

**NORMS
FOR
RATE ANALYSIS
OF
RETROFITTING
MASONRY BUILDING**

Prepared by
Retrofitting Technical Working Group
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Retrofitting Norms for Rate Analysis

Introduction

The detail damage assessment survey conducted after the 2015 Gorkha earthquake had identified around 70 thousand houses that could retain their seismic strength through retrofitting. With the start of the reconstruction phase most of the training and technical assistance systems promoted for the reconstruction were aimed at new construction only. The retrofitting construction related manuals only available in June 2017 which provided retrofit solutions to the beneficiaries of earthquake affected districts along with some retrofit trainings.

Despite the retrofitting manuals and trainings, retrofitting of houses could not speed up as compared to the reconstruction. As a consequence, there is no interest from the beneficiaries and beneficiaries switching or planning to switch from retrofit to reconstruction causing further delay in recovery/reconstruction process. There are various reasons for delay in the retrofitting construction process. One of the major reasons is lack of retrofitting norms for rate analysis in the earthquake affected districts. Other reasons are lack of proper technical guidance to the engineers and masons in the field and communication gap from reconstruction stakeholders.

A retrofit technical working group was formed on 20th December 2019 to support the NRA, CLPIU Building to speed up retrofitting of buildings in earthquake affected areas through standardization of technical documents, solutions and approaches related to retrofitting. A number of documents for better community awareness related to retrofitting have been preparing under the retrofitting technical working group. This group consist of partner organizations, namely, NSET, Build Change, UNDP and HRRP who are actively working in retrofitting in the earthquake affected districts of Nepal. **Retrofitting Norms for Rate Analysis** is one of the main documents being prepared by the retrofitting technical working group since the last three months. This document provides basic guidelines of norms for load-bearing masonry structures.

Objective

This document is prepared in order to support the retrofitting cost analysis of masonry structures. This is intended to be implemented by the engineers and mid-level technicians. Moreover, this document could also support the NRA, CLPIU Building to speed up retrofitting of buildings in earthquake affected areas.

Background

The 2015 Gorkha earthquake had widespread damages, especially in the private housing sector; more than half the total losses was incurred in private houses. Nearly 900,000 houses have been identified by the National Reconstruction Authority as beneficiaries of the national reconstruction program, 78,000 of whom are retrofitting beneficiaries. To

fulfill the need for technical assistance to such beneficiaries, the National Reconstruction Authority led the process and collaborated with several partner organizations for conduction of various awareness and capacity building activities.

One of the key aspects that need to be considered while undertaking a retrofitting activity is the cost of the interventions. A general understanding states that any retrofitting activity would be feasible if the cost of retrofitting falls under 30% of the total construction cost of the building (except in cases of buildings of historic, cultural or religious values). Furthermore, as most of the damaged buildings are situated in the rural areas, the cost of retrofitting is much more significant, owing the economic condition of the target beneficiaries. As such, a crucial step in implementing any retrofitting process is the estimation of the cost of such interventions.

Need

The process of strengthening buildings using retrofitting is not new in Nepal. Retrofitting of buildings started in Nepal in the late 1990s, with school buildings. More than 25 years later, 300 or more schools have been retrofitted. Over the course of time, the technology slowly proliferated into the private sector, with several hundreds of private houses being retrofitted. However, many of these retrofitting interventions were largely carried out RC frame of brick cement buildings in the urban cities in Kathmandu Valley. Retrofitting of rural buildings, typically of stone masonry buildings was not a major priority until the 2015 Gorkha earthquake. This led to a serious gap in knowledge, as no standardized norms or analysis of rates were available for retrofitting interventions. Hence, while rates for works like brick soling, reinforcements, concreting and plastering were generally adopted from new construction, rates for more specialized tasks such as plaster scraping, placement of GI wire mesh and GI wires, anchorage and repair works were not standardized, and used randomly. This created an inconsistency in rate analysis and estimation of retrofitting interventions across the country, with engineers unable to refer to a national standardized norm.

Process

With the dire need to expedite the process of reconstruction in earthquake affected areas, a Technical Working Group (TWG) was formed to consolidate and develop various documents and resource materials to support the NRA CLPIUs and all partner organizations in retrofitting interventions. Among various objectives and tasks of the TWG was to standardize norms for retrofitting of masonry buildings using technique as prescribed in the NRA Repair and Retrofit Manual and retrofitting techniques adopted and implemented by partner organization. The TWG consisted of engineers from UNDP, HRRP, NSET, Build Change and CRS, partners that had worked extensively in retrofitting of partially damaged buildings. The different steps in the consolidation process are as follows:

Volume of Work

To ascertain actual and practical norms and rates for the different tasks under retrofitting, various sites were examined and data on manpower and material recorded precisely. The table in Annex 1 highlights the volume of work referred to for the revision process

Scope and Basis

- The document covers stone and brick masonry buildings (both with mud and cement mortar) typology for splint and bandage, containment reinforcement (CR) system / local failure jacketing and strong-back method being implemented by partner organizations.
- The results are based upon observation of individual line items in a certain time frame from partner organizations (Build Change, NSET, UNDP and ESS). Additionally, some components have been adopted as they are in standard governmental norms for new construction. Further, information is documented in formats which is in usual practice of government.
- Each item's rate analysis is calculated by incorporating manpower (skilled / semiskilled / unskilled), materials, tools (calculation basis/lump sum) and overhead cost.
- Each man day (md) is considered as 8 hours working time in a day.
- Some changes have been made from observations while preparing analysis, considering the scenarios which may be different in training and actual work conditions.
- There are 12 items identified for rate analysis.

TABLE OF CONTENTS 1			
Work Group	Description	Description Sheet	
		Item No.	Page No.
A	Site Clearance and Protection Works	A1-A12	1-6
B	Excavation and Backfilling	B1-B2	7
C	Shoring works	C1-C2	8
D	Masonry works	D1-D6	9-11
E	Concrete & Rebar Works	E1-E4	12-13
F	Formwork	F1	14
G	Wiremesh Works	G1-G6	14-17
H	Plaster Works	H1-H5	17-19
I	Containment/Jacketing	I1-I2	21
J	Anchorage Works	J1-J3	21-22
K	Through Concrete, Dowel Works and Timber Splicing	K1-K3	22-23
L	Replacement of Heavy Gable with Light Material	L1-L2	24
M	Roof and connection Improvement	M1-M3	25-26

TABLE OF CONTENTS 2

FOR ***** DISTRICT

A					
<u>Work Group A : Site Clearance and Protection Works</u>					
	Items	Page No.	Rate Analysis		Unit
1	Providing and fixing the 500 gauge polythene sheet	1	NRs.		sq.m
2	Removing of existing door and windows shutter and its fixture	1	NRs.		No.
3	Demolition of wall BMC and storage within haulage of 10m	2	NRs.		cum
4	Demolition of wall BMM and storage within haulage of 10m	2	NRs.		cum
5	Demolition of wall SMM and storage within haulage of 10m	3	NRs.		cum
6	Demolition of wall SMC and storage within haulage of 10m	3	NRs.		cum
7	Demolition of existing PCC flooring	4	NRs.		cum
8	Demolition of Rigid floors (reinforced concrete slab)	4	NRs.		cum
9	Demolition of roof Light-CGI roofing including truss element	5	NRs.		sq.m
10	Demolition of roof Heavy-slate/clay/cement tiles including truss element	5	NRs.		sq.m
11	Stripping and Raking of of Exsiting mud plaster from SMM/BMM	6	NRs.		sq.m
12	d	6	NRs.		sq.m.
B					
<u>Work Group B : Excavation and Backfilling</u>					
	Items	Page No.	Rate Analysis		Unit
1	Earthwork in excavation in ordinary to mixed/hard soil	7	NRs.		cum
2	Backfilling Works	7	NRs.		cum

C	<u>Work Group C : Shoring works</u>				
	Items	Page No.	Rate Analysis		Unit
1	Providing Wooden Props for Shoring purpose	8	NRs.		cum
2	Providing Wooden while Shifting of Openings	8	NRs.		cum
D	<u>Work Group D : Masonry works</u>				
	Items	Page No.	Rate Analysis		Unit
1	Laying of stone mud mortar masonry wall	9	NRs.		cum
2	Laying of brick mud mortar masonry wall	9	NRs.		cum
3	Laying of masonry wall of stone in cement mortar 1:6	10	NRs.		cum
4	Laying of masonry wall of brick in cement mortar 1:6	10	NRs.		cum
5	Flat Brick soling	11	NRs.		sqm
6	Stone soling	11	NRs.		sqm
E	<u>Work Group E : Concrete & Rebar Works</u>				
	Items	Page No.	Rate Analysis		Unit
1	Providing, mixing and laying P.C.C. in 1:2:4 ratio	12	NRs.		cum
2	Providing, mixing and laying R.C.C. in 1:2:4 ratio	12	NRs.		cum
3	Providing, mixing and laying R.C.C. in 1:1.5:3 ratio	13	NRs.		cum
4	Providing high strength deformed bars (HYSD) of grade Fe:415	13	NRs.		metric ton
F	<u>Work Group F : Formwork</u>				
	Items	Page No.	Rate Analysis		Unit
1	Providing, fitting and fixing standard formwork	14	NRs.		sq.m

G	<u>Work Group G : Wiremesh Works</u>				
	Items	Page No.	Rate Analysis		Unit
1	Cutting and laying SWG10 welded wire mesh and mesh size 50mmx50 mm	14	NRs.		sq. m
2	Cutting and laying SWG10 welded wire mesh and mesh size 25mmx25 mm	15	NRs.		sq.m
3	Cutting and laying SWG12 welded wire mesh and mesh size 50mmx50mm	15	NRs.		sq.m
4	Cutting and laying SWG14 welded wire mesh and mesh size 31 mmx31 mm	16	NRs.		KG
5	Cutting and laying SWG12 welded wire mesh and mesh size 25mmx25mm	16	NRs.		sq.m
6	Cutting and laying SWG15 welded wire mesh and mesh size 20mm x 20mm	17	NRs.		sq.m
H	<u>Work Group H :Plaster Works</u>				
	Items	Page No.	Rate Analysis		Unit
1	Cement plaster works over on walls, with cement sand mix (1:4) and 12.5 mm thick	17	NRs.		sq.m
2	Cement plaster works over GI wire mesh / chicken wire mesh on Stone Masonry walls, with cement sand mix (1:3) and 30 mm thick	18	NRs.		sq.m
3	Cement plaster works over GI wire mesh / chicken wire mesh on Stone Masonry walls, with cement sand mix (1:3) and 20 mm thick	18	NRs.		sq.m
4	Cement plaster works over GI wire mesh / chicken wire mesh on Stone masonry walls, with cement sand mix (1:3) and 35 mm thick	19	NRs.		sq.m
5	Cement plaster works over GI wire mesh / chicken wire mesh on Stone masonry walls, with cement sand mix (1:3) and 40 mm thick	19	NRs.		sq.m

I	<u>Work Group I : Containment/Jacketing</u>				
	Items	Page No.	Rate Analysis		Unit
1	Providing 12G GI Wire @ 100mm c/c	20	NRs.		sq.m
2	Fixing 4mm dia G.I wire in specified location attached with each corss link hook placed at specified interval	20	NRs.		Rm
J	<u>Work Group J :Anchorage Works</u>				
	Items	Page No.	Rate Analysis		Unit
1	Throughout anchoring of SWG 10 (3.15) mm wire at 600 mm c/c with staggered layout for connection of jacketing mesh on both sides of wall	21	NRs.		nos
2	Anchorage of 4.75 mm bar with staggered layout at 600 mm c/c for connecting splints and bandages on both sides of wall	21	NRs.		nos
3	Cast In-situ Concrete Shear Connector for all belts in 450 mm thick wall with 8mm TOR rod and infill of Concrete 1:2:4	22	NRs.		
K	<u>Work Group K :Through Concrete, Dowel Works and Timber Splicing</u>				
	Items	Page No.	Rate Analysis		Unit
1	Providing 150mm thick and 450mm deep Through concrete	22	NRs.		1 no.
2	Providing 150mm thick and 450mm long dowel	23	NRs.		1 no.
3	Providing the timber splicing	23	NRs.		cum
L	<u>Work Group L :Replacement of Heavy Gable with Light Material</u>				
	Items	Page No.	Rate Analysis		Unit
1	Providing wooden frames as light gable	24	NRs.		cum
2	Providing and fixing 24 Gauge CGI Sheet as light material.	24	NRs.		sq.m

M	Work Group M :Roof and connection Improvement				
	Items	Page No.	Rate Analysis		Unit
1	Connection of Rafter and Purlin	25	NRs.		per connection
2	Connection of sill plate with ring beam	25	NRs.		per connection
3	Connection of Ridge Beam and Timber Post	26	NRs.		per connection

A	Providing and fixing the 500 gauge polythene sheet with adhesive tape and nail for protection of door/ window frame with its fixtures of (on which shutter has removed) by covering it, including removing it after completion of the work and cleaning thoroughly all complete as original condition or as per instruction by the Engineer.
1	

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Resources Total
Manpower	Skilled	Md	0.05			
	Unskilled	Md	0.05			
Material	Polythene Sheet (500 gauge)	sq.m	1.1			
	Nails	Ls				
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

A	Removing of existing door or window shutters and its fixtures (not frame) , its safe storage before construction and reinstate it after retrofitting including cleaning and fixing, all complete as original condition or as per instruction by the Engineer.
2	

Rate Analysis for Nos

Elements	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower for removing & safe storage	Skilled	Md	0.25			
	Unskilled	Md	0.25			
Labor for reinstate & cleaning	Skilled	Md	0.5			
	Unskilled	Md	0.5			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 Nos

A
3

Demolition of the existing brick masonry wall in cement mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 Cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Resources Total
Manpower for demolition and disposing	Skilled	Md	0			
	Unskilled	Md	2.12			
Damage recovery (30%)						
Tools (3% labor)						
					Actual Cost	
					Overhead Cost (...%)	
					Total Cost	
Rate per 1 cum						

Rs.

A
4

Demolition of the existing brick masonry wall in mud mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 Cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Resource Total
Manpower	Skilled	Md	0			
	Unskilled	Md	1.06			
Damage recovery (30%)						
Tools (3% labor)						
					Actual Cost	
					Overhead Cost (...%)	
					Total Cost	
Rate per 1 cum						

Rs.

A
5

Demolition of the existing stone masonry wall in mud mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 Cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0			
	Unskilled	Md	1.06			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 Cum

Rs.

A
6

Demolition of the existing stone masonry wall in cement mortar and disposing debris including , transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 cum

Resource	Particulars	Unit	Quantity	Unit Price	Total	Resource Total
Manpower	Skilled	Md	0			
	Unskilled	Md	2.12			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 cum

Rs.

A
7

Demolition of existing P.C.C. slab in perfect line, level and disposing the debris including transportation of debris, cleaning the site all complete as per drawing, specification and instruction by the Engineer.

Rate Analysis for 1 Cum

Resource	Particulars	Unit	Quantity	Unit Price	Total	Resource Total
Manpower	Skilled	Md	0			
	Unskilled	Md	4			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 Cum

Rs.

A
8

Demolition of existing R.C.C. slab in perfect line, level and disposing the debris including transportation of debris, cleaning the site all complete as per drawing, specification and instruction by the Engineer.

Rate Analysis for 1 Cum

Resource	Particulars	Unit	Quantity	Unit Price	Total	Resource Total
Manpower	Skilled	Md	0			
	Unskilled	Md	11			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 Cum

Rs.

A
9

Dismantel of existing roof truss with CGI sheet, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 sq.m

Elements	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.03			
	Unskilled	Md	0.04			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

A
10

Dismantel of existing tile roofing , surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 sq.m

Resource	Particulars	Unit	Quantity	Unit Price	Total	Resource Total
Manpower	Skilled	Md	0.054			
	Unskilled	Md	0.081			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

A
11

Stripping off the existing mud plaster on the masonry wall, raking out the mud mortar to a depth of 10 mm at joint, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Resource Total
Manpower for scrapping	Unskilled	Md	0.06			
Manpower for raking & cleaning	Unskilled	Md	0.06			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

A
12

Stripping off the existing cement plaster on the Masonry wall, raking out the cement mortar to a depth of 10 mm at joint, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower for scrapping	Unskilled	Md	0.108			
Manpower for raking & cleaning	Unskilled	Md	0.108			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

B
1

Earthwork in excavation in ordinary to mixed/hard soil in foundation including dressing of sides and proper compaction to trench bed, disposing of excess soil all complete as per drawing, specification and instructions by the Engineer.

Rate Analysis for 1 Cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0			
	Unskilled	Md	0.8			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 Cum

Rs.

B
2

Backfilling Works

Rate Analysis for 1 Cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0			
	Unskilled	Md	0.5			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 Cum

Rs

C
1

Providing Wooden Props for Shoring of Walls and Floors (Raker =100mmx100mm@3.3m spacing, Wall plate=100mmx100mm@3.3m spacing, Cleat=300mmx100mmx75mm)

Rate Analysis for 1 Cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	7.5			
	Unskilled	Md	3.8			
	Timber	cum	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per cum

Note: One element will be used for 3 times.

C
2

Providing Timber shoring while Shifting of Openings (125*125 sq mm horizontal wooden posts with vertical support @ 1 m spacing, Vertical Posts @ 100 *100 sq mm)

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	4.9			
	Unskilled	Md	4.9			
	Timber	cum	1.1			
	Nails (2 inches)	kg	1.2			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per cum

Rs.

Note: One element will be used for 3 times.

D
1

Stone masonry work in mud mortar including supply of hard stone blocks preparing mud mortar and construction of the wall upto 5m high haulage distance upto 30m

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	1			
	Unskilled	Md	2.25			
Material	Block Stone	cum	1			
	Bond Stone	cum	0.1			
	Soil	cum	0.42			
	Water	litre	70			
Tools (3% labor)						
					Actual Cost	
					Overhead Cost (...%)	
					Total Cost	

Rate per 1 cum

D
2

Good quality local chimney made brick work in mud mortar in perfect line, level and finishing including , curing, raking out green mortar from joints and cleaning the brick face before stopping the work and proper bonding with existing masonry all complete as per drawing, specification and instruction by the Engineer.

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	A)Skilled	Md	1			
	B)Unskilled	Md	1.7			
	C)Unskilled	Md	0.2			
Material	Brick	nos	560			
	Soil	cum	0.42			
	Water	litre	100			
Tools for Scaffolding	3% of C)					
Tools (3% labor)						
					Actual Cost	
					Overhead Cost (...%)	
					Total Cost	

Rate per 1 cum

Rs.

D Stone masonry work in cement mortar including supply of hard stone blocks preparing mud mortar and construction of the wall upto 5m high
3 haulage distance upto 30m

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	1.95			
	Unskilled	Md	2.06			
Material	Cement	MT	0.07			
	Sand(river)	cum	0.3			
	Block stone	cum	1.1			
	bond stone	cum	0.1			
	Water	litre	150			
Tools (3% labor)						
					Actual Cost	
					Overhead Cost (...%)	
					Total Cost	

Rate per 1 cum

Rs.

D Good quality local chimney made brick work in cement sand mortar (1:6) in perfect line, level and finishing including , curing, raking out green
4 mortar from joints and cleaning the brick face before stopping the work and proper bonding with existing masonry all complete as per drawing, specification and instruction by the Engineer.

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	A) Skilled	Md	1.5			
	B) Unskilled	Md	2.2			
	C) Unskilled	Md	0.7			
Material	Cement	bags	1.4			
	Brick	nos	560			
	Sand	cum	0.3			
	water	litre	100			
Tools for Scaffolding (3% of C)						
					Actual Cost	
					Overhead Cost (...%)	
					Total Cost	

Rate per 1 cum

Rs.

D
5

Dry flat brick soiling

Rate Analysis for 10 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.5			
	Unskilled	Md	1			
Material	Brick	nos	420			
	Sand(river)	cum	0.71			
Tools (3% labor)						
						Actual Cost
						Overhead Cost (...%)
						Total Cost

Rate per 1 sq.m

Rs.

D
6

Dry stone laying (soling)

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	1			
	Unskilled	Md	3.5			
Material	Stone	cum	1.1			
	Sand	cum	0.25			
Tools (3% labor)						
						Actual Cost
						Overhead Cost (...%)
						Total Cost

Rate per 1 cum

Rs.

E	Providing, mixing and laying P.C.C. in 1:2:4 ratio for foundation, beam with stone aggregate(10/ 20mm) down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.
1	

Rate Analysis for 1 cum

Elements	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	1			
	Unskilled	Md	4			
Material	Cement	Bags	6.4			
	Aggregate	cum	0.86			
	Sand	cum	0.445			
	Water	ltr	150			
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 cum

Rs.

E	Providing, mixing and laying R.C.C. in 1:2:4 ratio for foundation, beam with stone aggregate(10/ 20mm) down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.
2	

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.8			
	Unskilled	Md	7			
Material	Cement	Bags	6.4			
	Aggregate	cum	0.86			
	Sand	cum	0.445			
	Water	ltr	150			
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 cum

Rs.

E	Providing, mixing and laying R.C.C. in 1:1.5:3 ratio for foundation, beam with stone aggregate(10/ 20mm) down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.
3	

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.8			
	Unskilled	Md	7			
Material	Cement	Bags	8			
	Aggregate	cum	0.86			
	Sand	cum	0.43			
	Water	ltr	200			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 cum

Rs.

E	Providing high strength deformed bars (HYSD) of grade Fe:415 approved reinforcement confirming to IS: 1786 - 1985 for R.C.C work and approved bar bending schedule including straightening, cutting, bending, placing and binding in position by binding wires all complete as per drawing, specification and instruction by the Engineer.
4	

Rate Analysis for 1 metric ton

Elements	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	12			
	Unskilled	Md	12			
Material	TMT Rod	Metric ton	1.05			
	Binding Wire	kg	10			
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 metric ton

Rs.

F	Providing, fitting and fixing standard formwork of shuttering local wood including all necessary metal/wooden props, bracing, wedges and nails etc. and careful removal of form works at approved time for all type of R.C.C. works all complete as per specification and instruction by the Engineer.
1	

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.267			
	Unskilled	Md	0.4			
Material	Wooden Form	cum	0.07			
	Nails	kg	0.25			
Damage recovery (30%)						
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs. 0

G	Providing, cutting and laying SWG10 welded wire mesh and mesh size 50x50 mm including anchoring it on the wall with 4.75mm bar by drilling and fixing with cement slurry as per drawing details, specification and instruction by the Engineer.
1	

Rate Analysis for 1 sq.m

Elements	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.09			
	Unskilled	Md	0.12			
Material	Wiremesh	sq.m	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

G
2

Providing, cutting and laying SWG10 welded wire mesh of mesh size 25x25m as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.09			
	Unskilled	Md	0.12			
Material	Wiremesh	sq.m	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

G
3

Providing, cutting and laying SWG12 welded wire mesh and mesh size 50x50 mm including anchoring it on the wall with 4.75mm bar by drilling and fixing with cement slurry as per drawing details, specification and instruction by the Engineer.

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.09			
	Unskilled	Md	0.12			
Material	Wiremesh	sq.m	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

G
4

Providing, cutting and laying SWG14 (2.03mm) welded wire mesh of mesh size 31mmx31mm as per drawing details, specification and instruction by the Engineer

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.12			
	Unskilled	Md	0.23			
Material	Wiremesh	sq.m	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

G
5

Providing, cutting and laying SWG12 welded wire mesh of mesh size 25mmx25mm as per drawing details, specification and instruction by the Engineer

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.09			
	Unskilled	Md	0.12			
Material	Wiremesh	sq.m	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

G	Providing, cutting and laying SWG15(1.83mm) welded wire mesh of mesh size 20x20m as per drawing details, specification and instruction by the Engineer.
6	

Rate Analysis for 1 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.09			
	Unskilled	Md	0.12			
Material	Wiremesh	sq.m	1.1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

H	Cement plaster works over on walls, with cement sand mix (1:4) and 12.5 mm thick or as per existing plaster thickness in perfect line, level and plumb, making grooves on boundary of existing plaster and new plaster including cleaning and wetting the surface and curing all complete as per specification and instruction by the Engineer.
1	

Rate Analysis for 100 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	12			
	Unskilled	Md	16			
Material	Cement	bags	10.8			
	Sand	cum	1.5			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

H
2

Cement plaster works over GI wire mesh / chicken wire mesh on Brick walls, with cement sand mix (1:3) and 30 mm thick

Rate Analysis for 100 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	16			
	Unskilled	Md	16			
Material	Cement	bags	30			
	Sand	cum	3			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

H
3

Cement plaster works over GI wire mesh / chicken wire mesh on Brick walls, with cement sand mix (1:3) and 20 mm thick

Rate Analysis for 100 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	15			
	Unskilled	Md	15			
Material	Cement	bags	20			
	Sand	cum	2			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

H
4

Cement plaster works over GI wire mesh / chicken wire mesh on Stone masonry walls, with cement sand mix (1:3) and 35 mm thick

Rate Analysis for 100 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.391			
	Unskilled	Md	0.781			
Material	Cement	bags	0.4368			
	Sand	cum	0.046			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

H
5

40mm (Double Layer) Plastering work @ 1:3 Cement Mortar at the location of welded wiremesh and GI Wire jacketing (First layer of 25mm and second layer of 15mm.)

Rate Analysis for 100 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	16			
	Unskilled	Md	35			
Material	Cement	bags	42			
	Sand	cum	4.29			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

1
1

Providing 12G GI Wire @ 100mm c/c for prevention of local failure

Rate Analysis for 1 sqm area

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.06			
	Unskilled	Md	0.06			
Material	12G GI Wire	kg	1.012			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

1
2

Fixing 4mm dia G.I wire in specified location attached with each corss link hook placed at specified interval

Rate Analysis for 10 rm

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.179			
	Unskilled	Md	0.357			
Material	4mm GI Wire	kg	1			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 rm

Rs.

J
1

Throughout anchoring of SWG 10 (3.15) mm wire at 600 mm c/c with staggered layout for connection of jacketing mesh on both sides of wall

Rate Analysis for 1 nos.

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	MD	0.017			
	Unskilled	MD	0.017			
Materials	SWG 10(3.15) mm wire	kg	0.09			
Tools	Drilling Machine					
	Drill bit					
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 no.

Rs.

J
2

Anchorage of 4.75 mm bar with staggered layout at 600 mm c/c for connecting splints and bandages on both sides of wall

Rate Analysis for 1 nos.

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	MD	0.025			
	Unskilled	MD	0			
Material	Cement	Bags	0.002			
	Sand	cum	0.0003			
	4.75 mm rebar	kg	0.03			
Tools (3% labor)	Drilling Machine					
	Drilling Bit					
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 no.

Rs.

J
3

Cast In-situ Concrete Shear Connector for all belts in 450 mm thick wall with 8mm TOR rod and infill of Concrete 1:2:4 (Include making hole of 4''*4'')

Rate Analysis for 10 nos.

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	MD	0.056			
	Unskilled	MD	0.083			
Material	Steel -8mm dia.	Kg	0.16			
	Cement	Bag	0.011			
	Sand	cum	0.001			
	Aggregate	cum	0.002			
				Actual Cost		
				Overhead Cost (...%)		
				Total Cost		

Rate per 1 no.

Rs.

K
1

150mm thick and 450mm deep Through concrete placed in existing wall to prevent wall delamination

Rate Analysis for 10 nos.

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.5			
	Unskilled	Md	2.5			
Material	Cement	bags	0.7			
	Sand	cum	0.04			
	Aggregate	cum	0.08			
	Rebar (7mm)	kg	2			
				Actual Cost		
				Overhead Cost (...%)		
				Total Cost		

Rate per 1 no.

Rs.

K
2

Providing 150mm thick and 450mm long dowel for anchoring the new element with the existing element using rebar and concrete

Rate Analysis for 10 nos.

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.6			
	Unskilled	Md	2.5			
Material	Cement	bags	1			
	Sand	cum	0.04			
	Aggregate	cum	0.08			
	Rebar (12mm)	kg	11			
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 no.

Rs.

K
3

Providing the timber splicing for the wooden posts with splicing member

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	31			
	Unskilled	Md	3			
Material	Soft Wood	cum	1.1			
	12 mm bolt/Threaded rod	kg	183			
	Nuts and washers each	nos.	610			
Drilling Works (1% of total cost)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per cum

Rs.

L
1

Providing wooden frames as light gable

Rate Analysis for 1 cum

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	16.82			
	Unskilled	Md	5.61			
Material	Timber	cum	1.1			
	Nails	kg	16.82			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 cum

Rs.

L
2

Providing and fixing 24 Gauge CGI Sheet as light material.

Rate Analysis for 10 sq.m

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	1.1			
	Unskilled	Md	1.25			
Material	CGI Sheet (24 Gauge)	sqm	12			
	Nails	kg	0.5			
	Washer	nos	55			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per 1 sq.m

Rs.

M
1

Connection of rafter and purlin with 12G GI Wire

Rate Analysis for 40 connections

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Unskilled	Md	1			
Material	12G GI Wires	kg	1.2			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per connection

Rs.

M
2

Connection of sill plate with ring beam (1000mm x 75mm double folded 24 Gauge Plain GI Sheet)

Rate Analysis for 30 connections

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	1			
	Unskilled	Md	2			
Material	Plain GI Sheet	sqm	4.5			
	Nails (1.5")	kg	1.5			
Tools (3% labor)						
Actual Cost						
Overhead Cost (...%)						
Total Cost						

Rate per connection

Rs.

M
3

Connection of Ridge Beam and Timber Post with Plain GI Strap (24 Gauge)

Rate Analysis for 3 connections

Resources	Particulars	Unit	Quantity	Unit Price	Total	Elements Total
Manpower	Skilled	Md	0.25			
	Unskilled	Md	1			
Material	Plain GI Sheet	sqm	0.412			
	Nails (1.5")	kg	0.5			
Tools (3% labor)						
						Actual Cost
						Overhead Cost (...%)
						Total Cost

Rs.

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Rate per connection

**CALCULATION/OBSERVATION
FOR
NORMS CALCULATION**

H3	20mm (Double Layer) Plastering work @ 1:3 Cement Mortar at the location of welded wiremesh and GI Wire jacketing					
	Area (sq.m)	100				
	Thickness (mm)	20				
	Ratio	1:3				
	Plaster volume (cum)=	2				
	Increasing plaster volume by 30% for dry volume					
	Total volume=	2.6				
			cum	kg	bags	
	Cement =	0.65	0.65	936	19	
	Adding 10% for slurry and wastage				21	
	Sand=	1.95	cum			
	Adding 10% for wastage	2.145	cum			
	Skilled Manpower	16	On observation it was found that one mason in a day can plaster a wall panel of height 7 feet and width 10 feet , which is equal to around 68 sq ft(6.25 sq m) . Hence, for 100 sqm 16 MDs are required.			
	Unskilled Manpower	16	The unskilled manpower is required to support the skilled one in carrying and preparing 1:3 rich cement mortar using cement, sand, water and necessary tools like spade. Further, the manpower is also responsible for spraying slurry and supplying/hauling of prepared material to the skilled one.			

H2	30mm (Double Layer) Plastering work @ 1:3 Cement Mortar at the location of welded wiremesh and GI Wire jacketing					
	Area (sq.m)	100				
	Thickness (mm)	30				
	Ratio	1:3				
	Plaster volume (cum)=	3				
	Increasing plaster volume by 30% for dry volume					
	Total volume=	3.9				
	Cement =	0.975	0.975	1404	29	
	Adding 10% for slurry and wastage				32	
	Sand=	2.925	cum			
	Adding 10% for wastage	3.2175	cum			
	Skilled Manpower	15	On observation it was found that one mason in a day can plaster a wall panel of height 7 feet and width 10 feet , which is equal to around 72 sq ft(6.66 sq m) . Hence, for 100 sqm 15 MDs are required.			
	Unskilled Manpower	15	The unskilled manpower is required to support the skilled one in carrying and preparing 1:3 rich cement mortar using cement, sand, water and necessary tools like spade. Further, the manpower is also responsible for spraying slurry and supplying/hauling of prepared material to the skilled one.			

G1	Providing, cutting and laying SWG10 welded wire mesh and mesh size 50x50 mm as per drawing details, specification and instruction by the Engineer.		
	Skilled Manpower	0.09 MD	While cutting and installing a GI Welded Wire Mesh over surface of wall, it has been observed that skilled manpower is necessary to initially place, temporarily anchor and help other unskilled masons. For all these works total time taken for 1 sqm area is 44 minutes.
	Unskilled Manpower	0.12 MD	Unskilled Manpower are required to remove the existing interventions like joist, roofing materials, nailing wire mesh over walls and other purposes. For all these works total time taken for 1 sqm area is around 58 to 60 minutes.

J2	Anchorage of 4.75 mm bar with staggered layout at 600 mm c/c for connecting splints and bandages on both sides of wall					
	Total time required for preparation, placing and fixing of anchorages.					
	For preparation of anchorage bar	4	minutes			
	For drilling of holes	2	minutes			
	For placing and tampering rich cement mortar inside the hole	6	minutes			
	Total time required	12	minutes			
	Hence, converting it into man days, as skilled manpowers are used:					
	Skilled manpower required	0.025	MD			
	Drilling Works					
	Drilling Machine	3				
	Drilling Bit	2				
						Rate of renting each drilling machine is around NPR 500 per day. Such machines are used for around 8-10 days and their are around 1000 anchorage holes in an average Nepali building. Hence $((500*8)/1000)$ gives about Npr 3 per hole for drilling machine. Likewise, for drilling bit, an average bit when made locally from rods will cost NPR 800. Since 3-4 such bits are sufficient for a building in normal cases, per hole cost for 1000 holes is around NPR 2.

J1	Throughout anchoring of SWG 10 (3.15) mm wire at 600 mm c/c with staggered layout for connection of jacketing mesh on both sides of wall					
	Total time required for preparation, placing and fixing of anchorages.					
	For drilling of holes	8	minutes	In General this is done by 2 set of masons who sit at inner and outer side of walls.		
	For placing and tampering rich cement mortar inside the hole	8	minutes			
	Total time required	16	minutes			
	Hence, converting it into man days, as skilled manpowers are used:					
	Skilled manpower	0.0166667	MD	Divided the number into a skilled and unskilled masons		
	Unskilled manpower	0.0166667	MD			
	Drilling Works					
	Drilling Machine	3		Rate of renting each drilling machine is around NPR 500 per day. Such machines are used for around 8-10 days and there are around 1000 anchorage holes in an average Nepali building. Hence $((500*8)/1000)$ gives about Npr 3 per hole for drilling machine. Likewise, for drilling bit, an average bit when made locally from rods will cost NPR 800. Since 3-4 such bits are sufficient for a building in normal cases, per hole cost for 1000 holes is around NPR 2.		
	Drilling Bit	2				
I1	Providing 12G GI Wire @ 100mm c/c for prevention of local failure					
	Skilled Manpower	0.06	While cutting and installing a GI wire over surface of wall,			
	Unskilled Manpower	0.06	Unskilled Manpower are required to remove the existing			
	For quantity of material for which wire is placed at 100 mm c/c a sq m area the length is 23 m. (1 extra m is for binding works)					

C1	Providing Wooden Props for Shoring of Walls and Floors		
	Assuming elevation area of shoring = (10m x 5m i.e 10m length of building and 5m height of building)		
	No. of Raker (100mmx100mmx2440mm)	4	no.
	Wall Plate (100mmx100mmx3962mm)	4	no.
	Cleat(75mmx100mmx300mm)	4	no.
	Total volume of timber	0.27	cum
	Skilled	2	Md
	Unskilled	1	Md
	For 1 cum of timber shoring	1	cum
	Timber	1.1	cum
	Skilled	7.5	Md
	Unskilled	3.8	Md

C2	Providing Wooden while Shifting of Openings (125*125 sq mm horizontal wooden posts with vertical support @ 1 m spacing, Vertical Posts @ 100 *100 sq mm)		
	Assuming length of shoring = 4m and height of floor = 2m		
	Vertical Member (100mmx100mmx2000mm)	8	no.
	Horizontal Member (125mmx125mmx4000mm)	4	no.
	Total volume of timber	0.41	cum
	Skilled	2	Md
	Unskilled	2	Md
	Nails	0.5	kg
	For 1 cum of timber shoring	1	cum
	Timber	1.1	cum
	Skilled	4.9	Md
	Unskilled	4.9	Md
	Nails	1.2	kg

G2	Providing, cutting and laying SWG10 welded wire mesh and mesh size 25x25 mm as per drawing details, specification and instruction by the Engineer.		
	Skilled Manpower	0.09	While cutting and installing a GI Welded Wire Mesh over surface of wall, it has been observed that skilled manpower is necessary to initially place, temporarily anchor and help other unskilled masons. For all these works total time taken for 1 sqm area is 44 minutes.
	Unskilled Manpower	0.12	Unskilled Manpower are required to remove the existing interventions like joist, roofing materials, nailing wire mesh over walls and other purposes. For all these works total time taken for 1 sqm area is around 58 to 60 minutes.

G6	Providing, cutting and laying SWG15 welded wire mesh and mesh size 20x20 mm as per drawing details, specification and instruction by the Engineer.		
	Skilled Manpower	0.09	While cutting and installing a GI Welded Wire Mesh over surface of wall, it has been observed that skilled manpower is necessary to initially place, temporarily anchor and help other unskilled masons. For all these works total time taken for 1 sqm area is 44 minutes.
	Unskilled Manpower	0.12	Unskilled Manpower are required to remove the existing interventions like joist, roofing materials, nailing wire mesh over walls and other purposes. For all these works total time taken for 1 sqm area is around 58 to 60 minutes.

H1 Cement plaster works over on walls, with cement sand mix (1:4) and 12.5 mm thick						
Area (sq.m)	100					
Thickness (mm)	12.5					
Ratio	1:4					
Plaster volume (cum)=	1.25					
Increasing plaster volume by 35% for dry volume						
Total volume=	1.6875					
		cum	kg	bags		
Cement =	0.3375	0.3375	486	9.72		
Adding 10% for slurry and wastage				10.692		
Sand=	1.35	cum				
Adding 10% for wastage	1.485	cum				

Skilled Manpower	12	On observation it was found that one mason in a day can plaster a wall panel of height 9 feet and width 10 feet, which is equal to around 90 sq ft(8.36 sq m). Hence, for 100 sqm 12 MDs are required.
Unskilled Manpower	16	The unskilled manpower is required to support the skilled one in carrying and preparing 1:4 rich cement mortar using cement, sand, water and necessary tools like spade. Further, the manpower is also responsible for spraying slurry and supplying/hauling of prepared material to the skilled one.

H5 40mm (Double Layer) Plastering work @ 1:3 Cement Mortar at the location of welded wiremesh and GI Wire jacketing						
Area (sq.m)	100					
Thickness (mm)	40					
Ratio	1:3					
Plaster volume (cum)=	4					
Increasing plaster volume by 30% for dry volume						
Total volume=	5.2					
			cum	kg	bags	
Cement =	1.3	1.3		1872	38	
Adding 10% for slurry and wastage					42	
Sand=	3.9	cum				
Adding 10% for wastage	4.29	cum				

Skilled Manpower	16	On observation it was found that one mason in a day can plaster a wall panel of height 7 feet and width 10 feet, which is equal to around 70 sq ft(6.51 sq m). Hence, for 100 sqm 16 MDs are required.
Unskilled Manpower	35	The unskilled manpower is required to support the skilled one in carrying and preparing 1:3 rich cement mortar using cement, sand, water and necessary tools like spade. Further, the manpower is also responsible for spraying slurry and supplying/hauling of prepared material to the skilled one.

K1	150mm thick and 450mm deep Through concrete placed in existing wall to prevent wall delamination					
	Concrete Work For one no.					
	Volume (cum)	0.01				
	Ratio (Mix=M20)	1:1.5:3				
	Skilled	0.01	Md			
	Unskilled	0.06	Md			
	Cement	0.06	bags			
	Sand	0.003	cum			
	Aggregate	0.01	cum			
	Rebar Work For one no.					
	7mm rebar length required	0.565	m			
	Unit weight (kg/m)	0.30				
	Total kg	0.17	kg			
	Skilled	0.002	Md			
	Unskilled	0.002	Md			
	Rebar (7mm)	0.18	kg			
	Creating Holes in existing wallls for placing through concrete					
	Skilled	0.04	Md			
	Unskilled	0.19	Md			
	Total Material and Labour Required			For 10 no.	Factor	
	Skilled	0.05	Md	0.50	1.00	0.50
	Unskilled	0.25	Md	2.50	1.00	2.50
	Cement	0.06	bags	0.64	1.10	0.70
	Sand	0.003	cum	0.03	1.10	0.04
	Aggregate	0.01	cum	0.07	1.10	0.08
	Rebar (7mm)	0.18	kg	1.79	1.10	1.97

K2	150mm thick and 450mm long dowel for anchoring the new element with the existing element using rebar and concrete					
	Concrete Work For one no.					
	Volume (cum)	0.01				
	Ratio (Mix=M20)	1:1.5:3				
	Skilled	0.01	Md			
	Unskilled	0.06	Md			
	Cement	0.06	bags			
	Sand	0.003	cum			
	Aggregate	0.01	cum			
	Rebar Work For one no.					
	12mm rebar length required	0.99	m			
	Unit weight (kg/m)	0.89				
	Total kg	0.88	kg			
	Skilled	0.011	Md			
	Unskilled	0.011	Md			
	Rebar (12mm)	0.92	kg			
	Creating Holes in existing wallls for placing dowels					
	Skilled	0.04	Md			
	Unskilled	0.18	Md			
	Total Material and Labour Required			For 10 no.	Factor	
	Skilled	0.06	Md	0.60	1.00	0.60
	Unskilled	0.25	Md	2.50	1.00	2.50
	Cement	0.06	bags	0.64	1.10	0.70
	Sand	0.003	cum	0.03	1.10	0.04
	Aggregate	0.01	cum	0.07	1.10	0.08
	Rebar (12mm)	0.92	kg	9.24	1.10	10.16

K3	Timber splicing for the wooden posts with splicing member					
	Soft Wood (730mm x 150mm x 75mm x 2)					
	Volume	0.0164	cum			
	12mm bolt/threaded rod	3.00	kg	According to site experience		
	Nut/Washer	10.00	Nos.			
	Skilled	0.500	Md			
	Unskilled	0.04	Md			
	For 1 cum of Timber					
	Volume	1.1	cum			
	12mm bolt/threaded rod	183	kg			
	Nut/Washer	610	nos			
	Skilled	31	Md			
	Unskilled	3	Md			

L1	Providing wooden frames as light gable					
	Creating timber light gable frame (50mmx100mm)					
	Vertical(50mmx100mmx750mmx6no.)	0.0225	cum			
	Horizontal(50mmx100mmx2500mmx3no.)	0.0375	cum			
	Inclined(50mmx100mmx2920mmx2no.)	0.0292	cum			
	Total on two sides	0.1784	cum			
	Skilled	3	Md			
	Unskilled	1	Md			
	Nails	3	kg			
	For 1 cum of Timber					
	Timber	1.1	cum			
	Skilled	16.82	kg			
	Unskilled	5.61	nos			
	Nails	16.82	Md			

H5	40mm (Double Layer) Plastering work @ 1:3 Cement Mortar at the location of welded wiremesh and GI Wire jacketing					
	Area (sq.m)	100				
	Thickness (mm)	40				
	Ratio	1:3				
	Plaster volume (cum)=	4				
	Increasing plaster volume by 30% for dry volume					
	Total volume=	5.2				
			cum	kg	bags	
	Cement =	1.3	1.3	1872		38
	Adding 10% for slurry and wastage					42
	Sand=	3.9	cum			
	Adding 10% for wastage	4.29	cum			
G4	Providing, cutting and laying SWG10 welded wire mesh and mesh size 31x31 mm as per drawing details, specification and instruction by the Engineer.					
	Skilled Manpower	0.06 MD	While cutting and installing a GI Welded Wire Mesh over surface of wall, it has been observed that skilled manpower is necessary to initially place, temporarily anchor and help other unskilled masons. For all these works total time taken for 1 sqm area is 28 to 30 minutes.			Vertical seismic strap 200 mm (8" approx) wide
	Unskilled Manpower	0.18 MD	Unskilled Manpower are required to remove the existing interventions like joist, roofing materials, nailing wire mesh over walls and other purposes. For all these works total time taken for 1 sqm area is around 88 to 90 minutes.			

Annex 1: Volume of work referred for determination of retrofitting norms

S.N.	Line Items	Unit	TOTAL
1	Labor for removing and Safe Storage	LS	16
2	Demolition of the staircase and disposing debris including, transportation of debris, cleaning the site etc. all complete as per drawing details, specification and instruction by the Engineer.	LS	12
3	Demolition of existing P.C.C. Floor in perfect line, level and disposing the debris including transportation of debris, cleaning the site all complete as per drawing, specification and instruction by the Engineer.	cum	14.29
4	Stripping off the existing mud plaster on the wall, raking out the mud mortar to a depth of 10 mm at joint, surface cleaning and disposing the debris including transportation, etc all complete as per drawing details, specification and instruction by the Engineer.	sqm	3222.06
5	Earthwork in excavation in ordinary to mixed/hard soil in foundation including dressing of sides and proper compaction to trench bed, disposing of excess soil all complete as per drawing, specification and instructions by the Engineer.	cum	60.75
6	Backfilling works after completion of concreting works	cum	38.46
7	Providing and laying flat stone soling with voids filled with sand in foundation in line and level all complete as per drawing, specification and instruction by the Engineer.	sqm	80.95
8	Providing, mixing and laying P.C.C. in 1:1.5:3 ratio for foundation, flooring, beam with stone aggregate 20mm down with proper compaction and completion to perfect line, level and finishing including proper curing all complete as per drawing, specification and instruction by the Engineer.	cum	17.248
9	Providing, fitting and fixing standard formwork of shuttering local wood including all necessary metal/wooden props, bracing, wedges and nails etc. and careful removal of form works at approved time for all type of R.C.C. works all complete as per specification and instruction by the Engineer.	LS	16
10	Providing, cutting and laying SWG12 welded wire mesh and mesh size 50x50 mm including anchoring it on the wall with 4.75mm bar by drilling and fixing with cement slurry as per drawing details, specification and instruction by the Engineer.	sqm	455.82
11	Providing, cutting and laying SWG10 welded wire mesh and mesh size 50x50 mm including anchoring it on the wall with 4.75mm bar by drilling and fixing with cement slurry as per drawing details, specification and instruction by the Engineer.	sqm	1822.35

12	Providing high strength deformed bars (HYSD) of grade Fe:415 approved reinforcement confirming to IS: 1786 - 1985 for R.C.C work and approved bar bending schedule including straightening, cutting, bending, placing and binding in position by binding wires all complete as per drawing, specification and instruction by the Engineer.	MT	1.96
13	SWG 12 Wire mesh making and jacking with mesh size 100mm *100mm	sqm	1439
14	4.75mm anchorage rod	kg	995.219
15	SWG 10(3.24mm)G.I wire @600 c/c for connecting inner and outer mesh.	MT	1.22
16	Cement plaster works over GI wire mesh and jacketing part of whole outer surface of wall with cement sand mix (1:3) and 30 mm thick or as per existing plaster thickness in perfect line, level and plumb, making grooves on boundary of existing plaster and new plaster including cleaning and wetting the surface and curing all complete as per specification and instruction by the Engineer.	sqm	1599.25
17	Cement plaster works over GI wire mesh and jacketing portion of inner wall with cement sand mix (1:3) and 20 mm thick or as per existing plaster thickness in perfect line, level and plumb, making grooves on boundary of existing plaster and new plaster including cleaning and wetting the surface and curing all complete as per specification and instruction by the Engineer.	sqm	1623.785
18	75 mm thick PCC(1:2:4) for floor finish in the excavated part on floor for tie beam	sqm	102.44
19	Addition of cross walls according to necessary design conditions	cum	8.57
20	Scaffolding Works	No.	16