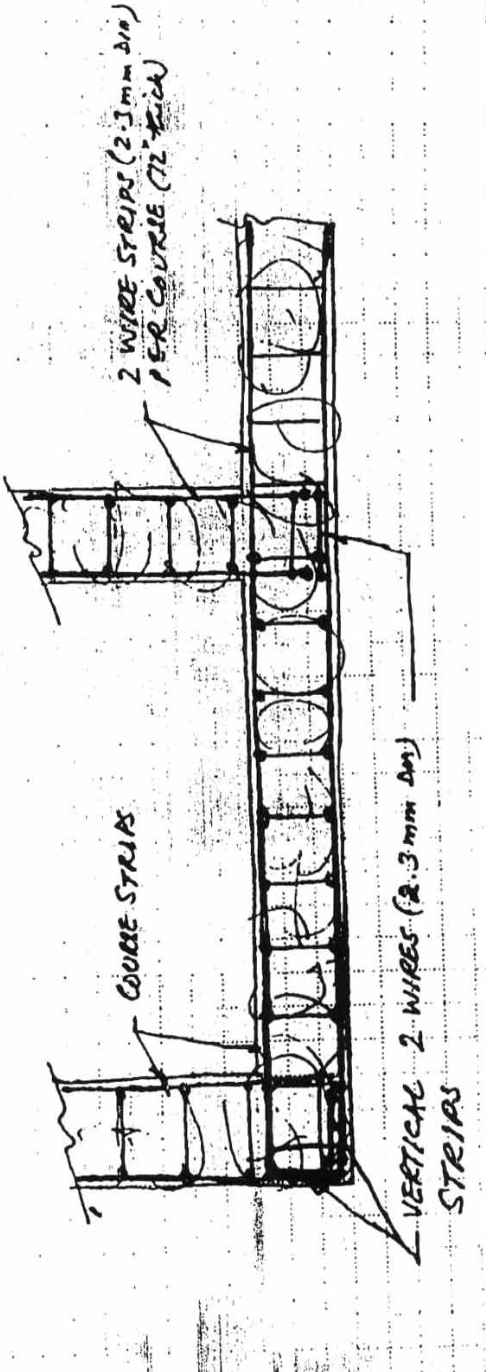
NESPAK
CONSULTING ENGINEERS

PROJECT: BACIP House Improvements
SUBJECT: Application of GI wire mesh Reinforcement

SHEET 6 OF 6
JOB NO. 156
BY KHK.
CHK JAM
DATE 29-5-2000



TYP SECTIONAL PLAN
(STONE WALL CONSTRUCTION

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Thickness Choices

The initial selection of wire thickness for the wall reinforcement was 2 mm, 2.3 mm and 3.2 mm as these wires could be bent using fairly simple methods. After some testing the 2 mm appeared to be the best suited for the light hand-operated equipment used for making the knotted wire-mesh. The 2.3 mm wire was difficult to wind tight. However, because of its higher overall resistance against stress, it was decided to use the 2.3 mm wire as the length wires of the manufactured "ladders" and the 2 mm wire for doing the hand-knotting work. The 3.2 mm wire was found to be the most appropriate for the anchoring wires for floor beams.

Depending on the location in the building and the further development of the equipment, it may be possible to also use the 3.2 mm wire for the length wires that provide the stress reinforcement in the construction. The wave dye equipment will need to be adapted for that purpose as the present equipment has been developed for the 2.3 mm and 2 mm wire knots.

Table of the Different Characteristics of Concrete Reinforcement

Wire Thickness Diameter	2 mm	2,3 mm	3.2 mm
Cross Section	3.14 mm^2	4.15 mm^2	8.04 mm^2
Stress Resistance in Full Elastic Area	60.000 psi = 10.000 pound/cm^2 = 50 kgf/mm^2	60.000 psi = 10.000 pound/cm^2 = 50 kgf/mm^2	60.000 psi = 10.000 pound/cm^2 = 50 kgf/mm^2
Force Resistance in Full Elastic Area	150 kgf	200 kgf	400 kgf
Breaking Resistance	100 kgf/mm^2	100 kgf/mm^2	100 kgf/mm^2
Minimum Breaking Resistance	300 kgf per wire	400 kgf per wire	800 kgf per wire
Cost per kg	Rs. 36 /kg = 0.66 $/kg	Rs. 35 /kg = 0.64 $/kg	Rs. 34 /kg = 0.62 $/kg
Elastic Force : Rs.	50 : 36 = 1.18	50 : 35 = 1.43	50 : 34 = 1.47
Breaking Force : Rs.	**100 : 36 = 2.8**	**100 : 35 = 2.87**	**100 : 34 = 2.94**
Concrete Reinforcement Bars, Non-galvanised	¼" = 6 mm	3/8" = 9 mm	3/8" = 9 mm profiled, cold deformed
Cross Section	28 mm^2	63.5 mm^2	63.5 mm^2
Stress Resistance in Full Elastic Area	26.500 psi = 4.400 pound/cm^2 = 22 kgf/mm^2	26.500 psi = 4.400 pound/cm^2 = 22 kgf/mm^2	45.000 psi = 7.500 pound/cm^2 = 37.5 kgf/mm^2
Force Resistance in Full Elastic Area	600 kgf - 650 kgf	1500 kgf - 1600 kgf	2400 kgf - 2500 kgf
Breaking Resistance	30 kgf/mm^2	30 kgf/mm^2	45 kgf/mm^2
Minimum Breaking Resistance	900 kgf - 1000 kgf per bar	2200 kgf - 2400 kgf per bar	2800 kgf - 3000 kgf per bar
Number of Wires per Common Reinforcement Bar in Elastic Area	600 kgf : 150 kgf = 4	1600 kgf : 200 kgf = 8	2400 kgf : 400 kgf = 6
Number of Wires per Common Reinforcement Bar at Breaking Strength	900 kgf : 300 kgf = 3	2400 kgf : 400 kgf = 6	2800 kgf : 800 kgf = 3.5
Cost per kg	Rs. 22 /kg = 0.40 $/kg	Rs. 23 /kg = 0.42 $/kg	Rs. 26 /kg = 0.47 $/kg
Elastic Force : Rs.	22 : 22 = 1.00	22 : 23 = 0.95	37.5 : 26 = 1.44
Breaking Force : Rs.	**30 : 22 = 1.36**	**30 : 23 = 1.30**	**45 : 26 = 1.73**

For net wire diameter, at breaking point the wire is about twice as effective as the bars per price unit. The distribution of the wire in the wall is much better than that of the bars.

TABLE No. 17.6. Rated Fire Resistive Periods for Various Walls and Partitions*

Material	Construction[1]	Minimum Finished Thickness Face-to-Face (in.)			
		4 hr	3 hr	2 hr	1 hr
Concrete masonry units[2]	expanded slag or pumice	4.7	4.0	3.2	2.1
	expanded clay or shale	5.7	4.8	3.8	2.6
	limestone, cinders or air cooled slag	5.9	5.0	4.0	2.7
	calcareous or siliceous gravel	6.2	5.3	4.2	2.8

*From UBC

[1] Thicknesses shown for concrete masonry units are "equivalent thicknesses" as definec in U.B.C. Standard No. 24-4. Thickness includes plaster, lath and gypsum wallboarc where mentioned and grout when all cells are solidly grouted.

[2] See also Footnote No. 1. The equivalent thickness may include the thickness o. portland cement plaster or 1.5 times the thickness of gypsum plaster applied in accordance with the requirements of Chapter 47 of the Code.

periods of vibration or the introduction of discontinuities and variation in pier sizes or shear walls, the stiffening effect of towers, stairs, and so forth. If potential elements of distress can be eliminated before design, the solution is much simpler.

The calculations herein are concerned primarily with the manipulation of numbers and equations in accordance with the *Uniform Building Code* requirements. There are several types of structural styystems which respond differently to earthquake motion, and accordingly, there are different code coefficients. The load-bearing type of building is a "box" system, that is, bearing and shear wall systems for the vertical loads, with diaphragms to carry the horizontal loads to those vertical shear walls. The assumptions of design are that loads are applied laterally to the structure at their centers of gravity and carried down through the system to the foundation.

The factors determining the magnitude of those forces are largely set on the basis of probability, as in Table 23II of the UBC.[17-1]

We may accept the summaries in the governing codes of earthquake design as the best judgment to follow at present. These, however, are to be considered as economic mini-

TABLE 17.7. Minimum Thickness of Masonry Walls

Type of Masonry	Maximum Ratio unsupported height or length to thickness	Nominal Minimum Thickness (in.)
Bearing Walls:		
unburned clay masonry	10	16
stone masonry	14	16
cavity wall masonry	18	8
hollow unit masonry	18	8
solid masonry	20	8
grouted masonry	20	6
reinforced grouted masonry	25	6
reinforced hollow unit masonry	25	6
Nonbearing Walls:		
exterior unreinforced walls	20	2
exterior reinforced walls	30	2
interior partitions unreinforced	36	2
interior partitions reinforced	48	2

mums, and the engineer is advised designing to those numerical minin may find it advisable to increase tl he may wish to revise a placement to minimize the possibility of damaj

Most of the local code provisions like Los Angeles, and the *Uniform I* on the Lateral Force Recommendi Engineers Association of California, study, exercise of judgment, and coı

17.7.3 Wall Design

Walls and parapets are designed to that would be due to their own ii right angles to the plane of the wa simultaneous vertical loads. This ir combining bending and direct stress. seem to be a complicated problem nize that the walls are designed with than the minimum, and they are su compressive stre: that will minimiz sion. Also, they are relatively sho bending, say, a story height of 8 to I ing stress that might cause tension on masonry section that would complii generally occur due to this type of lc lower stories.

A check should be made of the those carrying roof load only, or fo story, to confirm that the tension e seismic load normal to the face wı compressive value contributed by thı

Essentially, the designer will not forces perpendicular to the wall. Hi: those walls that serve as cantileve direction of the wall plane. This inv. of bending and compression. The (may use the equation:,

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} \text{ shall not e}$$

Although it is recognized that thi: correct, particularly when consideri is adequately on the safe side, wit mitted design stresses, and is safe a use. A more correct and precise me justified in view of the inaccuracy of special conditions warranting closer,