CHAPTER 9
REPAIR, RESTORATION AND STRENGTHENING OF BUILDINGS

9.2 Introduction

Repair, restoration and strengthening involve the process of
repairing or restoring a building or structure to its original state,
or enhancing its structural integrity. These processes are typically
undertaken to address issues such as damage caused by natural
forces, wear and tear, or deterioration over time.

9.3.1 Introduction

In the context of buildings, repair and restoration often involve
the application of various techniques and materials to correct
defects or deficiencies. Strengthening, on the other hand,
focuses on enhancing the structural capacity of a building to
withstand increased loads or external forces.

9.4 Repair, Restoration and Strengthening Concepts

These concepts are fundamental to the practice of building
maintenance and preservation. Understanding and applying
these principles is crucial for ensuring the safety and
durability of architectural structures.

9.4.1 Repair

Repair is a critical aspect of building maintenance, aimed at
addressing and fixing specific issues or defects within a
building. This may involve anything from minor repairs to
major renovations, depending on the extent of the damage.

9.4.1.1 Repair

In the context of repair, it is essential to identify the
nature of the defect and select appropriate materials and
techniques to effect a lasting solution.

9.4.2 Restoration

Restoration involves the process of returning a building to
its original or historical state, often involving a
reconstruction or adaptive reuse of the structure.

9.4.3 Strengthening

Strengthening is a process that enhances the structural
capacity of a building to ensure it can withstand increased
loads or external forces. This may involve adding
reinforcement to existing structures or incorporating new
materials to improve overall stability.

9.4.3.1 Strengthening

Effective strengthening requires a thorough understanding
of the building's structural integrity and the application of
appropriate techniques to ensure the durability and safety
of the structure.

9.5 Conclusion

In conclusion, repair, restoration, and strengthening are
integral aspects of building maintenance and preservation.
Understanding and implementing these concepts is crucial
for ensuring the longevity and safety of architectural
structures.


5.9.9 

Restoration


1) ଗାର ବୈପାନ କରନ୍ତୁ ପୂର୍ଣମାନ ଗାର ଆନଖାରା ଗୌତିକ ଏକ ବୃଦ୍ଧାକ୍ଷର କୌତୁବା ହେବ।

2) ପ୍ରତ୍ୟେକ ଗାର ଆନଖାରା ଗୌତିକ ଏକ ବୃଦ୍ଧାକ୍ଷର କୌତୁବା ହେବ।

3) ଗାର ଆନଖାରା ଗୌତିକ ଏକ ବୃଦ୍ଧାକ୍ଷର କୌତୁବା ହେବ।

5.9.9 

Strengthening of Existing Building

1. ସୂବେବ କରାଇବ。
2. ଯାଗ ଭୂମିର ପ୍ରଭାବ କୌତୁବା ବେଳେ ଗୌତିକ ଏକ ବୃଦ୍ଧାକ୍ଷର କୌତୁବା ହେବ।

3. ପ୍ରପ୍ଦନ୍ତୀ ଏବଂ ଵର୍ତ୍ତନ କରାଇବ (ports)

Section A - A

Section A - A

Section A - A

Section A - A

Section A - A
(c) বিক্ষোভ করনো ২ ছানা নিয়ে রাখ বাছা বাছা খাদ গুরু খাদ বাচানো চুকুনি বলতে

1. লালুর ক্লাম্প পায়ের দলি কলিঁ
2. গুলি (Clamps)
3. লালুর খাদ পায়ের দলি কলিঁ
4. বিক্ষোভ গুলি কলিঁ
5. লালুর খাদ

চিত্র ৫.২ (c) - গুলি গুলি খাদ লালুর চুকুনি বলতে

চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে চরিত্রস্থল বিক্ষোভ চুকুনি বল লালুর চলতে 

(1) গুলি বল, গুলি বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল 

(2) বিক্ষোভ গুলি বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল 

(3) বিক্ষোভ গুলি বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল বল 

(4) বিক্ষোভ গুলি বল বল বল বল বল বল বল 

(5) বিক্ষোভ গুলি বল বল বল 

(6) বিক্ষোভ গুলি বল বল 

(7) বিক্ষোভ গুলি বল 

(8) বিক্ষোভ গুলি বল 

(9) বিক্ষোভ গুলি বল 

(10) বিক্ষোভ গুলি বল 

(11) বিক্ষোভ গুলি বল 

(12) বিক্ষোভ গুলি বল 

(13) বিক্ষোভ গুলি বল 

(14) বিক্ষোভ গুলি বল 

(15) বিক্ষোভ গুলি বল 

(16) বিক্ষোভ গুলি বল 

(17) বিক্ষোভ গুলি বল 

(18) বিক্ষোভ গুলি বল 

(19) বিক্ষোভ গুলি বল 

(20) বিক্ষোভ গুলি বল 

(21) বিক্ষোভ গুলি বল 

(22) বিক্ষোভ গুলি বল 

(23) বিক্ষোভ গুলি বল 

(24) বিক্ষোভ গুলি বল 

(25) বিক্ষোভ গুলি বল 

(26) বিক্ষোভ গুলি বল 

(27) বিক্ষোভ গুলি বল 

(28) বিক্ষোভ গুলি বল 

(29) বিক্ষোভ গুলি বল 

(30) বিক্ষোভ গুলি বল
1. **Stress**
2. **Deflection**
3. **Sag**
4. **Stiffness**
5. (200 x 40) mm plank
6. (200 x 40) mm plank
7. 76 mm U-channel, 50 x 3 or 4, or U-Anchor
8. **Anchor**

**Section A - A**

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**Repair materials**

- **Shinking**
- **Concrete**
- **Steel**
- **Wood**

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5.7.1 Shotcrete

Mortar or concrete can be placed under pressure (Pressure gun) or pneumatically (Pneumatically) using an air compressor. Mortar is commonly used in the construction industry. Mortar is commonly used in plumbing and masonry work.

5.7.2 Epoxy Resins

Epoxy resins are used as a bonding agent (Tensile Strength) for various applications. They can be used as a binding agent (Binding Agent) in various applications. Epoxy resins are also used in the construction industry as a bonding agent.

5.7.3 Epoxy Mortar

Epoxy mortars are used in various applications. They are commonly used in the construction industry as a bonding agent. Epoxy mortars are also used in the plumbing industry.

5.7.4 Gypsum Cement Mortar

Gypsum cement mortars are commonly used in the construction industry. They are also used in the plumbing industry. Gypsum cement mortars are commonly used in the plumbing industry.

5.7.5 Quicksetting Cement Mortar

Quicksetting cement mortars are commonly used in the construction industry. They are also used in the plumbing industry.

5.7.6 Mechanical Anchors

Mechanical anchors are commonly used in the construction industry. They are also used in the plumbing industry.

5.7.7 Techniques to Restore Original Strength

Techniques to restore original strength are commonly used in the construction industry. They are also used in the plumbing industry.

5.7.8 Small Cracks

Small cracks are commonly found in various applications. They are also found in the plumbing industry.
1. Butt welding
2. Lap welding
3. Splicing overlapping
4. Fractured, Excessively Yielded and Buckled Reinforcement
5. Chamfered, Dovetail, etc.
6. Welded, Welded Railing, etc.
7. Grooves cut in Wall

Section A - A

Detail B
5.4.4 Fractured Wooden Members & Joints

5.5.4 Roof Structure

Modification of Roof

5.6.4 Roof Edges

6.4.4 Insulation of the Roof
3.1 Substitution or Strengthening of Slabs

1. Insertion of New Slab

2. Existing Wooden Slab

3. Connection of the Slab to the Walls
Modification in Planner & Strengthening of Walls

Inserting New Walls

1. 2. 3. 4. 5. 6.
1. ପୂର୍ଣ କିର୍ରିଣ କାଲ
2. ସୂର୍ଯ୍ୟ ବଣ୍ଡି
3. ଲେଖା ତିକାନିତ ଭାବେ ଭାଗାନା ମୁଖ
4. ମୁଖରେଦା ବଣିଞ୍ଚି କିରିତି ପୁରୁଷ ଲୋକ
(ଜେଳେ ମୁଖରେଦା ତିକାନିତି)

(ସେବ) ପୂର୍ଣ କିରିଣ କାଲ
2. ସୂର୍ଯ୍ୟ ବଣ୍ଡି
3. ଲେଖା ତିକାନିତ ଭାବେ ମୁଖ
4. ମୁଖରେଦା ଲୋକ

(ଜେଲ) ମୁଖରେଦା ମୁଖରେଦା ସୂର୍ଯ୍ୟ କାଲ ପୁରୁଷ ହେବାରେ

1. ପୂର୍ଣ କିରିଣ କାଲ
2. ସୂର୍ଯ୍ୟ ବଣ୍ଡି
3. ଲେଖା ତିକାନିତ ଭାବେ ଭାଗାନା ମୁଖ
4. ମୁଖରେଦା ଲୋକ

(ସେବ) ପୂର୍ଣ କିରିଣ କାଲ
2. ସୂର୍ଯ୍ୟ ବଣ୍ଡି
3. ଲେଖା ତିକାନିତ ଭାବେ ମୁଖ
4. ମୁଖରେଦା ଲୋକ
1. ତରକାପର୍ପ ଛେଣା ତାବେକା ଦ୍ୱୂପ
2. ଭାଜୁ ଦ୍ୱୂପ
3. ତରକାପର୍ପ ତରକପର୍ପ ଦ୍ୱୂପ (with links)
4. ପିଙ୍ଗଳା ତରକପର୍ପ ଦ୍ୱୂପ ୫୦
5. କାପର୍ପ କାପର୍ପ ଦ୍ୱୂପ କାପର୍ପ ୫୦
6. ପିଙ୍ଗଳା
2) **Grouting**

Grouting is a technique used to fill voids or spaces in concrete or masonry structures. It involves injecting a material, typically a grout, into the voids to increase the overall strength and stability of the structure. Grouting can be performed at various stages of construction or repair to ensure a safe and durable outcome.

Grouting can be used to:
- Fill cracks or voids in concrete structures.
- Increase the bond between different materials.
- Improve the structural integrity of a building.
- Prevent water infiltration into structures.

Grouting is typically performed using specialized equipment and materials, and requires careful planning and execution to ensure success. It is often used in conjunction with other repair or construction techniques to achieve optimal results.
1. নির্দিষ্টক বাতি প্রদর্শন করুন।
2. মোড় দ্বন্দ্ব।

চিত্র ৫.২৪ – নির্দিষ্টক বাতি প্রদর্শন করুন।

(d) ধূলী কাঠিত ধূলী সুস্থতার বৃহত্তর সার্থকতা।

Strengthening with Wire Materials

ধূলী কাঠিত ধূলী সুস্থতার বৃহত্তর সার্থকতা। ধূলী কাঠিত ধূলী সুস্থতার বৃহত্তর সার্থকতা।

Connection Between Existing Stone Walls

ধূলী কাঠিত ধূলী সুস্থতার বৃহত্তর সার্থকতা।

চিত্র ৫.২৪ – নির্দিষ্টক বাতি প্রদর্শন করুন।

চিত্র ৫.২৪ – নির্দিষ্টক বাতি প্রদর্শন করুন।

(ii) ପ୍ୟେସ୍୰୍ୟେର୍ସ୍୰େ ପ୍ୟେସ୍୰୍ୟେର୍ସ୍୰େ

Prestressing

ଖାନ୍ତା କାର୍ଯ୍ୟରେ ପ୍ୟେସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ସ୍ଟର୍ଃ ।

1. ବାଗାକୁନ୍ତି
2. ବାଗାକୁନ୍ତି ବାଗାକୁନ୍ତି
3. ବାଗାକୁନ୍ତି ବାଗାକୁନ୍ତି
4. ବାଗାକୁନ୍ତି bearing plate
### Masonary Arches

A masonry arch is a bridge or tunnel that has a curved section made of masonry materials such as brick or stone. The arch is supported at the base by a series of curved blocks that distribute the weight of the arch to the ground. The term "springing level" refers to the point at which the arch begins. It is important to note that the arch should be designed and built with proper engineering to ensure stability and safety.

**Diagram**: The diagram illustrates a simple masonry arch with labeled sections indicating different parts of the arch. The sections are marked with numbers and labels for clarity.

1. **1. Springing Level**
2. **2. Arch Veneer**
3. **3. Key Stone**
4. **4. Base Course**

The arch is constructed with a level at the springing, which is then渐变 to the crown, ensuring smooth transition.

### Other Points

#### 1. Masonary Arches

A masonry arch is a critical element in construction, providing structural support and aesthetic value. Proper design and execution are essential to ensure durability and safety.

1. **1. Springing Level**
2. **2. Arch Veneer**
3. **3. Key Stone**
4. **4. Base Course**

The arch is designed to distribute weight evenly, with the key stone playing a crucial role in maintaining structural integrity.

#### 4. Other Points

The diagram and text together provide a comprehensive understanding of masonry arch construction, emphasizing the importance of proper design and execution.

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*Note: The text is in Odia, a language spoken in India.*

**Source**: Original document page
1. ଭୂଳଳି କରିବା 
2. ଚୁରୁଣ୍ଡିକା ରହିବା ଲାଗିବା 
3. ମୂନା କୁଲାକ ରହିବା
4. ଗୁଙ୍ଗି ବିଷର ରହିବ ଦିନ 

ନିମ୍ନ ୫.୨୫ - ବୃତ୍ତାଂକୁ ଗ୍ରହଣ ଓ କରିବା କରାର

(କ)ରେବରେ ବାବା (Framed Building)କୀ-କନ୍ଧ (Knee Brace)କୀ-ରୋଗକୁ (Diagonal Brace)କୀ-ଲିକିତ ବାବା (Infill Wall)ର ମଧ୍ୟରେ କରାର କରାର, ଏକ ତତ୍କାଲେ ୨.ଜାର ଗୁହାଟିକ ଶ୍ରେଷ୍ଠାକାର ବର୍ତ୍ତମାଣ ଦ୍ୱାରକ ନିଯାମକ କରିବା ପାଇଁ କୁମାର ମୂଲତୃତିକ ଗ୍ରହଣ କରାବା ପାଇଁ।

(ଛ)ପ୍ରତିବର୍ତ୍ତ୍ତ୍ତ୍ତ୍ତିତ (Framed Building)କୀ-କନ୍ଧ (Knee Brace)କୀ-କନ୍ଧକୁ ରୋଗକୁ (Diagonal Brace)କୀ-ଲିକିତ ବାବା (Infill Wall)ର ମଧ୍ୟରେ ବିକାଶ କରାବା ପାଇଁ, ଏକ ତତ୍କାଲେ ୨.ଜାର ଗୁହାଟିକ ଶ୍ରେଷ୍ଠାକାର ବର୍ତ୍ତମାଣ ଦ୍ୱାରକ ନିଯାମକ କରାର କରାବା ପାଇଁ। କୁମାର ମୂଲତୃତିକ ଗ୍ରହଣ କରାବା ପାଇଁ।
3) ବରରେ ଲାଗଣା ରୋଖିବା ପାଇଁ କରିବା ଲାଗି ପୁଷ୍ଟି କରାନ୍ତି ମାନେ ବରିଷ୍ଟାଲ ପ୍ରତ୍ଯେକ ଶ୍ରେଷ୍ଠକ କରିବା।
4) ତେବେ ପ୍ରତିଭାରୀ ପ୍ରତିଭାରୀ କରିବା ଲାଗି ପୁଷ୍ଟି କରାନ୍ତି ମାନେ ବରିଷ୍ଟାଲ

![Diagram]

ପରିବର୍ତ୍ତୀକା ଗ୍ରାହ୍ମଣ ଗ୍ରାହ୍ମଣ ଗ୍ରାହ୍ମଣ ଗ୍ରାହ୍ମଣ

1. ପୁଷ୍ଟିର କର୍ମ
2. ଜୀବନ ସମାଧାନ
3. ପୂର୍ବ କରିଷ୍ଟବିନ୍ଦ୍ରଣ ଜୀବ ଜୀବ ଜୀବ

9.90 - ପୁଷ୍ଟି ପୁଷ୍ଟି ପୁଷ୍ଟି ପୁଷ୍ଟି
6.5 **Strengthening of Foundation**

- *Apron* (Foundation Apron) is the most common type of apron. It is a horizontal extension that provides additional support to the foundation. The apron is typically constructed with concrete or masonry and is designed to distribute the load from the building structure to the underlying soil. It helps in reducing the settlement of the foundation and increases its stability.

- *Underpinning* is a technique used to reinforce a foundation that is not structurally strong enough to support the weight of the building. It involves excavating the soil under the foundation and replacing it with a stronger material, such as concrete or gravel, to provide additional support.

- *Jacking* is a process used to lift and stabilize a building's foundation. It involves the use of hydraulic jacks to lift the foundation and then pushing it back into place. This technique is often used when a foundation has settled or when there is a need to align a building that is leaning or misaligned.

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