सी एस आई आर – केन्द्रीय यांत्रिक अभियांत्रिकी अनुसंधान संस्थान
CSIR-CENTRAL MECHANICAL ENGINEERING RESEARCH INSTITUTE
(सी.एस.आई.आर.का एक संघटक संस्थापन, भारत सरकार) (A Constituent Establishment of CSIR, Govt. Of India)
महात्मा गांधी एवेन्यू,
दुर्गापुर - 713209, भारत
Mahatma Gandhi Avenue
Durgapur - 713209, India
CSIR-CMERI

Ref No. F25117(L&B)/2024-25/Admin/KVCMERI-Dgr/695 **दिनांक Date: 20.02.2025**

To,

The Principal
PM Shri Kendriya, Durgapur CMERI.

Sub: Sub: Regarding submission of Structural audit and non- structural audit report of school building.

Dear Sir,

Greetings from CSIR-CMERI.

With ref to your **Letter no F25117(L&B)/2024-25/Admin/KVCMERI-Dgr/659 Dated 12.02.2025** I am directed to forward you the Structural audit and non- structural audit reports of school building (Pages 1 to 14).

भवदीय,
Yours faithfully,

20/02/25

(डॉ. रंजीत राय/ Dr. Ranjit Ray)
प्रमुख, ईएसडी / Head, ESD

प्राचार्य / Principal
पीएम श्री केन्द्रीय विद्यालय दुर्गापुर सी.एम.ई.आर.आई
PM SHRI Kendriya Vidyalaya, Durgapur C.M.E.R.I.

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TITLE: Condition assessment of the Kendriya Vidyalaya Building at CSIR-CMERI Colony

Ref:

1. Letter of the Principal of Central School (No. F.25117/Admn/2023-24/KV CMERI-Dgr/315-317 dated 04/10/2023
2. Note of Head ESD dated 11/10/2023
3. Approval of C.A Dated 23/06/2023

INTRODUCTION:

In reference to the above, a team of Scientist and Technical officers from CSIR-CMERI-MSEG visited the Kendriya Vidyalaya School Building on 01/11/2023, inspected the condition of the building and carried out necessary Non-Destructive Tests (NDT) to determine present condition of the Structure. The evaluation of NDT results and inspection report are elaborated below.

VISUAL OBSERVATION OF SCHOOL BUILDING STRUCTURES:

Outer surface of the building (Guest House Side)

1. All window chhajas found heavily damaged and Reinforcement found exposed & Corroded – **All damaged Chhajas need dismantling and reconstruction with new reinforcement.**
2. Rain water pipes found damaged and missing at several locations. Window panes found broken- **All missing rain water pipes need replacement and broken window panes need replacement.**
3. Growth of plant on wall observed- **Removal of plants needed.**
4. Seepage in wall observed **-Damaged wall need re-plastering at locations.**

Outer surface of the building (Main Road Side)

1. All window chhajas found **heavily damaged at locations. Heavily spalling &** corrosion of Reinforcement observed- **All damaged Chhajas need dismantling and reconstruction with new reinforcement.**

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2. Window Panes found Missing and broken at locations. Rain water pipe at locations found missing- **All missing rain water pipes need replacement and broken window panes need replacement.**
3. Growth of Plants & vegetation observed at locations causing crack and seepage in wall - **Removal of plants needed.**

Outer surface of the building (Assembly/AB Banglow Side)

1. In wall no major damage observed.
2. In staircase platform beam, considerable spalling and exposure of reinforcement observed at locations- Need repair of spalled concrete through cover concreting with application of adequate bonding agent to ensure bonding with old concrete.
3. Steel staircase found ok and painted.

Outer surface of the building (Quarter Side)

1. In Class IX front side- at outside beam throughout longitudinal crack observed. This is caused due to ageing and internal reinforcement corrosion **-Need thorough repair of the cracks after chipping off old loose concrete and applying crack repair chemicals.**

Inside the Building

1. Near room no. 19 and Courtyard, in concrete column of corridor longitudinal crack in column observed which is a typical corrosion crack. In Transverse beam also longitudinal corrosion crack observed at location - **Need thorough repair of the cracks after chipping off old loose concrete and applying crack repair chemicals.**
2. Window panes found missing- **missing window panes need replacement.**

Interior stair columns

1. Longitudinal corrosion cracks observed in main columns of staircase. Presence of loose concrete observed. Reinforcement found considerably corroded. Presence of considerable voids in concrete observed in terms of hollow sound and Rebound Hammer results during test- **Recommended repair of the all staircase columns by Jacketing method with additional reinforcement casing after removing all loose concrete, disintegrated and excessively corroded reinforcement and applying concrete of M25 grade or above (Annexure 2).**

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Inside Class-XB, Room 16 Lab

Ceiling cross beams found heavily damaged. Heavy spalling of beam cover concrete found and Reinforcement found heavily exposed at locations- **Repair of beams needed with fresh cover concreting and applying adequate bonding agent.**

Inside Chemistry Lab

Roof beams found ok. No exposure of reinforcement observed.

Toilets Bays (Ground Floor) beside Geography Lab

1. Considerable seepage in wall and Roof observed.
2. Window found completely damaged- **Need replacement of damaged window.**

Biology Lab at First floor:

Cross beams found damaged and cracked at locations. Reinforcement found exposed at locations- **Need repair of beam by cover concreting and crack repair.**

Staff wash Room

Seepage in wall observed.

Primary Section Roof

Presently no crack observed in roof.

First floor corridor (In front of Room No-28)

1. Cross beams found heavily damaged.
2. Exposed reinforcement found heavily corroded.
3. Concrete found disintegrated and spalling of concrete observed - **Damaged beams need repair after removal of loose concrete and rust with cover concreting and bonding chemical.**

Second floor corridor

Reinforcement crack in column observed at locations- **Repair of crack needed.**

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Top Roof

1. Concrete columns found heavily cracked and concrete found disintegrated with heavy corrosion of reinforcement- **The damaged columns need complete repair by jacketing.**
2. Cracks in beam bottom observed- **Need repair of cracks.**
3. Heavy growth of plants on roof of staircase observed- **Vegetation need to be cleaned thoroughly to prevent further damage.**
4. Existing APP found cracked and disintegrated at locations- **Roof treatment required with APP over physics laboratory and staircase roof.**

Physics Lab.

1. Heavy seepage of water from roof reported during rainy season- **Need roof treatment with APP.**
2. Spalling of concrete at locations of beam observed- **Need repair of spalled concrete.**
3. Seepage in wall observed- **Outside external painting required after repair of wall to prevent further seepage.**

Visual observation inside the Class Rooms

Ground Floor

Class I (Room no 7) - Roof & Beams found free from any visual damage.

Class II Room no 8 - Roof & Beams found free from any visual damage.

Class III Room no 9 - Roof & Beams found free from any visual damage.

Class IV Room no - Crack in wall observed at location- **need repair.**

Room no 19 – Ceiling cross beams found heavily damaged with significant spalling of concrete and exposure of reinforcement- **need urgent repair of the cross-beams to prevent falling off of concrete.**

Room no 20 and 22 - Roof and beams found free from any damage.

First Floor

Room no 28– Heavy spalling of concrete roof from cross beams observed and reinforcement found exposed- **need urgent repair of the cross-beams to prevent falling off of concrete.**

Room no 29 and 30 –Found free from visual damage.

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Room no 31 – Damage of cross beam found initiated- **Need removal of loose concrete to prevent further spalling.**

Library Room

1. Heavy seepage. Roof treatment required.
2. Crack in beam observed.

NON DESTRUCTIVE TEST (NDT) RESULTS OVER THE STRUCTURE:

1. **Rebound Hammer Test result.**

CSIR-CENTRAL MECHANICAL ENGINEERING RESEARCH INSTITUTE, DURGAPUR - 713209												
DATE OF FIELD DATA COLLECTION:	01-11-2023											
W.O/ SERVICE NO :	Letter of the Principal of Central School (No. F.25117/Admn/2023-24 KV CMERI-Dgr/315-317 dated 04/10/2023 and note of Head ESD dated 11/10/2023											
PLACE / LOCATION :	CMERI Kendriya Vidyalaya 1st Floor											
Location ID	**REBOUND NUMBER**											**Estimated Cube Compressive Strength (Mpa)**
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**AVERAGE**	
Staircase Column - Level 1st Floor												
Column 1	10	20	22	20	22	21	21	19	21	22	19.8	7.7
Column 2	22	21	23	21	22	19	21	22	21	22	21.	9.1
Corridor Column - Level 1st Floor												
Column1	21	21	21	19	22	20	22	21	21	22	21	9.1
Column2	22	21	22	21	20	21	22	21	22	22	21.4	9.6
Column3	21	20	21	20	21	22	22	22	21	22	21.2	9.3
Column4	20	21	21	22	20	21	20	22	21	22	21	9.1
Beam of Stair	20	21	21	20	21	21	21	21	20	21	20.7	8.7

Remark:
Low in-situ compressive strength indicates presence of voids, pores and cracks in concrete and deterioration of overall quality.

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DATE OF FIELD DATA COLLECTION:	01-11-2023
W.O SERVICE NO:	Letter of the Principal of Central School (No. F.25117/Admn/2023-24/KV CMFRI-Dgr/315-317 dated 04/10/2023 and note of Head ESD dated 11/10/2023
PLACE LOCATION:	**CMERI Kendriya Vidyalaya 2nd Floor**

Location ID	**REBOUND NUMBER**											**Estimated Cube Compressive Strength (Mpa)**
	R1	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**AVERAGE**	
Staircase Column - Level 2nd Floor												
Column 1	19	20	22	20	22	21	21	19	21	22	19.8	7.7
Column 2	22	21	23	21	22	19	21	22	21	22	21	9.1
Corridor Column - Level 2nd Floor												
Column1	20	21	22	19	20	20	22	21	21	22	20.8	8.9
Column2	21	22	20	21	21	21	20	22	22	22	21.2	9.3
Column3	21	22	21	20	21	20	22	22	21	21	21.1	9.2
Column4	20	21	21	22	19	21	20	22	21	22	21	9.1
Beam of Stair	20	21	21	20	21	21	21	21	20	21	20.7	8.7
Staircase Column - Level 2nd Floor Roof												
Column 1	19	19	18	19	21	20	21	19	18	19	19.3	7.1
Column 2	18	19	21	20	21	22	21	22	21	22	20.7	8.7

Remark:

Low in-situ compressive strength indicates presence of voids, pores and cracks in concrete and deterioration of overall quality.

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2. **Ultrasonic Pulse Velocity Test Result.**

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DATE OF FIELD DATA COLLECTION:						01-11-2023	
W.O/ SERVICE NO :						Letter of the Principal of Central School (No. F.25117/Admn/2023-24/KV CMERI-Dgr/315-317 dated 04/10/2023 and note of Head ESD dated 11/10/2023	
PLACE / LOCATION :						**CMERI Kendriya Vidyalaya 1st Floor**	
Location ID	**Ultra sonic pulse velocity (km/s)**				**Average Ultra sonic pulse velocity (km/s)**	**As per IS 13311 (part 1) :1992 Reaffirmed 2004 Table 2**	**Estimated Dynamic Modulus of Elasticity (E) in Gpa**
Staircase Column							
Column 1	2.20	2.06	2.10	2.10	2.10	Doubtfull	9.0
Column 2	2.10	2.40	2.30	2.40	2.30	Doubtfull	10.8
Column 3	1.05	0.82	2.10	2.40	1.59	Doubtfull	5.2
Corridor Columns							
Column 1	1.05	1.50	2.10	2.40	1.76	Doubtfull	6.3
Column 2	2.10	2.40	2.30	2.40	2.30	Doubtfull	10.8
Column 3	2.10	2.50	2.30	2.40	2.33	Doubtfull	11.0

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DATE OF FIELD DATA COLLECTION:						01-11-2023	
W.O/ SERVICE NO :						Letter of the Principal of Central School (No. F.25117/Admn/2023-24/KV CMERI-Dgr/315-317 dated 04/10/2023 and note of Head ESD dated 11/10/2023	
PLACE / LOCATION :						**CMERI Kendriya Vidyalaya 2nd Floor**	
Location ID	**Ultra sonic pulse velocity (km/s)**				**Average Ultra sonic pulse velocity (km/s)**	**As per IS 13311 (part 1) :1992 Reaffirmed 2004 Table 2**	**Estimated Dynamic Modulus of Elasticity (E) in Gpa**
Staircase Column							
Column 1	2.00	2.10	2.50	2.20	2.35	Doubtfull	11.2
Column 2	2.10	2.40	2.30	2.40	2.30	Doubtfull	10.8
Corridor Columns							
Column 1	2.20	2.30	2.10	2.40	2.20	Doubtfull	9.9
Column 2	2.10	2.30	2.20	2.20	2.20	Doubtfull	9.9
Column 3	2.10	2.10	2.00	2.30	2.20	Doubtfull	9.9
Stair Columns at Roof	No results due to crack in columns						

FINDINGS OF NDT RESULT:

The rebound hammer test reveals poor in-situ compressive strength of concrete of different columns and beams at selected locations. It indicates presence of considerable voids and porosity in concrete. The hollow sound during testing indicates looseness of cover concrete. The ultrasonic pulse velocity test result in columns at selected locations indicates qualitative degradation of the material significantly. This may be attributed to the ageing of the structures along with significant corrosion of the internal reinforcement.

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RECOMMENDATION:

Based on the visual inspection and non-destructive evaluation, considerable damage of the building is found. At Locations severe damage observed in terms of cracks and disintegration of material. The damage can be attributed to ageing of the building material, corrosion of reinforcement and environmental effect. Following is the recommendation for repair of the building to be carried out to prevent further damage (refer visual observation for locations).

- **All staircase columns need repair by Jacketing method with additional reinforcement casing after removing all loose concrete, disintegrated and excessively corroded reinforcement and applying concrete of M25 grade or above (refer Annexure 2).**
- **Damaged concrete cross beams in class rooms and corridor need urgent repair to prevent falling of concrete (Annexure 1).**
- **Cracks and spalled concrete in beams and columns need repair as noted in visual observation (Annexure 1).**
- **All damaged and corroded outside windows and grills need replacement.**
- **Damaged and missing rain water pipes need replacement to prevent seepage of walls and roofs.**
- **All damaged outside window chhajas need dismantling and reconstruction.**
- **External painting on damaged outside wall on guest house side and main road side is required to prevent seepage.**
- **Roof treatment with APP needed over roof of Physics Lab and Library to prevent leakage of water.**

PHOTOGRAPH OF THE SCHOOL BUILDING