review and clearance of proposals	Project Director, PIU
<b>Environment &amp; Social Matters</b>	
Screening	External agency as deputed by PIU
Social consultations	External agency in coordination with line department
Conduct of EA	External Agency as deputed by the PIU
Obtaining Environment Clearance	PIU in coordination with Line Department
Monitoring status of clearance	PIU – environment specialist
Preparation of EMPs	External Agency as deputed by the PIU
Preparation of RAPs	Preparation of RAPs
Inclusions of EMPs and RAPs in the DPR and bid document	Line department (PRED)
Adherence to EMPs/ RAPs	Line department (PRED)
Disbursement of funds	PIU
Monitoring adherence to EMPs and RAPs	PIU – social and environment specialist with support from auditors
<b>DPR Preparation</b>	
Preparation of Designs and estimates	Line Dept (PRED) by engaging Design & Proof Consultants
Quality Assurance of Designs & Estimates	Line Department (PRED) and Proof Consultant
DPR Review and Clearance	CE, (PRED), NABARD in consultation with Proof consultants
<b>Bidding</b>	
Preparation and revision of the procurement plan	PIU – Procurement Specialist in consultation with the Line Department (PRED)
Bid document preparation	Line department (PRED)
Quality assurance of Bid document	CE (PRED), NABARD and PIU at State Disaster Management Wing
Bid Invitation through advertisements	Chief Engineer (PR), NABARD
Receipt of bids	Line Dept EE/SE/CE office
Opening of bids	Respective offices based on value
Evaluation of bids	EE/SE/CE
Scrutiny of Evaluation	within Line Dept
Approval of Evaluation	As per GO No 195 dated 10.05.99: - By CE (Up to Rupees two crores)

Task	Responsibility
Clearance for award	<ul style="list-style-type: none"> <li>- By COT (Greater than Rupees two Crores)</li> </ul> EE/SE/CE of Line department and review by PIU: <ul style="list-style-type: none"> <li>- Procurement specialist for compliance with NCRMP procurement guidelines</li> <li>- Environment and social specialist for inclusion of EMPs and RAPs where required</li> </ul>
Award	EE/SE/CE of Line department
Rebid requests	Respective line dept offices
Clearance for rebids	EE/SE/CE of Line department
Retention of documentation	Line department with copies to the PIU, if required
<b>Quality Assurance</b>	
Quality Control and Assurance	In house QC wing within the line department to be responsible jointly with the field staff responsible for execution of works
<b>Contract Actions</b>	
Variations/termination etc.	EE/SE/CE of Line department
Clearance of contract actions	Respective SEs in line department in consultation with CE, NABARD followed by clearance by PIU, Procurement specialist
Progress monitoring	<ul style="list-style-type: none"> <li>- Primary responsibility of onsite supervision: Line department.</li> <li>- Overall progress monitoring - PIU</li> </ul>
<b>Payments</b>	
Preparation of bills	Concerned AEE in the field along with works book
Scrutiny of bills	By the concerned EE of the district
Clearance for payment	By the concerned SE of the district
Recording of bills and approving payment	By the concerned SE of the district
Payment method	Direct release by concerned SE in district

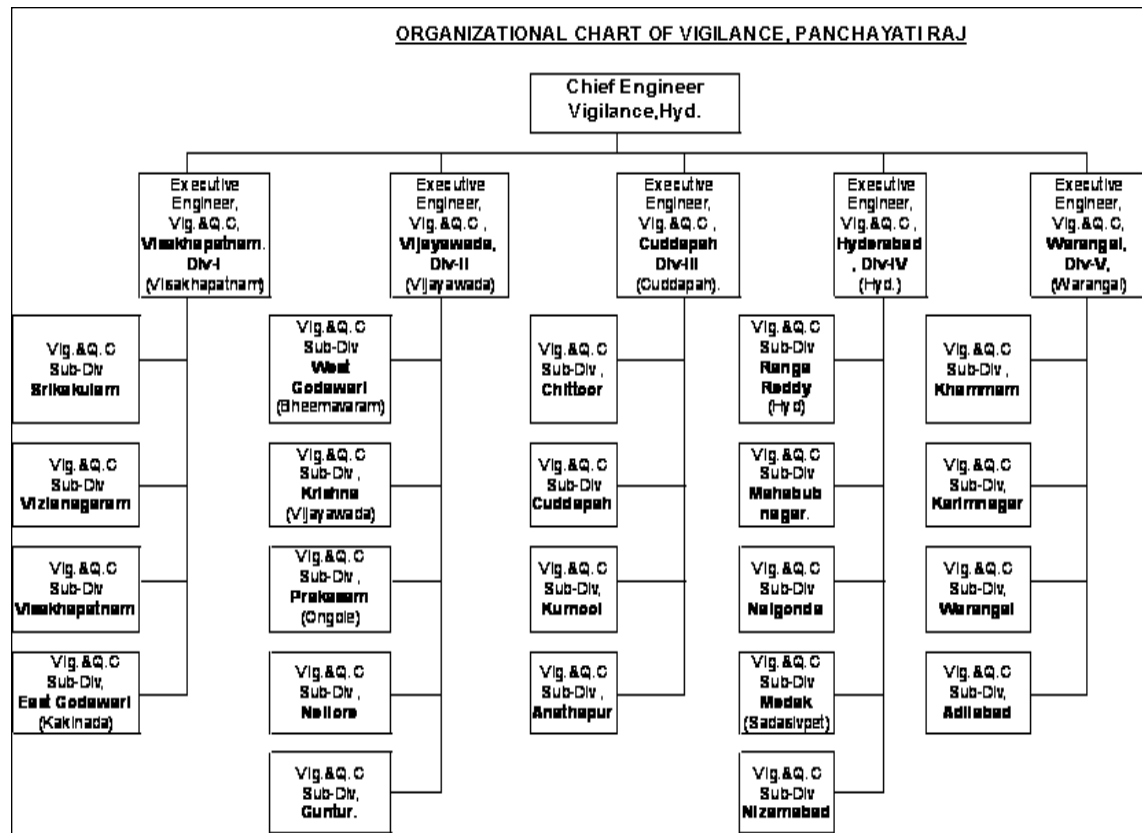
*Note: The above procedures will be subject to further confirmation with the Bank and as finalized in the Finance/ Procurement/ Operations and other manuals developed for NCRMP.*

## 8.1 Procurement Strategy

- Once the project is cleared by the Bank, the investment proposals will be accorded the required administrative sanction from the Government of India.
- For these sanctioned works, tenders will be called through National Competitive Bidding contracts by duly advertising in two newspapers.
- The bidding documents will be made available for sale upto a period of one month from the date of the advertisement. The cost of the bidding document will be Rupees Ten Thousand
- A pre-bid meeting will be conducted, if necessary atleast 15 days prior to the last date of submission of the bids
- The bids are received from the bidders with a validity period of ninety days
- The bids are evaluated by the concerned authority as per the Government Order No. 195 dated 10.05.99
- The bids are scrutinized by the concerned SE of the relevant district and are submitted for further evaluation to the Chief Engineer, NABARD
- The Chief Engineer, NABARD will finalise the tender as per GO No. 195 and submit for further approvals, if necessary (i.e. where the cost of works is greater than 2 Crores) to the Committee of Tenders (COT)
- After accordance of the necessary approvals, the Letter of Approval (LOA) will be issued to the successful bidder with a request to conclude the agreement with the concerned Superintending Engineer (SE)
- Once the agreement has been concluded, the works will be executed by the successful bidder and monitored/ quality controlled as per the procedures mentioned in the sections below.
- On completion of the works, the SE will be required to submit the project completion report to the Chief Engineer, NABARD
- On approval of the report from the Chief engineer, NABARD, payments will be duly released to the Contractor
- *The above procurement strategy with be subject to compliance with the Procurement Manual applicable for the NCRMP.*

## 8.2 Quality Control & Monitoring Strategy

The PRED has an in-house Vigilance & Quality control wing headed by a Chief Engineer. The department has in-house QC laboratories and also seeks assistance of Laboratories available in the Universities and Engineering Colleges spread all over the state. The set-up is as follows:



It is to be ensured that proper tests are conducted by the executive staff during the execution of the works. The tests that are to be conducted on materials and finished items of works on roads, bridges and works shall be as follows:

Component	Tests
Coarse aggregate	1. Impact value 2. Flakiness index 3. Grading tests
Fine aggregate	4. Fineness modules 5. Silt content
Soils	6. Dry density/ protector compaction 7. CBR value
WBM	8. Camber 9. Thickness of layer and grading 10. Width of metal layer
Concrete	11. Grading of aggregate 12. Impact value of aggregate 13. Flakiness index of aggregate

Component	Tests
	14. Fineness module of sand 15. Silt content of sand 16. Suitability of water for concrete 17. Steel: Tensile strength 18. Cement: Initial and final setting time compressive strength 19. Cube strength of concrete 20. Slump test

The Chief Engineers (PR) shall undertake a critical analysis of the quality control test results and shall ensure that work performed and materials used in the works confine to the specification requirements. The Vigilance wing in the PR department headed by the CE, Vigilance will check both quality and quantity of works during after the execution of works. The vigilance staff shall draw random samples from the collected materials and also from the finished works and conduct tests to assess whether the quality achieved is of desired specifications. The vigilance staff shall also check whether the execution staff are conducting the prescribed quality control tests as per the required norms and verify the quality control records maintained by them at the office and field level.

The Chief Engineer in charge will be responsible for responding to the observations made in the Vigilance reports of PRED, Vigilance and enforcement department and Advisor of Quality Control, General Administrative Department, Press reports, representations from Public representatives, and references from Lokayukta etc. on the implementation of works. The Chief Engineer in charge shall correlate the quality control registers maintained by the execution staff with the above reports. The SE/ EE in charge shall critically scrutinize all the relevant records of both works and quality control. If any additional tests are to be conducted, the officers concerned will draw the samples and get the tests conducted in the departmental/private/ engineering college laboratories. When an allegation is made against an officer, the officer one rank above shall carry out these tests.

The Chief engineer in charge after a detailed examination of the records and test results shall initiate necessary corrective actions to rectify the defects and recover costs where needed.

In addition to the above, the works, if required, will also be subject to a third party quality audit by a third party agency as selected by the project implementing unit.



## **8.3 Roles and Responsibilities of various Stakeholders**

### **8.3.1 Roles & Responsibilities of Nodal Agency/PIU**

- Allocation of funds for total sector
- Finalisation of individual project locations.
- Quality clearance of Investment Proposals and Detailed Project Reports (DPRs)
- Release of funds as per requirements
- Monitor Progress - physical and financial through monthly reports prescribed on a particular date in every month from the Line Department/Executing Agency.
- Ensure compliance with financial and procurement guidelines
- Monitor compliance with environmental and social guidelines (screening, conduct of SIA/EIA, inclusion of EMPs, RAPs in bid documents and contracts, obtaining clearances and monitoring adherence with the EMPs and RAPs)
- In case of escalation, additional sanctions to be obtained after review by Nodal and funding Agencies.

### **8.3.2 Roles & Responsibilities of Line Department/ Executing Agency**

- Preparation of project proposals including investment proposals and determination of individual project locations
- Preparation of designs, specifications and estimates for cyclone shelters, roads and supporting infrastructure in respective locations as agreed by the Nodal Agency.
- Finalization and submission of project proposals to the Nodal Agency.
- Preparation of bid documents (NCB) based on cost estimates, after obtaining approvals from the Nodal Agency/NDMA for the proposed works.
- Invitation of bids in approved format and as per approved procedure once the same has been obtained from the Nodal Agency/ NDMA
- Tenders finalization and entrustment of works to the contractors as per the procedures approved
- Execution of works
- Monitoring the progress of works through the 'Engineer' ( of PR Dept)
- Verification of works Quantity/Quality by the 'Engineer', (of PR Dept)
- Fortnight review of works progress by the Engineer by conducting meeting with the Contractor
- To arrange for the monthly payments to the contractor
- Monthly review of works by the Engineer-In-Chief (PR) of PR dept
- Quality assurance and verification by the Chief Engineer(PR) Quality Control, PR dept

- Verification and recommendation of variations by the Engineer to the Employer for approval
- Approval of variations, extensions, rates for new items and to take any policy decisions by the Employer.
- Submissions of monthly progress reports, report on variations, cost escalations due to variations etc to the Nodal Agency/PIU.
- To appraise the Nodal Agency/ PIU the Project Progress and financial aspects.
- To coordinate with auditors and respond to any audit observations
- Obtaining completion certificates after verification of Quality and acceptability
- Coordinating for the effective project implementation
- Project Completion within stipulated costs

For smooth execution, the number of levels authorizing implementation is to be kept as min as possible. The Direct Executing Agency is to be sufficiently empowered for smooth execution of the project.

### **8.3.3 Roles & Responsibilities of Quality Control Wing for Quality Control and Assurance**

- To establish a Quality assurance plan for construction
- To conduct sensitization, review, training programmes to the Engineer/Field staff and the contractor on methodology for effective implementation of Quality Assurance
- Design register/records for Quality Assurance;
- To ensure users' involvement in quality monitoring for trust/confidence building
- Specify and approve quality of materials
- Specify and approve standards of workmanship
- Conduct on site/ lab Tests for materials, etc.
- Appraising the PR department on the results of the quality checks performed
- To suggest any rectifications or rejection of works in case deviations against standards are detected during quality checks.

## 9 Operations & Maintenance of Proposed Cyclone Shelters

It is proposed that after construction the management of the cyclone shelters would be entrusted to the Gram Panchayat. In cases where the shelter is proposed to be used as a School, it shall be entrusted to the Department of Education for use during normal times by Gram Panchayat.

Wherever the asset is utilized by the Department of Education to operate as primary schools, the maintenance activities, standard security measures and drills will be carried out by the Principal/Headmaster of the school. In other cases where community/Gram Panchayats operate and maintain the asset, the responsibility of security and maintenance measures will be carried out by the Gram Panchayats. The costs towards such measures and maintenance will be drawn from the regular operational budgets of the Department of Education and Gram Panchayats as the case may be.

IEC and training camps will be conducted for relevant department personnel by the State Disaster Management Authorities. Stationery like Cash book, Registers and other items based on the secondary utility of the building will also be supplied.

The relevant Gram Panchayat would then be required to do the following:

- a) Ensure that the cyclone shelter has been put to its intended social use for the benefit of the community;
- b) Where the shelter is proposed as a community centre or an integrated service centre, collect suitable lending fee from the users and use the funds towards maintenance of the shelters;
- c) Establish and maintain corpus fund: A provision for a corpus fund has been included in the overall investment proposal. The fund will be established and maintained by the village panchayat or a separate cyclone shelter management committee constituted by the Panchayat. The accounts would be maintained by the Panchayat Secretary, subjected to LF audit.

### 9.1 Specific maintenance activities

For the proposed cyclone shelters, 'preventive' maintenance measures will be deployed over and above the 'Break down' maintenance measures. The repairs, if any will be done in advance of damages. Cracks, Leakage, Soakage and stagnation of water on roofs and chajja tops will be prevented from occurrence by making a priori maintenance, since a posteriori maintenance of damages to such buildings is extremely difficult and costly. It is therefore proposed that every cyclone shelter will be inspected before and after the onset of monsoon or after occurrence of cyclonic storms by the relevant field staff of the department. The following areas will typically be inspected during such a visit:

#### 1. Foundation Details:

- a. Existence of scours / cracks.
- b. Condition of pitching
- c. If exposed surface is painted properly.
- 2. Super Structure: Exterior**
  - a. Soakage and stagnation of water on roof/chajja tops/ porch tops etc
  - b. Patches on walls and floors.
- 3. Super Structure: Interior**
  - a. Corrosion / spalling of steel / concrete.
  - b. Cracks in flooring / walls / plinth.
  - c. Joinery for existence of white ants.
  - d. Application of paints / colour and lime wash

The relevant department/ Gram Panchayat will be responsible for informing the field staff of PRED, any need based maintenance requirements around the following areas:

- Colouring
- Patch work
- Flooring
- Electricity & Water Supply damages, if any
- Maintenance of doors and windows and other

## 9.2 Long term sustainability of the proposed investments

The sustainability of benefits from the proposed works will be ensured through the enhanced design and construction standards that would be deployed. The institutionalization of a maintenance system and promotion of community participation will help provide timely maintenance. An effective operation and maintenance system overall as has been described above, including the allocation of adequate funds and resources, will further ensure proper usage and maintenance, thereby enhancing the long term sustainability of all the infrastructure works.

This sub section elaborates the risk factors considered, the design features deployed to mitigate the effects of the phenomena associated with cyclones as well as measures to involve the community during the planning implementation phases so as to make the investments sustainable over a longer period of time.

### 9.2.1 Design and Construction Standards deployed for long term sustainability

#### a. Effects of Inundation

Effect	Design Solution
Flooded basement	Choose sites at higher elevations
Flooding of lower floors	Raise the buildings above flood elevation
Flooding of mechanical electrical & communication system & equipment	Do not stack or install vital material or equipments on floors or basement lying below tsunami inundation level

Effect	Design Solution
Damage to building materials & contents	Protect hazardous material storage facility located in tsunami prone area.
Contamination of affected areas with water borne pollutants	<ul style="list-style-type: none"> <li>Locate mechanical systems &amp; equipments at higher location in the building</li> <li>Use corrosion resistant concrete &amp; steel for the portions of the building</li> </ul>
Hydrostatic forces (Pressure on walls by variation in water depth on opposite sides)	<ul style="list-style-type: none"> <li>Elevate building above flood level.</li> <li>Provide adequate openings to allow water to reach equal heights inside &amp; outside of buildings.</li> <li>Design for static water pressure on walls.</li> </ul>
Buoyancy floatation or uplift forces caused by buoyancy	<ul style="list-style-type: none"> <li>Elevate building to avoid flooding.</li> <li>Anchor building to foundation to prevent floatation</li> </ul>
Saturation of soil causing slope instability and/or loss of bearing capacity	<ul style="list-style-type: none"> <li>Evaluate bearing capacity &amp; shear strength of soil that support building foundation &amp; embankment slopes under condition of saturation.</li> <li>Avoid slopes or setbacks from slope that may be destabilized when inundated.</li> </ul>

b. Effects of Currents (Wave Brea & Bore)

Effect	Design Solution
Hydrodynamic forces (pushing forces on the front face of the building and drag caused by flow around the building)	<ul style="list-style-type: none"> <li>Elevate building to avoid</li> <li>Design for dynamic water forces on walls &amp; building elements.</li> <li>Anchor building to foundation.</li> </ul>
Debris Impact	<ul style="list-style-type: none"> <li>Elevate building to avoid.</li> <li>Design for Impact loads.</li> </ul>
Scour	<ul style="list-style-type: none"> <li>Use deeper foundation (piles or piers).</li> <li>Protect against scour and erosion around foundation.</li> </ul>

c. Effects from Draw down

Effect	Design Solution
Embankment instability	<ul style="list-style-type: none"> <li>Design water front slopes, walls &amp; buttresses to resist saturated soils without water in front</li> <li>Provide adequate drainage.</li> </ul>
Scour	Design for scour & erosion of soil around foundation & piles.

d. Effects of Fire

Effect	Design Solution
Waterborne flammable materials and ignition increase in buildings	<ul style="list-style-type: none"> <li>Use fire resistant materials</li> <li>Locate flammable materials storage outside of high - hazard areas.</li> </ul>

## 9.2.2 Risk Factors

Like all infrastructure projects in the rural sector, this component also has some risk factors. These factors are identified through the experiences and lessons learnt through implementation of earlier Bank funded ECRP (1992) and APHM (1998-2003) projects and other National and State Government initiatives. The following are the risk factors considered, as well as the mitigation measures deployed while planning the investments to ensure long term sustainability of the investments:

Risk	Risk rating	Mitigation measures deployed	Responsibility
1. Inadequate field investigations and poor site selection	M	1.2. Adequate field investigations. 1.3. Consultation with the local community. 1.4. Finalization of site selection at the beginning of the project.	PRED/ Revenue Dept.
2. Impaired quality of construction	M	2.2. Departmental V & QC wing to monitor quality. 2.3. Testing of materials used prior to use.	PRED
3. Problems in the provision of sufficient electric and water supply, and sanitation facilities.	M	3.2. Provision made during design of the structure; 3.3. Costing included in the basic cost estimates of the component; 3.4. Final bills to be paid up on certification by QC that these facilities are in working condition	PRED/ Gram Panchayat
4. Maintenance system for these facilities	M	4.2. GoAP made a provision in annual budget; 4.3. User charges to be collected for general purpose use during normal time;	GoAP/ PRED/ Gram Panchayat

### **9.2.3 Community participation**

While informal interactions have been conducted with Villagers residing in the habitations where the cyclone shelters have been proposed, a formal Gram Sabha will be convened by the Sarpanch and attended by the members of each Gram Panchayat where cyclone shelters are being proposed. The objective will be to discuss and accord opinion on the necessity and multiple use of the cyclone shelter in their Gram Panchayat. The Sarpanch and the members of the Gram Panchayat will take a resolution based on the opinion of the concerned people within the Sabha. A copy of the resolution will be forwarded to the field staff of PRED according the necessary resolution for the cyclone shelter in the Village. These proposals will be submitted and reviewed by the Chief engineer of the Department prior to inclusion in the Detailed Project Reports. As the assets created are proposed to be operated and maintained by the Gram Panchayats, this process of involving them in locating and planning the investment will ensure greater ownership of the investment.

Post construction, the asset will be handed over to the Gram Panchayat or the relevant department for operations and upkeep, so as to ensure usability during emergency operations.

## 10 Annexures

The following is the list of annexures enclosed with this investment proposal

Annexure No.	Description
Annexure I	Detailed list of investments
Annexure II	1. Cost breakup summary for both phases 2. Phase I cost break up Phase II cost break up
Annexure III	1. Architectural drawings for Type Design A 2. Architectural drawings for Type Design B 3. Architectural drawings for Type Design C Architectural drawings for Type Design D
Annexure IV	1. Site plan for Type Design A 2. Site plan for Type Design B 3. Site plan for Type Design C 4. Site plan for Type Design D