

Structural Audit Report

1.1 -	Description of Building	<p>The Building of Kendriya Vidyalaya No.2, is situated in Infantry Lines Campus, Jamnagar.</p> <p>The building is divided into two wings. The wing with Principal office is a G+1 storey building, whereas the wing with Library is Single storey structure.</p> <p>The building is a R.C.C framed type construction with R.C.C grid slabs and masonry walls.</p> <p>The building is having two staircases.</p>
1.2	History	<p>The building was constructed in 1986. During the life of 34 years it has undergone following repairs:-</p> <p>a) Repairs and retrofitting work after Bhuj 2001 Earthquake.</p> <p>b) Terrace water proofing.</p> <p>c) Painting of building and routine repairs is carried out regularly as and when required.</p>
1.3	Problems faced	<p>Following problems are faced:</p> <p>a) No major problems were observed.</p> <p>b) Some R.C.C. Chhajjas and Lintels were damaged due to corrosion of reinforcement.</p> <p>c) The Bituminous sheet waterproofing is detached in few places, due to which there is water seepage in some parts in first floor.</p> <p>d) Walls of toilet area in between both the buildings attached with water room has lots of moisture due to leakages that are observed in the water tank installed above the water room.</p> <p>e) The toilet block in the main building also has lot of moist walls that has resulted in spalling of the paint and plaster at many places both on interior as well as exterior walls.</p>
1.4	Date of Inspection	The inspection was done on 3 rd January 2020.
2.0	List of Units / Areas Surveyed	Entire building was inspected.
3.0	Observations over structural members	<p>All the observations noted during inspection are marked in detail in the form of photographs. The observations include following type of damages:-</p> <p>1. Cracks in the concrete members like column, beam, chhajjas, parapet, etc.</p> <p>Cracks in concrete elements like slab, beam, columns etc.</p> <p>No major damage was observed in any concrete structural members except some minor cracks or minor damage was found in very few members. These cracks or damages were observed specifically at places where the water proofing in the terrace was detached. Some cracks were observed in the toilet block area.</p> <p>• Carbonation of concrete</p> <p>Carbonation of concrete is caused by the chemical reaction between atmospheric carbon-di-oxide & free lime of concrete over the years. Carbonation reduces alkalinity of concrete which is a positive inhibitor of corrosion. Once the inhibiting force is diminished the steel is opened to</p>

	<p>attack by moisture, pollutant gases and other elements.</p> <ul style="list-style-type: none"> • Leakage of sewage or rain water: Leakage of sewage or rainwater finds its way through porous or honeycombed concrete, which promotes corrosion. • Porous Concrete: Atmospheric oxygen, moisture, pollutant gases can easily find their way to reinforcement bar through porous concrete which promotes corrosion. • Cover to the reinforcement bars: If the cover to the reinforcement bars is less than the specified cover as per sound engineering practice, then the elements causing corrosion can have easy access to the reinforcement bars. <p>* Mechanism of cracking These corroded bars occupy more than 2.5 times volume of its original volume. To accommodate this additional volume the concrete around the bar is ruptured. The cracks keep on widening because of inside force exerted by corrosion products. This force is so much that it can crack surface treatments like concrete, plaster, tiles & other fancy cladding and coating materials very easily. The concrete falls down at the location of cracks leaving the reinforcement bars totally exposed. In case of columns, beams and slab soffits these cracks can be very easily seen. In case of slab top reinforcement, this damage is seen in the form of upheaving the floor tiles.</p>
<p>4.0</p> <p>Remarks Regarding Structural Condition of The Building</p>	<p>The overall condition of the building is found in good condition. No serious structural damage is observed. To keep the building in good condition, immediate minor repairing works needs to be carried out at certain parts of the building. This includes some of the chajjas, toilet blocks and water proofing repairs in terrace region. Some of the pipelines need to be repaired as water logging was observed near the water tanks in both places near the location of water tank.</p>
<p>5.0</p> <p>Observations on Other Elements Of Building</p>	<p>Plaster -: Plaster is in good condition except the external plaster just above the ground level. These problem can be due to following:- a) Accumulation of rain water and moisture just above the ground level. b) Upward movement of moisture due to rise of capillary water from soil in contact of the wall.</p> <p>Terrace :- The terrace is treated with waterproofing treatment using special bituminous coating. It was found that in many locations, specifically near expansion joints, the bituminous layer was unglued from the terrace that might allow the water to percolate through the water proofing layer and can allow seepage of water through RCC slab.</p> <p>Leakages:- Some leakages were observed through terrace and toilet blocks.</p> <p>Rain Water Drain pipes :- At some location, rain water pipes were found broken in terrace as well as near ground surface.</p>

6.0

Suggested Remedial Measures

Damage to R. C. C. members

No any major structural damage is found in any RCC structural member.

Other R.C.C. members

At some location RCC chajjas and elevation band was found damaged due to corrosion of reinforcement. This shall be repaired with one or the combination of the methods given below. The selection of method or methods will depend on extent of damage.

- a. Removing the damaged RCC parapet wall and replace this masonry walls.
- b. Repairing with Polymer modified mortar.
- c. Superfluid micro concrete treatment
- d. Or any other suitable method

All these methods essentially involve following steps:-

- a. Breaking and removing cracked concrete and plaster.
- b. Cleaning the reinforcement bars with light tapping, wire brushing, emery paper and finally by acetone.
- c. Applying a protection coat made out polymer and cement slurry
- d. Reinstating the lost concrete with polymer modified mortar or superfluid micro concrete, depending on the extent of the damage.

Column & beams: No serious damage was observed in columns and beams of the building.

Chajjas and Lintels: Some of the chajjas and lintels are found cracked due to corrosion of reinforcement bars. These members shall be repaired by any of the method mentioned above after treating the corroded reinforcement.

Protection to repaired parts:

The damage caused by corrosion is recurrent in nature. This aspect needs to be taken care while addressing the repairs procedure. The corrosion is an electro-chemical process. This process can take place only in presence of oxygen and moisture. Hence it is essential to cut off supply of oxygen and moisture to avoid recurrence of corrosion over the repaired spot. This shall be achieved by treating the building surface with Polymer impregnation method. This process involves following steps:-

1. Clean the surface
2. Saturate the surface by application of dilute polymer.
3. Apply two coats of acrylic polymer coating.

This treatment shall be done on entire external surface and on repaired patches of internal surface. This will not only protect the concrete members but prevent water seepage also.

Longevity of Repaired portion:-

The damage to concrete due to corrosion of reinforcement bars is recurrent in nature. There is no permanent economical solution available to solve this problem.

The only practical solution is to repair these cracks as and when they are formed. This is a regular maintenance feature,.

The recurrence of cracks depends on various factors like:-

- a) Original quality of construction.
- b) Inherent design and/or construction defects
- c) Leakage of water
- d) Degree of maintenance etc.

		<p>The building can be maintained in "fit for human habitation condition" by repairing it in above said manner.</p> <p>Plaster :- The plaster is in cracked condition at some locations of building. Hence the plaster shall be removed in the damaged portion & re-done with new plaster.</p> <p>Terrace :- The existing water proofing treatment needs repairs at many locations</p> <p>Leakage from side walls:- No leakages were observed from the side walls.</p> <p>Drain pipes:- The Rain water drain pipes shall be replaced at some places with new PVC pipes totally.</p>
7.0	Water supply pipes	Water supply pipes near the water tank needs minor repairs and drainage pipes are in good conditions and no leakages are found.
8.0	Record of Observations	Record of observations in the form of photographs, text form, is given separately.
9.0	Co-operation	We take the opportunity to thank officers and employees of Kendriya Vidyalaya No.2, Infantry Lines and especially the Principal, for excellent cooperation extended during inspection.
10.0	Disclaimer	The areas covered under fixed furniture, false ceilings etc could not be inspected as they were covered.

Recommendation:

As the plan and detailed architectural drawing of the building are not available, it is requested to prepare the detailed drawings or acquire the same from the concerned authority.

Overall Observation:

Looking to the condition of the building and overall observation during the inspection of building, is found in very good condition and stable. This building can be used in future for the purpose of which it is designed.