Implementation of Energy Conservation Building Code - Transformers

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Highlights

- All India Installed Capacity is more than 329 GW
- AT&C Losses 24.62%
- More than 80,000 MVA Distribution Transformation capacity
- 10-12% DTC failure rate

- 19% reduction in Distribution Losses by 2030
- 13.3 million tons annual reduction in CO2 emissions
- 21000 Crores investment in energy efficient DTs

Introduction and significance of ECBC

1. ECBC sets minimum energy efficiency standards for design and construction of commercial buildings
2. ECBC encourages energy efficient design or retrofit of buildings so that It does not constrain the building function, comfort, health, or the productivity of the occupants
3. Addresses local design conditions and helps improve existing construction practices
4. Emphasis on Integrated Building Design approach

- Regulates building thermal performance & energy use according to climate zone
- Encourages climatic responsive building design
- Encourages use of daylighting, shading, natural ventilation, solar energy etc.
- Energy efficiency strategies appropriate for India
- Focuses on energy performance of buildings rather than green building design

Purpose:

The purpose of the Energy Conservation Building Code (Code) is to provide minimum requirements for the energy-efficient design and construction of buildings. The Code also provides two additional sets of incremental requirements for buildings to achieve enhanced levels of energy efficiency that go beyond the minimum requirements.

Scope:

The Code is applicable to buildings or building complexes that have a connected load of 100 kW or greater or a contract demand of 120 kVA or greater and are intended to be used for commercial purposes.

Building systems:

The provisions of the code apply to :

- Building envelopes, except for unconditioned storages or ware houses
- Mechanical systems and equipment, including heating, ventilating and air conditioning
- Interior and exterior lighting
- Electrical power and motors

Increasing levels of stringency

Mandatory

- Energy Conservation Building Code Compliant (ECBC) Building (MEP)

Voluntary

- Energy Conservation Building Code plus (ECBC+) Building
- Super Energy Conservation Building Code (SuperECBC) Building

ECBC prescribes standards for

- Building Envelope (Walls, Roofs, Windows)
- Lighting (Indoor and Outdoor)
- Heating Ventilation and Air Conditioning (HVAC) System – Comfort Systems and Control
- Electrical and Renewable Energy Systems

Electrical Systems

- Transformers
  - Mandatory Requirements
    - Maximum Allowable Power Transformer Losses

    Power transformers of the proper ratings and design must be selected to satisfy the minimum acceptable efficiency at 50% and full load rating.
    - Permissible total loss values shall not exceed
      - 5% of the maximum total loss values mentioned in IS 1180 for oil type transformers in voltage class above 11 kV but not more than 22 kV
      - 7.5% of the maximum total loss values mentioned in above IS 1180 for oil type transformers in voltage class above 22 kV and up to and including 33 kV
      - values listed in Table for dry type transformers

Electrical Power

Maximum Allowable Power Transformer Losses :

Power transformers of the proper ratings and design must be selected to satisfy the minimum acceptable efficiency at 50% and full load rating.

Measurement and Reporting of Transformer Losses :

All measurement of losses shall be carried out by using calibrated digital meters of class 0.5 or better accuracy and certified .

All 500kVA and above Transformers would be equipped with additional metering class CTs and PTs .

Voltage Drop:

- Voltage drop for feeders shall not exceed 2% at design load
- Voltage drop for branch circuit shall not exceed 3% at design load

ECBC 2007

ECBC 2017 additions

Electric Power

Transformers :

The maximum allowable distribution transformer losses(according to **ECBC 2007 and ECBC 2017**) :

Dry-type Transformers

Rating KVA	Max. Losses at 50 % loading [kW]*	Max. Losses at 100 % loading [kW]*	Total Losses at 50 % load [kW]*	Total losses at rated load [kW]*
	Up to 22 kV class		33 kV class	
100	0.94	2.4	1.12	2.4
160	1.29	3.3	1.42	3.3
200	1.5	3.8	1.75	4
250	1.7	4.32	1.97	4.6
315	2	5.04	2.4	5.4
400	2.38	6.04	2.9	6.8
500	2.8	7.25	3.3	7.8
630	3.34	8.82	3.95	9.2
800	3.88	10.24	4.65	11.4
1000	4.5	12	5.3	12.8
1250	5.19	13.87	6.25	14.5
1600	6.32	16.8	7.5	18

Table 7-1 Dry Type Transformers

Rating (kVA)	Impedance (%)	Max. Total Loss (W)					
		ECBC Building		ECBC+ Building		SuperECBC Building	
		50 % Load	100% Load	50 % Load	100% Load	50 % Load	100% Load
16	4.5	150	480	135	440	120	400
25	4.5	210	695	190	635	175	595
63	4.5	380	1,250	340	1,140	300	1,050
100	4.5	520	1,800	475	1,650	435	1,500
160	4.5	770	2,200	670	1,950	570	1,700
200	4.5	890	2,700	780	2,300	670	2,100
250	4.5	1,050	3,150	980	2,930	920	2,700
315	4.5	1,100	3,275	1,025	3,100	955	2,750
400	4.5	1,300	3,875	1,225	3,450	1,150	3,330
500	4.5	1,600	4,750	1,510	4,300	1,430	4,100
630	4.5	2,000	5,855	1,860	5,300	1,745	4,850
1000	5	3,000	9,000	2,790	7,700	2,620	7,000
1250	5	3,600	1,0750	3,300	9,200	3,220	8,400
1600	6.25	4,500	13,500	4,200	11,800	3,970	11,300
2000	6.25	5,400	17,000	5,050	15,000	4,790	14,100
2500	6.25	6,500	20,000	6,150	18,500	5,900	17,500

ELECTRICAL POWER

Transformers :

The maximum allowable distribution transformer losses(according to **ECBC 2007** and **ECBC 2017**)

Oil Filled Transformers

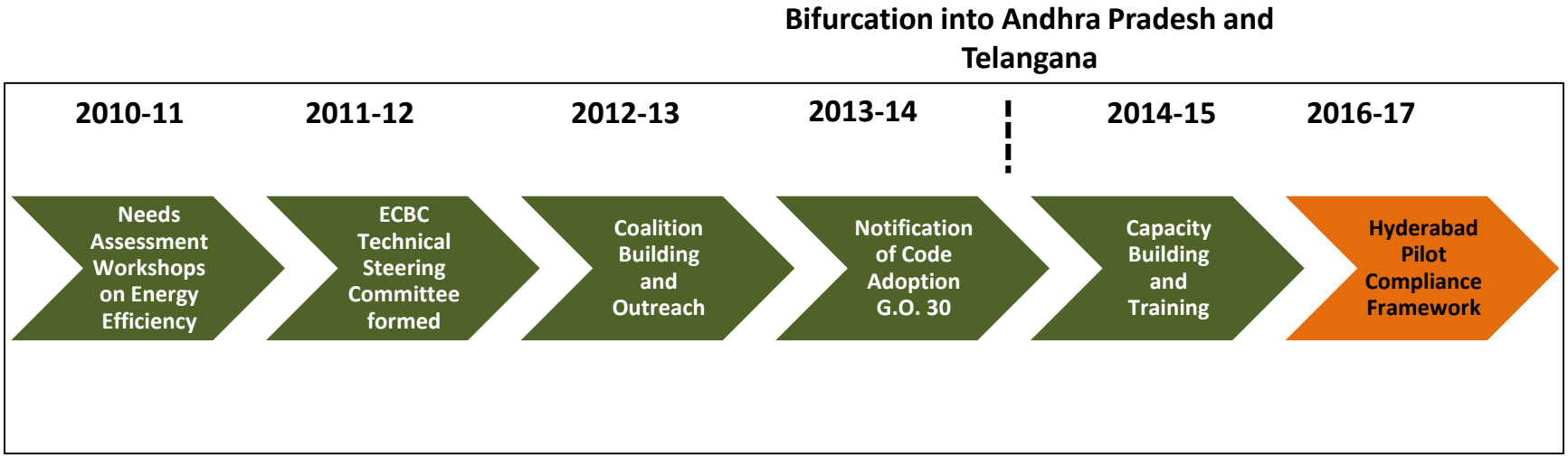
Rating KVA	Max. Losses at 50 % loading [kW]*	Max. Losses at 100 % loading [kW]*	Total Losses at 50 % load [kW]*	Total losses at rated load [kW]*
	Up to 11kV class		33 kV class	
100	0.52	1.80	0.56	1.82
160	0.77	2.20	0.78	2.58
200	0.89	2.70	0.90	3.00
250	1.05	3.32	--	--
315	1.10	3.63	1.30	4.30
400	1.45	4.63	1.52	5.10
500	1.60	5.50	1.95	6.45
630	2.00	6.64	2.30	7.60
1000	3.00	9.80	3.45	11.35
1250	3.60	12.00	4.00	13.25
1600	4.50	15.00	4.85	16.00
2000	5.40	18.40	5.70	18.50
2500	6.50	22.50	7.05	23.00

Table 7-2 Permissible Losses for Oil Type Transformers. Total losses for oil type transformers shall confirm with Indian Standard IS 1180.

Rating (kVA)	Impedance (%)	Max. Total Loss (W)					
		ECBC Building		ECBC+ Building		SuperECBC Building	
		50 % Load	100% Load	50 % Load	100% Load	50 % Load	100% Load
16	4.5	150	480	135	440	120	400
25	4.5	210	695	190	635	175	595
63	4.5	380	1250	340	1140	300	1050
100	4.5	520	1800	475	1650	435	1500
160	4.5	770	2200	670	1950	570	1700
200	4.5	890	2700	780	2300	670	2100
250	4.5	1050	3150	980	2930	920	2700
315	4.5	1100	3275	1025	3100	955	2750
400	4.5	1300	3875	1225	3450	1150	3330
500	4.5	1600	4750	1510	4300	1430	4100
630	4.5	2000	5855	1860	5300	1745	4850
1000	5	3000	9000	2790	7700	2620	7000
1250	5	3600	10750	3300	9200	3220	8400
1600	6.25	4500	13500	4200	11800	3970	11300
2000	6.25	5400	17000	5050	15000	4790	14100
2500	6.25	6500	20000	6150	18500	5900	17500

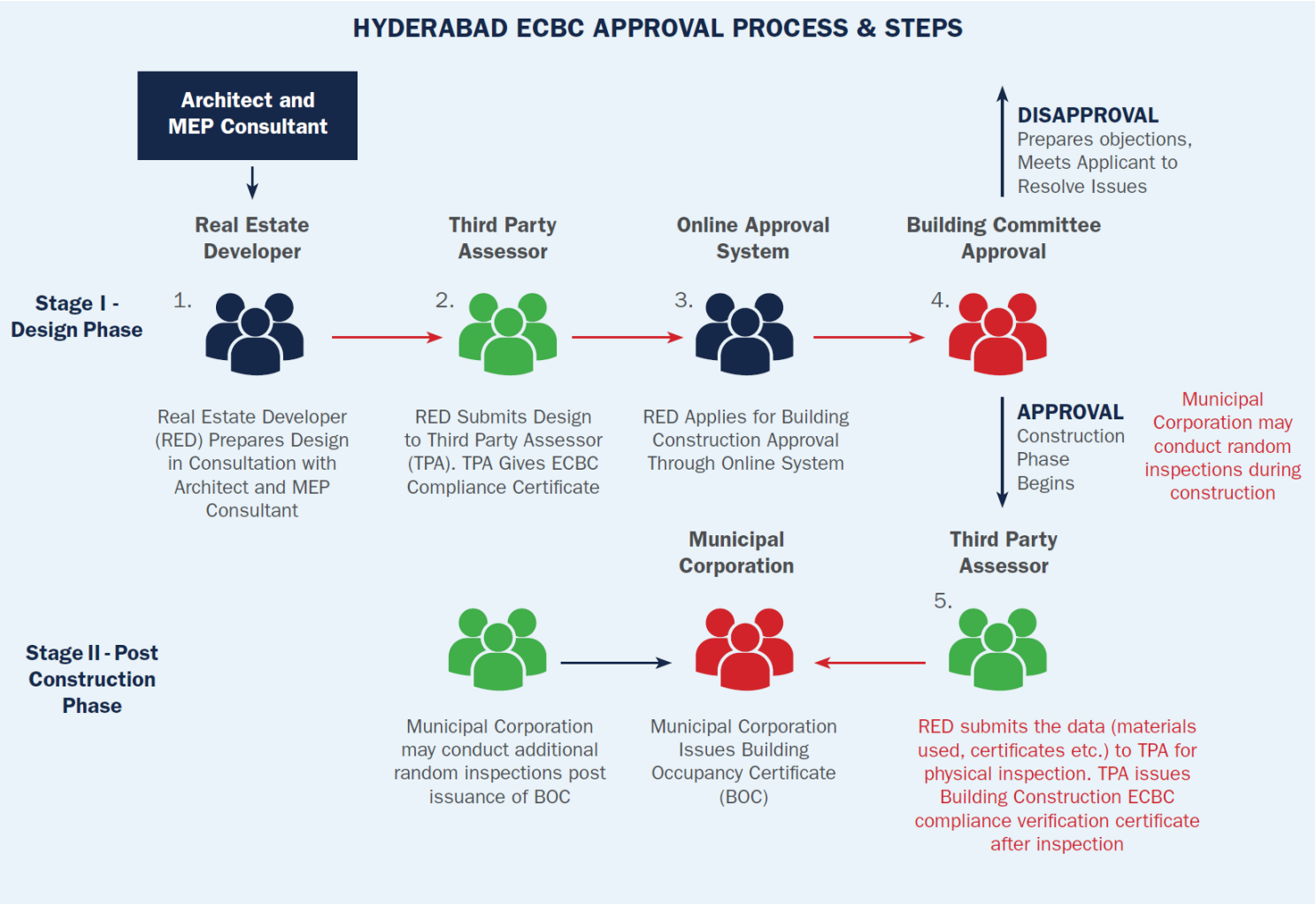
SOURCE : Energy conservation Building Code 2017

ECBC in Andhra Pradesh and Telangana: Work that went into the code, and next steps



- Extensive stakeholder consultations and awareness building about ECBC
- Formation of a steering committee and a technical committee to inform process and adapt ECBC to local bylaws
- Notification of ECBC through amendment to G.O.M.S.168 i.e., G.O.M.S. 30 dt. 28.01.2014.
- Implementation of ECBC in the state of Andhra Pradesh and newly formed Telangana
- Empanelment of architects - completed
- Training completed – more than 750 government officials, real estate developers and architects in AP and Telangana

Building Approval Process – Hyderabad Model

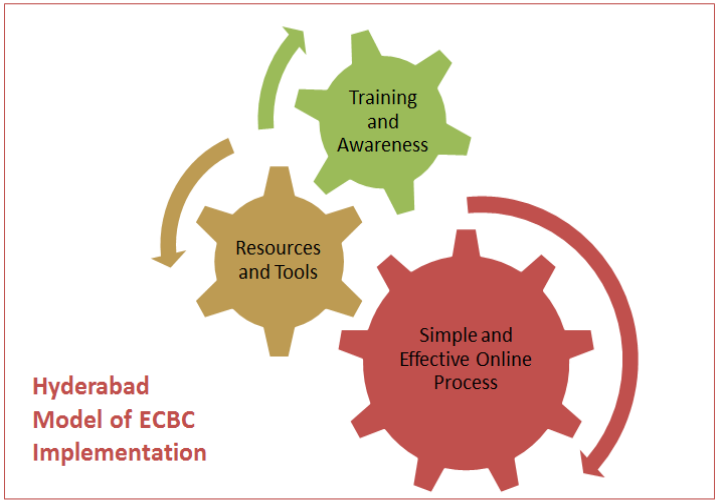


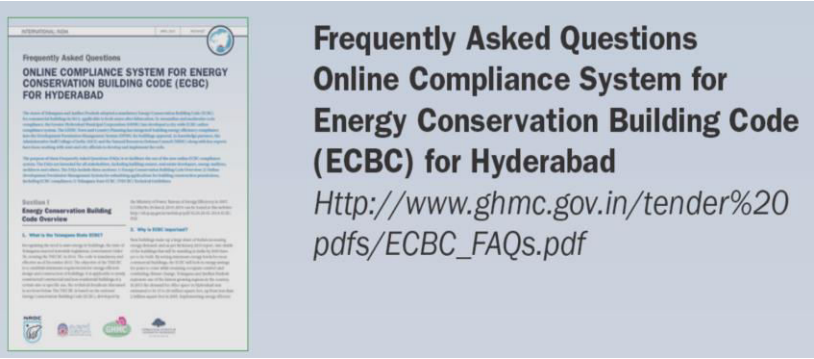
ECBC Implementation status

- For effective implementation of ECBC and achieve higher level of compliance following activities were completed in the state with the support of Administrative Staff College of India (UNDP-GEF-BEE funding)
  - Empanelment of Third Party Assessors for ECBC compliance verification and issuing the certificate. 42 Third Party Assessors are empanelled in first phase and 34 individual TPAs are empanelled with GHMC in second phase
  - More than 750 participants which includes government officials from town & country planning, municipal bodies, electricity utilities etc. and private people like Architects, Real Estate Developers and Engineers etc. are trained in the state of Andhra Pradesh as part of capacity building.
  - More than 120 participants are trained through robust 5 day certification program to create a pool of experts to strengthen the effective ECBC compliance framework in Telangana

Support Action

- Regular conduct of Technical Committee (set by GO 1328) meetings to review ECBC implementation – **Top level commitment**
- Released easy TS-ECBC Guidelines and Frequently Asked Questions - **Supportive Resources**
- Strengthen the implementation framework by incorporation of ECBC in Online Building Approval System – **Ease of Compliance**





Further Action

- Strengthen the implementation framework by defining rules and regulation and creating formats for TPAs for easy ECBC compliance
- Identifying key upcoming projects and handholding through ECBC compliance
- Directions for Commercial building approval committees at each ULB level to scrutinize ECBC as ***15c of GO 168 in the application forms***
- Strengthen the Online Building Approval System by linking it with EMIS kind of monitoring and verification tools
- Continuous Capacity Building, Promotion and outreach plan for ECBC

Few Screenshots to understand the process of ECBC compliance implementation in Greater Hyderabad Municipal Corporation

GHMC Building Application- ECBC incorporation

- Provisions for ECBC empanelled TPA are to be incorporated in Part I, table C point 4 of building application form of GHMC as shown below

C	DETAILS OF BUILDER / LICENSED PERSONNEL			
S. No.	Name	Address	License No.	Validity
1	..... Builder / Developer			
2	..... Architect/Engineer/Surveyor			
3	..... Structural Engineer			
4	..... **ECBC Empanelled TPA**			

GHMC Building Application- ECBC incorporation

- Provisions for ECBC compliance documents (compliance report) in Part I, table E, point 33 of building application form of GHMC as shown below

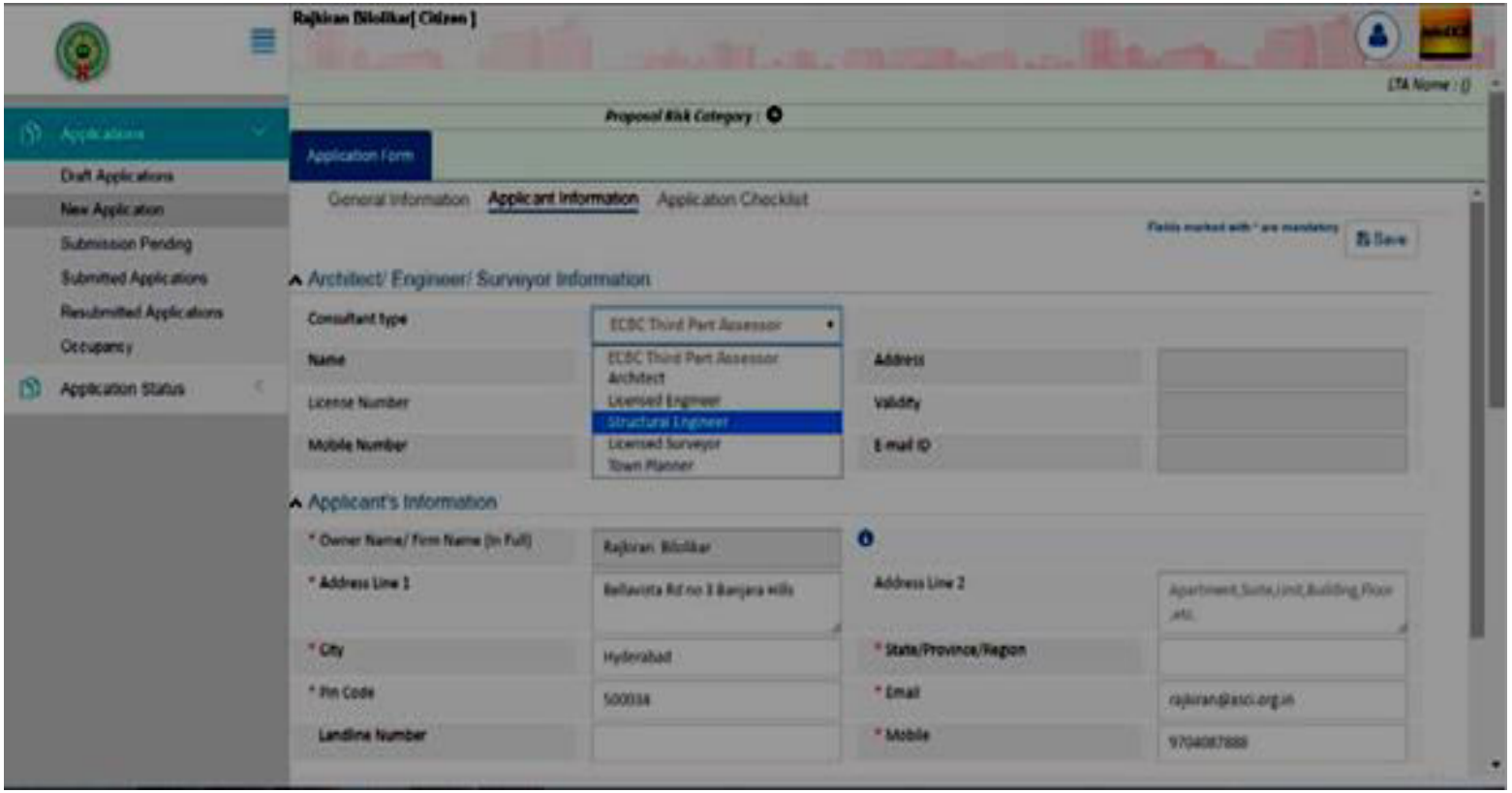
25	Structural Drawings *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
26	Undertaking Rs.100/- Non judicial stamp paper duly stating whether the construction is taken up by the owner. *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
27	Declaration-Cum-Undertaking on Rs.100/- Non Judicial Stamp Paper from the Owner and Builder. *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
28	Undertaking on Rs.100/- NJS by Owner, Builder, Architect, Structural Engineer (Duly Notarised). *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
29	Undertaking on Rs.100/- NJS paper jointly by owner and Builder seeking Occupancy Certificate. (Duly Notarised). *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
30	Joint undertaking on Rs.100/- Non Judicial Stamp paper for not stocking Building materials on road margin not to enclose balconies, usage of parking, payment of special sanitation charges, garbage charges and not to increase number of units. *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
31	Comprehensive Insurance Policy for 3 years *(G.O.Ms.No.541 MA, dt:17.11.2000)*			
32	Undertaking on Rs. 20/- NJS paper for handing over road widening portion wherever applicable.			
33	**ECBC compliance report issued by empanelled Third Party Assessor (as per *G.O.M.S. 30 MA&UD, dt 28.01.2014*)**			

GHMC Building Application- ECBC incorporation

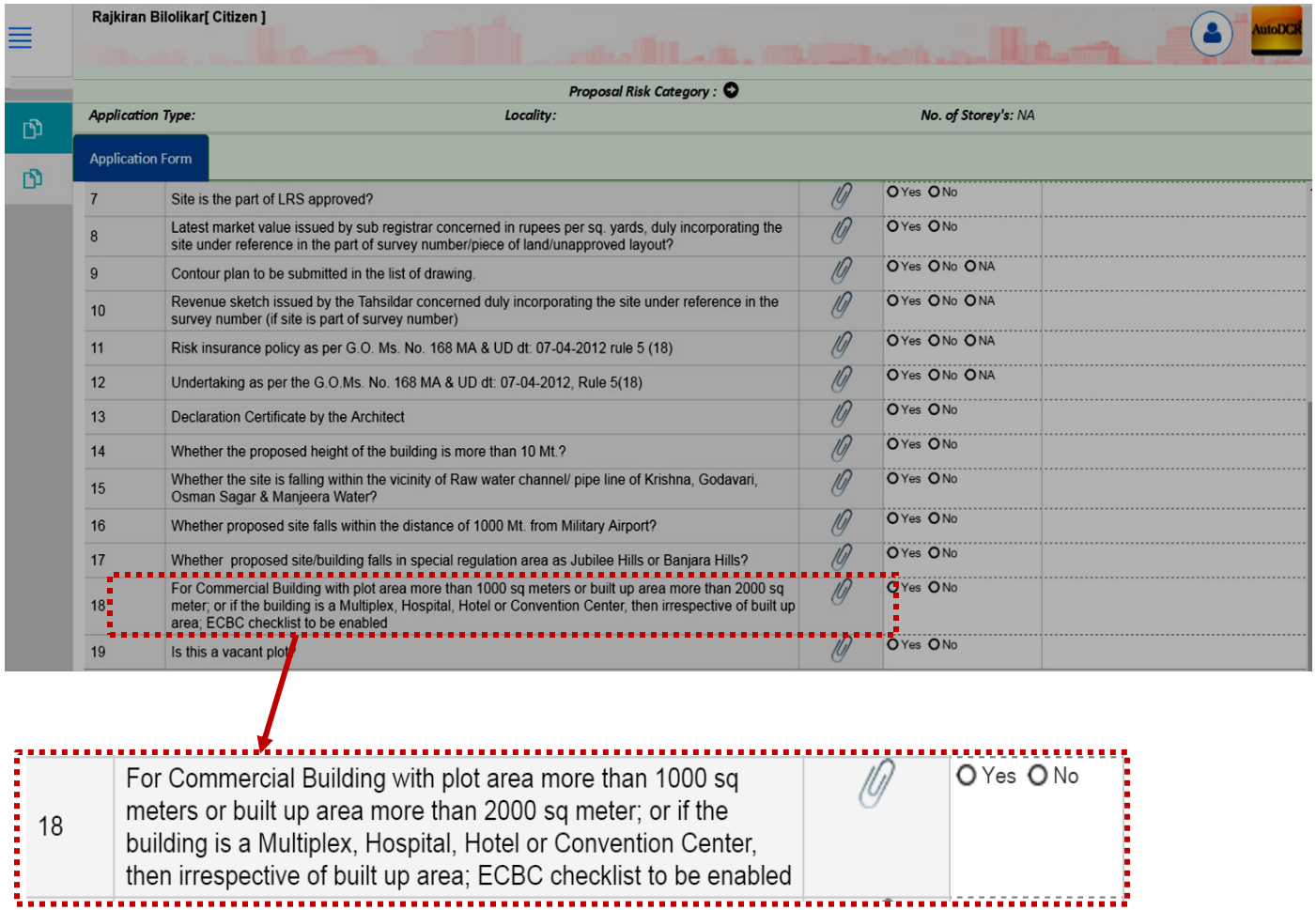
- Provisions for ECBC compliance certificate (issued by empanelled TPA) in Part III table A, point 13 of building application form of GHMC as shown below

6	NOC from AAI, wherever applicable			
7	NOC Fire Services & Emergency Department, wherever required			
8	Structural stability certificate issued by CE, GHMC			
9	NOC of Commissioner of Police, wherever required			
10	NOC of Traffic Assessment Report from Traffic Police, wherever required			
11	NOC from Heritage Conservation Committee			
12	Report from Irrigation/Revenue Department in case of lands abut water bodies, Water courses & nalas			
13	**ECBC Compliance Certificate issued by Empanelled TPA**			

Incorporation of ECBC in GHMC online Building Approval System

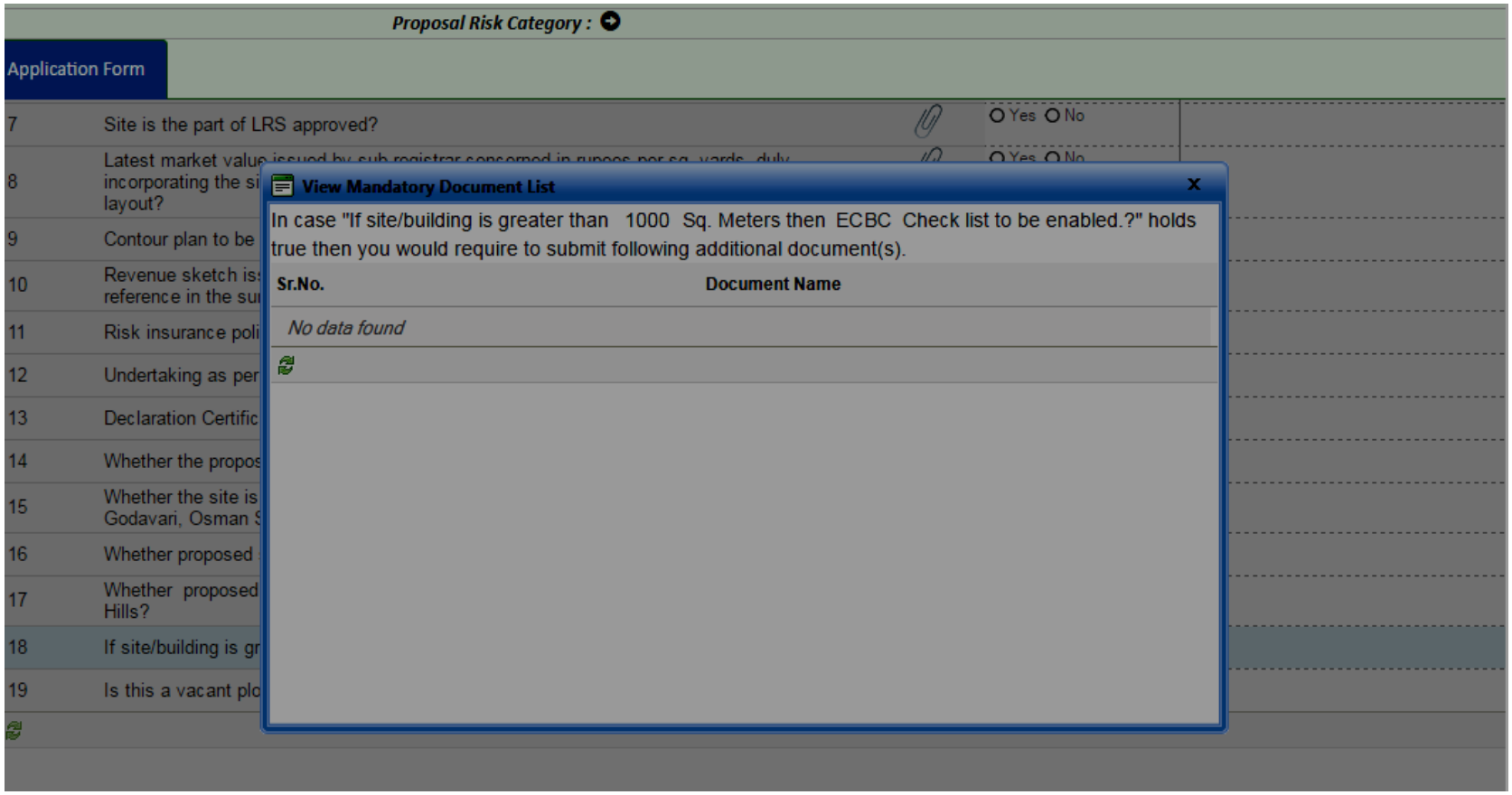


Incorporation of ECBC in GHMC online Building Approval System



18 For Commercial Building with plot area more than 1000 sq meters or built up area more than 2000 sq meter; or if the building is a Multiplex, Hospital, Hotel or Convention Center, then irrespective of built up area; ECBC checklist to be enabled Yes No

Incorporation of ECBC in GHMC online Building Approval System



Supportive Resources - http://ghmc1.ghmc.gov.in/index.asp

[Expression of Interest for Empanelment of Third Party Assessors for implementation of ECBC in Telangana](#)

[FAQs on Online Compliance System for ECBC](#)

Thank You

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