

# Detailed Engineering Assessment

Structural-Design Consultant Meeting

December 2024



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- Q&A (15 min)

# General Overview

## Accord Strategy towards Structural Assessment

- ① **Step-1:** To review the documents such as as-built drawings, soil report, stability certificate, any previous inspection report, testing results obtained during construction etc.
- ② **Step-2:** Initial inspection of the entire factory collect data such as framing, member sizes, grid sizes, review loading etc.
- ③ **Step-3:** Perform testing such as ferro-scanning of rebars and rebound hammer test for concrete strength.
- ④ **Step-4:** Perform stress analysis in column. Check highly overstressed column and recommend DEA if it is required.

# Detailed Engineering Assessment (DEA)

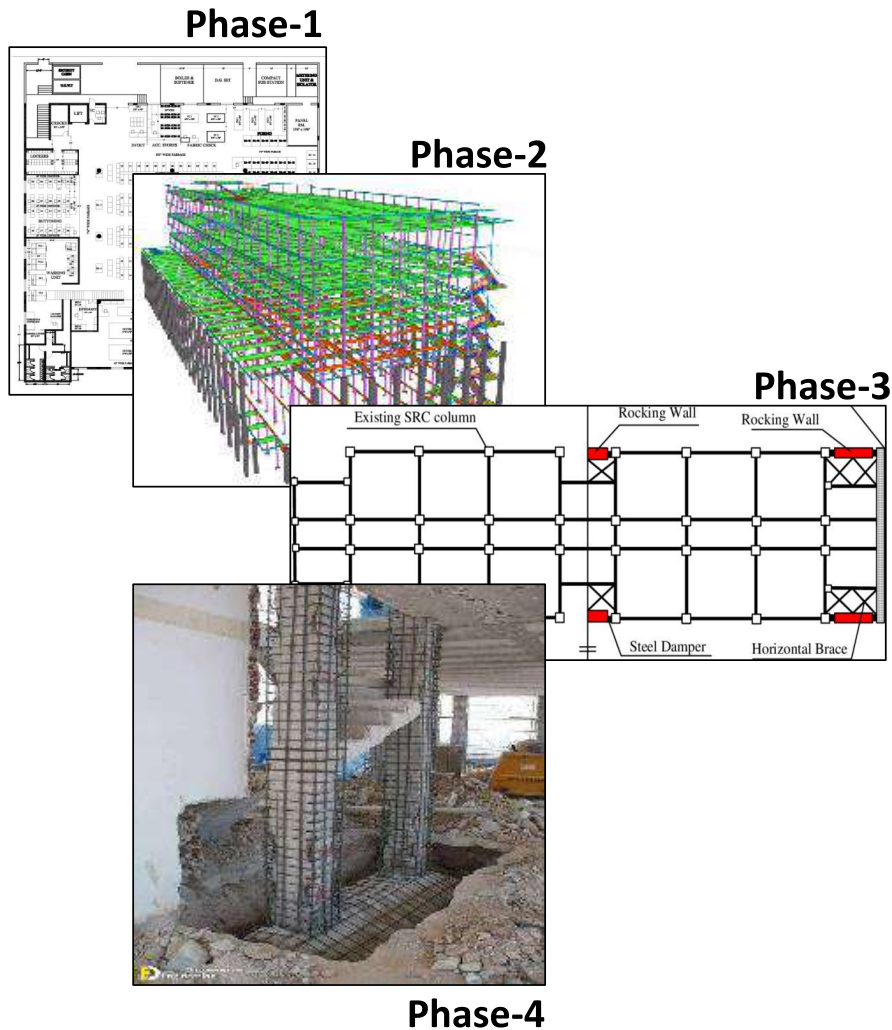
# DEA: An Introduction

Detailed Engineering Assessment (DEA) of a building is used to comprehensively evaluate the structure's condition, safety, and compliance with relevant codes and standards. It aims to ensure the building's resilience, functionality, and long-term sustainability.

It is a recommendation of initial inspection of the building and required when the low safety factor obtained from stress analysis in vertical load resisting system.

# DEA Methodology

# DEA Methodology



## DEA Methodology comprises of four stages

- 🕒 **Phase-1:** Acquiring accurate as-built information of the structure to use as input data for an analysis.
- 🕒 **Phase-2:** Analysis of the performance of the existing structure under the specified loading conditions.
- 🕒 **Phase-3:** Recommendations as to any retrofit works required to achieve adequate performance of the structure, with remedial work options if appropriate.
- 🕒 **Phase-4:** Description and design of the remedial works for the option agreed with the factory and Pakistan Accord.



# DEA Methodology

## Phase-01

### Architectural Drawings

Develop architectural drawing from as built information (such as plan, section and elevation)

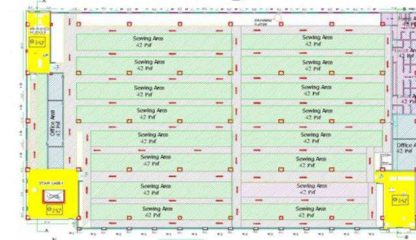
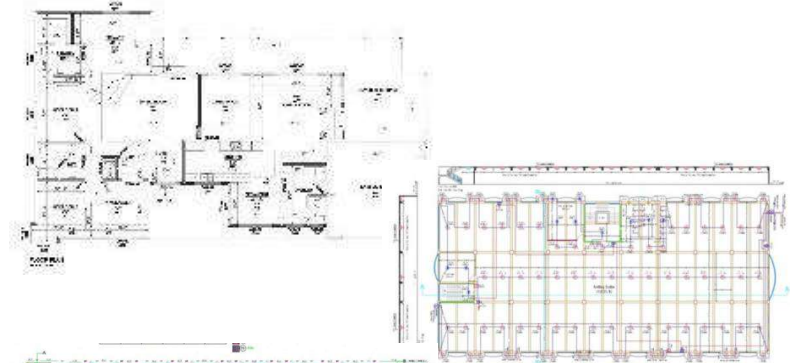
### Structural Drawings

Develop structural drawing from as built information (such as framing plan, beam profile, column schedule etc.)

### Review of Existing Load Plans

Review types of load based on observation from site

### Investigate Material Properties



## Phase-02

### ⦿ Loading on the structure

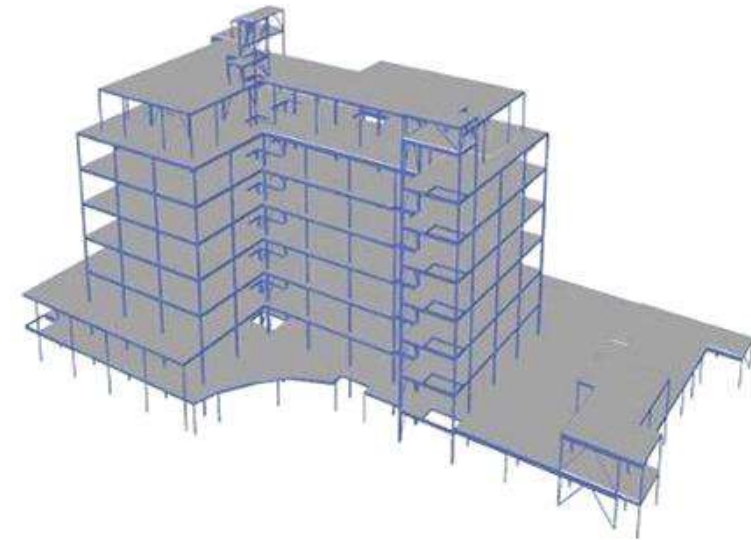
Differentiate different types of dead load/superimposed dead load/live load/wind load and earthquake load

### ⦿ Analysis of the structure

Gravity and lateral load analysis through finite element methods using code provisions and standards

### ⦿ Analysis Results

Check demand/capacity ration in column, inter-story drift, deflection in slab and beam elements and compare with code compliance criteria



## Phase-03

### 🕒 Identification of elements that need strengthening

Find out overstressed element/change their sizes and redo the analysis both for gravity and lateral loads (Wind/Earthquake loads)

### 🕒 Foundation Assessment

Check the provided sizes are adequate or not.

### 🕒 Agree remedial works option

Propose strengthening/retrofitting strategies as per site constraints such as RC/Steel jacketing of column, beam and RC walls



## Phase-04

### ④ Develop detailed remedial measure for elements need strengthening

Develop detailed design drawings and implementation strategy for decided retrofitting scheme

### ④ Develop Safe Load Plans

Regenerate new load plans based on revised sizes of structural elements or revised faming



# Codes and Standard for DEA

# Codes/Standard

Stage	Loading type	Loading values
Initial inspection	Gravity only	Observation, 2kpa minimum
DEA - Analysis	Gravity and wind	BCP 2007
DEA - Retrofit Design	Gravity and wind and seismic	BCP 2007
New Design/Construction	Gravity and wind and seismic	BCP 2021

**Existing Building**

**Pakistan Accord Building Standard**  
Final Version: 11 September 2023



**New Buildings**





# DEA Deliverables

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## DEA REPORT CONTENT LIST

### Executive Summary

Summary of work carried out and key findings

### 1 Introduction

1.1 Brief Overview of Buildings

1.2 Requirement for DEA Report

### 2 Methodology for Initial Assessment Work

2.1 Existing Data Collection

2.2 Visual Inspection

2.3 As –Built Surveys

2.4 Assessment of In-Situ Material Properties

### 3 Detailed Description of Buildings Subject to DEA

3.1 Phases and years of construction

3.2 Structural Systems & Construction Methods

3.3 Existing Buildings Records

### 4 Ground Conditions

4.1 Existing Soils Data Verification

4.2 Foundation Assessment for DEA

4.3 Soil Characteristics Assumed for DEA Analysis

### 5 Foundations

5.1 Foundation Design Drawings

5.2 Verification of Existing Foundations

### 6 Structural and Architectural Drawings

6.1 Verification of Accuracy of Provided Drawings



# DEA Deliverables

## DEA REPORT CONTENT LIST

6.2 Preparation of As-Built Architectural Drawings

6.3 Preparation of As-Built Structural Drawings

6.4 Determining Reinforcement Details

### 7 Material Properties

7.1 Determining Actual Concrete Strength

7.2 Determining Reinforcement Strength

7.3 Material Properties for Other Materials

### 8 Loading on Structure

8.1 Existing Loads on Structure

8.2 Loading Assumed for Structural Analysis

### 9 Analysis of Structural Performance

9.1 Analysis Tools

9.2 Input Data Used in the Analysis

9.3 Analysis Results and Conclusions of Initial Analysis

9.4 Seismic Analysis Results and Commentary

9.5 Updated Analysis Including Proposed Strengthening

### 10 Proposed Strengthening Measures

10.1 Strengthening Options and Recommendations

10.2 Design of Strengthening Measures

### 11 Preparation of Safe Load Plans

11.1 Interim Safe Load Plans

11.2 Final Safe Load Plans

### 12 Conclusions and Recommendations

### Appendices

# DEA Deliverables

## DEA REPORT CONTENT LIST

### *Appendix A*

Preliminary Assessment Report (Structural Inspection Report)

### *Appendix B*

Soils Report

### *Appendix C*

As-Built Architectural Drawings

### *Appendix D*

As-Built Structural Drawings

### *Appendix E*

Ferrosan Report

### *Appendix F*

Core Testing Results and Concrete Strength Calculation

### *Appendix G*

Steel Reinforcement Testing

### *Appendix H*

Other Materials Testing

### *Appendix I*

Existing Loading Plans

### *Appendix J*

Analysis Results

### *Appendix K*

Strengthening Design and Drawings

### *Appendix L*

Factory Safe Load Plans

# Qualified Consultant

# Qualification of Consultant

The DEA report shall be prepared by at least two suitably qualified full time Engineers (two Structural or one Structural and one Geotechnical) or Structural Engineering Consultancy ('the Engineer'), who is required to have the following minimum education and experience:

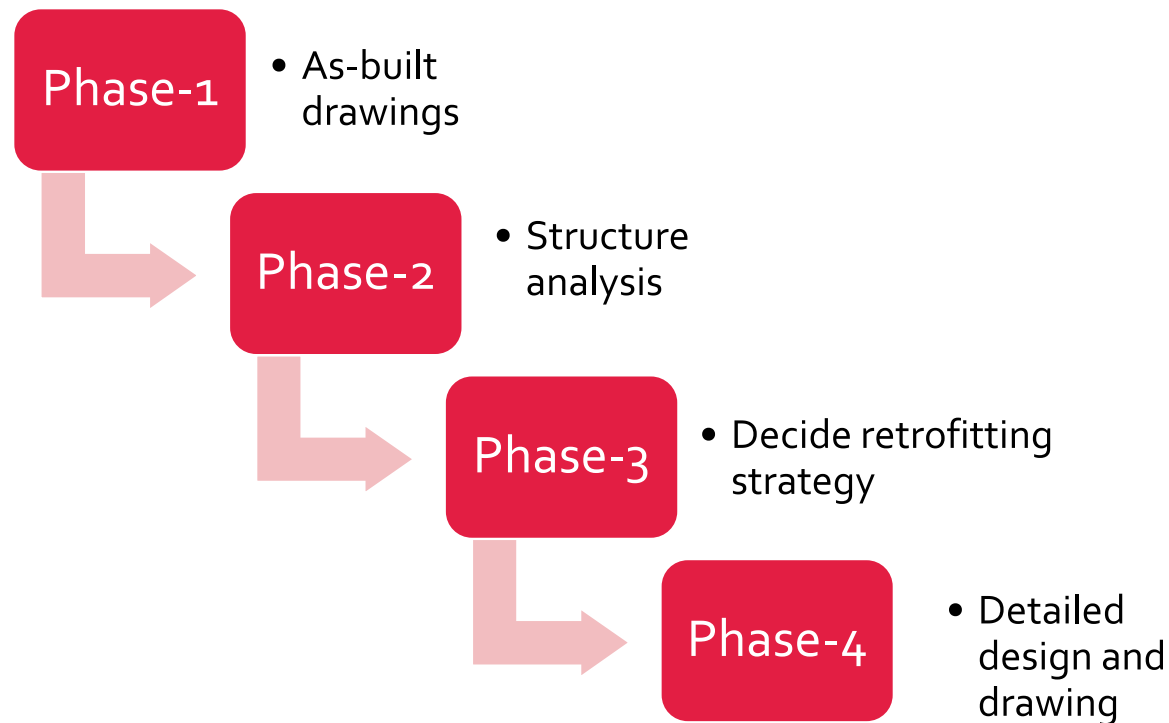
***Education:*** Bachelor's degree in Civil/ Structural Engineering from recognized university

***Experience:*** Minimum of five years of experience with both engineers having a combined 15 years of professional experience with proven skills and expertise in Structural Engineering. Ideally experience of at least three DEAs or similar in comparable area in last two years

# Timeline/Duration

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The contract should start as soon as possible and the work is expected to take no longer than 3 months for a single building (4 or 5 story building).



# Reporting Arrangements

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The contracted firm is expected to work remotely but keep in contact with the Factory and the relevant supervisory body on a regular basis throughout the development of the DEA report.

The consultancy should arrange to have at least one preview session with the relevant supervisory prior to final submission of the DEA report. This is to limit the possibilities of the DEA report being returned to the consultant for modifications or additions to the report.

The consultancy will retain responsibility throughout the contract for approval by the relevant supervisory of the DEA report, at which stage the contracted works will be complete.