7. OCCUPATIONAL HEALTH AND SAFETY

7. Guideline for Occupational Health and Safety Cost

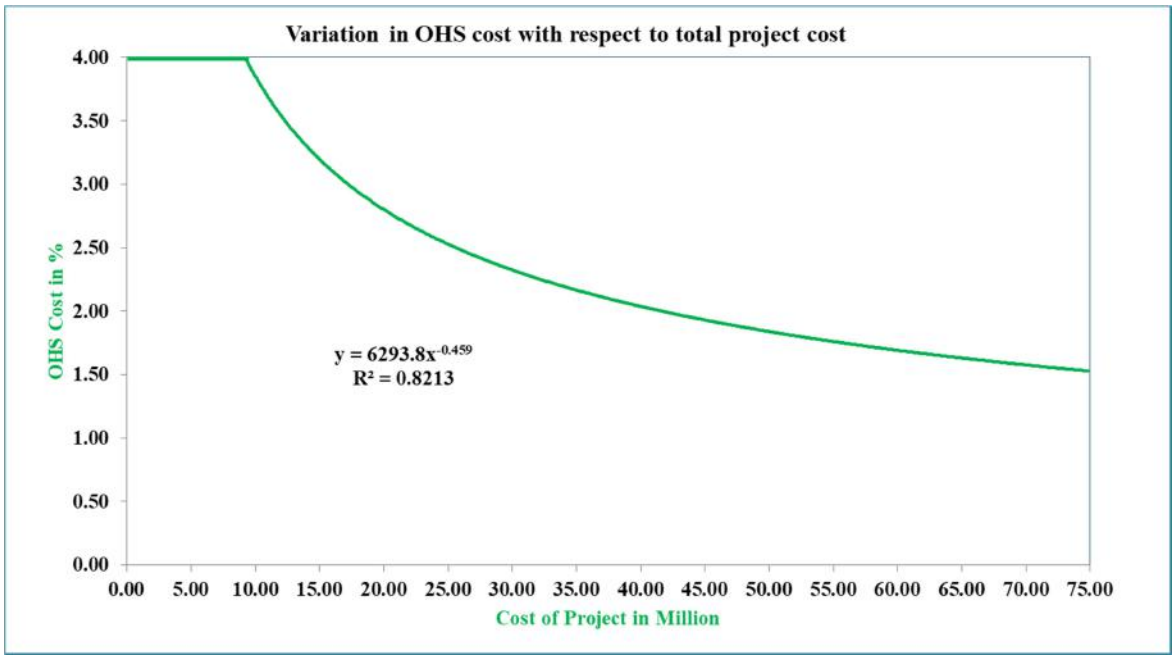
For the purpose of estimation of overall project cost, the cost for Occupational Health and Safety (OHS) may be derived using one of the two equations below, generated from the line of best fit plotted for cost of project versus the percentage of OHS cost. The OHS cost shall be calculated as the percentage of the estimated project cost.

7.1 Selection of the Best Fit Curve

Given the varying nature of the work, it is very challenging to get a best fit curve for every type of construction work. The following curves have been developed for the most common type of construction works in the country. For types of work not covered, the procuring agency may select the curve most suitable to their work from the two curves.

However, the procuring agencies are encouraged to design and analyze their OHS cost depending on the complexity of their project and also if their project requires additional OHS inputs beyond the minimal mandatory requirements specified in Section 2 of this guideline.

7.2 For Buildings and Bridges



$y = 6293.8\ x^{-0.459}$ [1] **(Up to a maximum of 4 percent)**

Where; y = OHS Cost in %

[1] ***Important Note****: For projects where the equation yields a percentage of OHS cost higher than 4 percent, the procuring agencies should limit the OHS cost to a maximum of 4 percent.*

x = estimated project cost

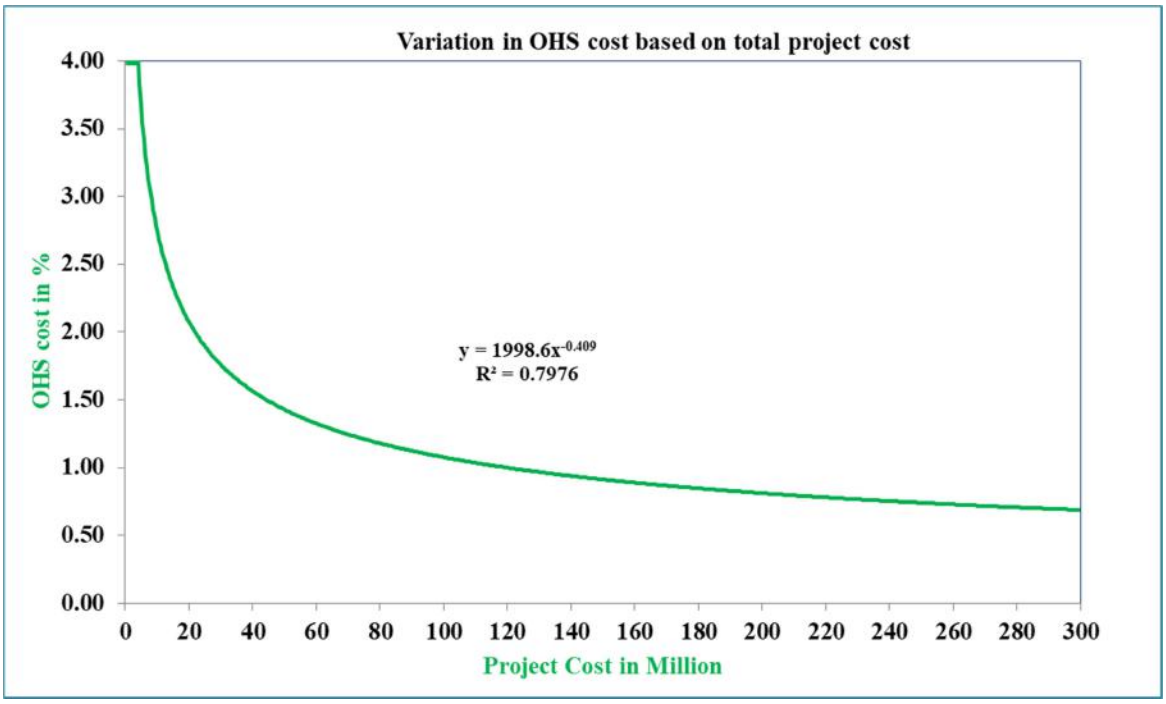
For example, if the estimated project cost is Nu. 30 Million, the cost of OHS would be:

OHS Cost in % = $6293.8*(30{,}000{,}000)^{-0.459}$

= 2.33 %

Therefore, the OHS cost will be: 2.33 % * 30,000,000 = Nu. 699,000.00

7.3 For Road and Irrigation Works



$y = 1998.6\ x^{-0.409}$ [2] **(Up to a maximum of 4%)**

Where; y = OHS Cost in %

x = estimated project cost

For example, if the estimated project cost is Nu.100 Million, the cost of OHS would be:

OHS Cost in % = $1998.6 * (100{,}000{,}000)^{-0.409}$

= 1.07 %

Therefore, the OHS cost will be: 1.07 % * 100,000,000.00 = Nu. 1,070,000.00

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[2] ***Important Note****: For projects where the equation yields a percentage of OHS cost higher than 4 percent, the procuring agencies should limit the OHS cost to a maximum of 4 percent.*

7.4 The following list of OHS inputs are the minimal mandatory requirements at a construction site. These requirements had been derived in consensus with the Department of Labour (DoL), Ministry of Labour and Human Resources (MoLHR).

7.4.1 Insurance

Every worker shall be insured for the entire period of construction. The capital sum to be insured shall be as per the requirements of Labour and Employment Act of Bhutan - 2007 and its regulations.

7.4.2 Personal Protective Equipment (PPE)

Every worker shall be provided with minimal PPE to minimize exposure to hazard and to ensure safety at the construction sites "at all times". The PPE could be grouped and provided as below:

- To be provided to all:
  - Safety helmet
  - Safety shoes
  - Protective gloves
  - High visibility Vest
  - Dust mask
- To be provided to specific workers: [3]
  - Safety belt
  - Safety harness
  - Safety goggle and spectacle
  - Ear muffs
  - Ear plugs
  - Welding shield/glass

7.4.3 Common Protection Measures (CPMs)

- First Aid tool box with aid kits
- Medical examination and records
- Adequate safety signs and signboards
- Boundary fence/barricade
- Fire and electrical safety
- Fall protection
- Trained OHS Officer/ Safety Supervisor/Safety Representative [4]
- Trained first aider [5]
- Safety and health orientation to new workers and safety training
- Housekeeping
- Traffic management at construction site
- Trenching and excavation safety

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[3] *Specific workers includes (but not limited to) those workers working at height, welders, workers engaged in works with high noise level, etc.*

[4] *This requirement will only come into effect after the DoL and CDB starts the required training. The site engineer/project manager of the contractor can be OHS officer after getting trained.*

[5] *The site supervisor or one of the workers can be the first aider after getting trained.*

7.5 The standards and specifications for the OHS materials and (or) equipment shall be in compliance with the Labour and Employment Act - 2007, Regulation on Occupational Health, Safety and Welfare - 2012, and other relevant national documents.

7.6 The list of the OHS requirements as per the above list with additional list (if any) shall be attached along the Bill of Quantities (BoQ) along with an appropriate item description to allow the bidder to quote reasonably against the item, and to enable strict compliance and ease the monitoring during the project implementation time.

7.7 The procuring agency may allow the reuse of OHS items so long as these reused items serve the intended purpose. Furthermore, all OHS items will remain as the property of the bidder upon completion of the project. This is to encourage the bidders to conscientiously assess the OHS cost and quote reasonably keeping in view the reusability of such items in later projects.

Procuring agencies may also include the OHS officer and the first aider as 'key personnel' required by Labour and Employment Act – 2007 and its regulations depending on the complexity of the project.

7.8 Monitoring: Once OHS is integrated into the project cost and the work awarded, the contractor will have to mandatorily mobilize the resources. The site engineers and the respective Procuring Agencies will have to monitor and ensure that the OHS requirements are provided by the contractor at site and used appropriately "at all times". Besides this regular monitoring, a Third Party monitoring of OHS will also be carried out by the Construction Development Board and the Ministry of Labour from time to time.

7.9 Mode of Payment: It is recommended that the payment mode be designed to suit the procuring agency. Before making the payment, the project engineer/site engineer and the project manager should verify and confirm that the OHS input requirements have been mobilized and implemented at site. It is also recommended that the payment be made in phases depending on the nature and duration of the project.

No additional payment for OHS shall be made for Variations (Change of rate, time extension, deviation, price adjustment, additional works, etc.)

7.10 General Note: The guideline is prepared fundamentally for the purpose of estimation of the cost of OHS in the project. For the purpose of the payment, it shall be based on the contractor's quoted amount/contract agreement.

In case of works executed departmentally, the agencies have to insure the workers and procure the PPE/CPM following proper procuring procedures. The items must be properly stored for future use and inventory of the same must be maintained.

8. TEMPORARY LIVING ACCOMMODATION

8.1 Guideline for Estimating Cost of Temporary Living Accommodation

For the estimation purpose, the project estimator can use table – I. However, the payment for the same shall be made based on the contractor's bid. The following steps shall be followed for estimating the cost of accommodation facility for a project.

8.1.1 Although a proper accommodation is encouraged to be provided, its need for a particular project shall be decided by the procuring agency. Some works such as minor maintenance, community contracting, projects with very short project duration, etc., may not require the provision of accommodation. Therefore, the decision on this shall be taken by the procuring agencies diligently.

8.1.2 If it is decided to provide accommodation, then the project estimator shall firstly estimate the average daily number of workers that will be engaged for the project. It is preferred that the daily number of workers be worked out using methods of project planning and management. However, in the absence of required skills and competency to compute the number of workers, project estimators can use the approximate number of workers with practical experience of similar projects. Locate the estimated number of workers for the project in the table - I.

8.1.3 Locate the project duration in the table - I.

8.1.4 The cell corresponding to the number of workers and the project duration will be the cost of accommodation for the particular project.

For example; Let the number of workers be: **8 < N ≤ 12**

The project duration be: **12 months**

Then the cost of accommodation will be: **Nu. 95,196.00**

8.1.5 If the project duration is in between consecutive project durations in the table, the cost of accommodation can be computed by interpolating the value ahead of and the following value of the particular project duration.

For example; let the number of workers be: 8 < N ≤ 12

The project duration be: **14 months** (*this lies between 12 and 18 months*)

Then the cost of accommodation (AC) will be:

$$AC = \left[\frac{AC1 - ACo}{T1 - To}\right] \text{ x (T-To)} + \text{Aco}$$

Where, AC: Accommodation cost for 14 months

ACo: Accommodation cost for 12 months

AC1: Accommodation cost for 18 months

T: Project duration for AC (*14 in this case*)

To: Project duration for ACo (*12 in this case*)

T1: Project duration for ACo (*18 in this case*)

Therefore, the cost of accommodation with number of workers **8 < N ≤ 12** and project duration of 14 months will be:

$$AC = [\frac{108,796 - \ ,196}{18-12}] \times (14-12) + 95,196$$

$$AC = \textbf{Nu. 99,729.33}$$

8.1.6 Use the same description as specified in OHS 002 of Bhutan schedule of Rates. It is recommended to clearly state in the description that after the completion of the project, the facilities provided for the accommodation be dismantled and the site be cleaned. The materials used for the temporary accommodation shall be the property of the contractor. This is to enable the bidders to quote conscientiously.

*A drawing with details, and the **'temporary living accommodation standards'** for accommodation facility shall be attached with the BoQ. The drawing should be prepared as per this standard and the prototype drawing. However, the sizes shall be determined depending on the number of labours estimated in 8.1.2.*

8.1.7 In case the contractor fails to provide specified temporary accommodation, then the procuring agencies can construct accommodation facilities as specified in 'temporary living accommodation standards'. The actual cost of construction can be recovered from the first running bill with the condition that the useful materials of the accommodation facilities can be taken ownership by the contractor. A clause on this may be specified in the Special Conditions of Contract (GCC 16.1) of the bidding document.

8.1.8 No additional payment for accommodation shall be made for variations (Change of rate, time extension, deviation, price adjustment, additional works, etc.).

8.1.9 In case of works executed departmentally, the agencies have to construct accommodation facilities if decided as per step – 1 of this guide. The items must be properly stored for future use and inventory of the same must be maintained.

Note:

If the procuring agencies need additional facilities other than the ones specified, then the procuring agencies can analyse the cost for estimating. The payment shall be based on the bidders quoted rate.

Table 8.1.1 Cost of Accommodation for construction projects

No of Labours (N)	Project Duration, T (months)					
	T≤6	**12**	**18**	**24**	**30**	**36 ≤ T**
N ≤ 4	42,245	47,525	54,315	63,367	76,040	95,051
4 < N ≤ 8	58,187	65,461	74,812	87,281	104,737	130,922
8 < N ≤ 12	84,619	95,196	108,796	126,928	152,314	190,393
12 < N ≤ 16	111,050	124,932	142,779	166,576	199,891	249,864
16 < N ≤ 20	137,482	154,667	176,763	206,223	247,468	309,335
20 < N ≤ 24	169,238	190,393	217,592	253,857	304,628	380,785
24 < N ≤ 28	195,669	220,128	251,575	293,504	352,205	440,256
28 < N ≤ 32	222,101	249,864	285,558	333,151	399,782	499,727
32 < N ≤ 36	238,044	267,799	306,056	357,065	428,479	535,598
36 < N ≤ 40	264,475	297,535	340,040	396,713	476,055	595,069
40 < N ≤ 44	306,720	345,060	394,354	460,080	552,096	690,120
44 < N ≤ 48	322,663	362,995	414,852	483,994	580,793	725,991
48 < N ≤ 52	349,094	392,731	448,835	523,641	628,369	785,462
52 < N ≤ 56	365,037	410,666	469,333	547,555	657,066	821,333
56 < N ≤ 60	391,468	440,402	503,316	587,202	704,643	880,804
60≤ N	For increase in every 4 - labours, add following values for respective project duration, T (months)					
	26,098	29,360	33,554	39,147	46,976	58,720

8.2 Temporary Living Accommodation Standards

When providing living accommodation to workers at construction sites, the objective should be to ensure adequate and decent accommodation and a suitable living environment for workers. The provision of accommodation to workers shall align with the objectives of Occupational Health and Safety. Therefore, it shall meet certain minimum specifications in respect of the nature and standard of the accommodation, and facilities to be made available.

The following specifications are drawn for the provision of accommodation to workers in Bhutanese construction industry based on international labour standards.

8.2.1 Location

The temporary living accommodation for employees should be constructed at the safest place where there is no risk of flooding, landslide, collapse hazards, falling boulders and other elements.

8.2.2 Accommodation

a) A gender friendly living accommodation should be provided.

b) Accommodation should be constructed where workers are protected against the elements (such as wind, cold, rain, heat, etc.)

c) There should be one room for every 4 employees. Adequate headroom and movement space shall be provided. The size of the room shall be at least 3.5 square meter per person (*refer drawing*).

d) A separate kitchen shall be provided if employees cook by themselves. However, if the meals are provided by the employer, a common dining room, canteen or mess room, located away from the sleeping areas should be provided.

e) A separate pour-flush toilet cum bathroom, washing facilities for male and female shall be provided. There shall be one toilet cum bathroom for every six users. The size of the toilet shall comply with the Building Code of Bhutan/ the attached drawing.

f) The floors of each room shall be constructed of wood or concrete. Floor shall be provided with good finishes. All wooden floors shall be elevated not less than 1 foot above the ground level at all points to prevent dampness and to permit free circulation of air beneath.

g) The walls of the bed room and the kitchen must be constructed preferably with ply boards of at least 10 mm thickness (or equivalent) and CGI/ PPI Sheet for roofing. For toilets, both walls and roof shall be constructed with CGI/ PPI sheets (or equivalent).

h) There should be adequate natural light during the daytime and adequate artificial light (*refer drawing*).

i) Adequate ventilation to ensure sufficient movement of air in all conditions of weather and climate.

8.2.3 Health and Hygiene

a) An adequate and convenient water supply shall be provided for drinking, cooking, bathing, and laundry purposes.

b) The accommodation should maintain good sanitation and hygiene (proper drainage system, proper waste management, good housekeeping, etc.).

c) Measures should be taken to prevent the spread of diseases, especially communicable diseases.

8.2.4 Safety at temporary accommodation site

a) Any electricity supplied for the accommodation should abide by the Electricity Act of Bhutan, 2001.

b) There should not be any exposed live wire or unattended electrical switches & sockets in the living accommodation.

c) Every cable used for any purpose should have a plug at one end.

d) Combustible, explosive, and highly flammable materials should not be stored in the living accommodation.

e) Fire safety measures should be taken, including installing and maintaining fire equipment.

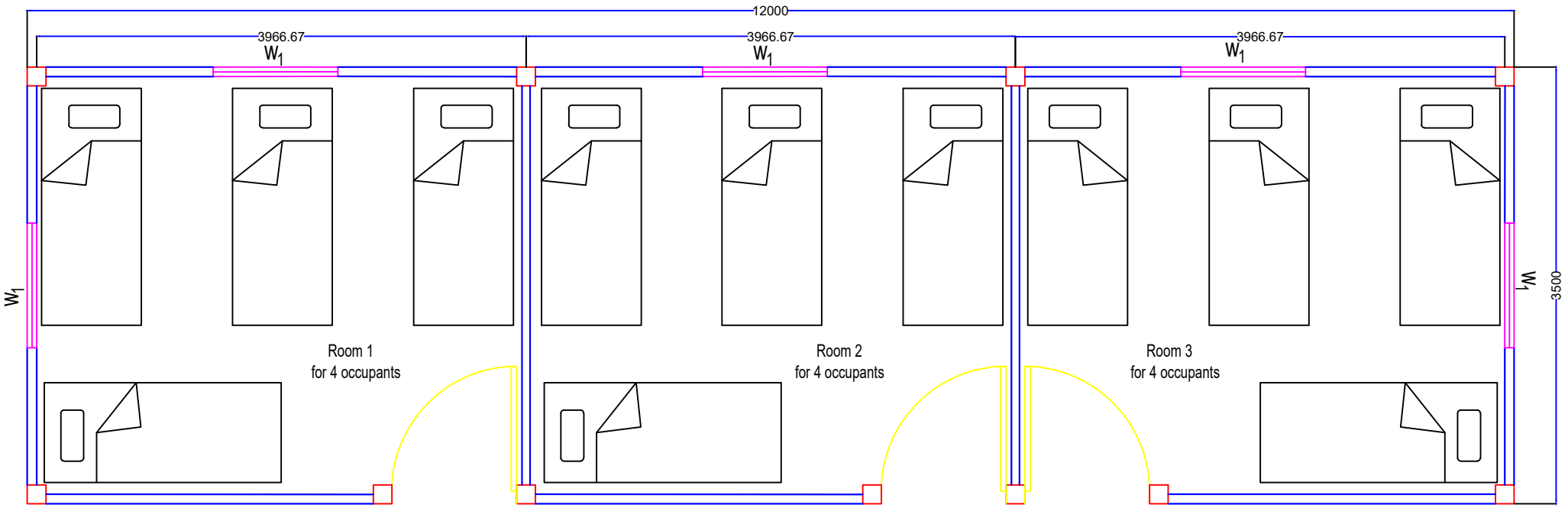
f) As far as possible, floors, walls, ceilings and equipment should be constructed to minimize health risks.

The accommodation shall be provided and maintained for the entire contract period including the time extension if any or the delays. The complete work of providing temporary living accommodation to workers at construction sites shall be treated as an item of work under Occupational Health and Safety.

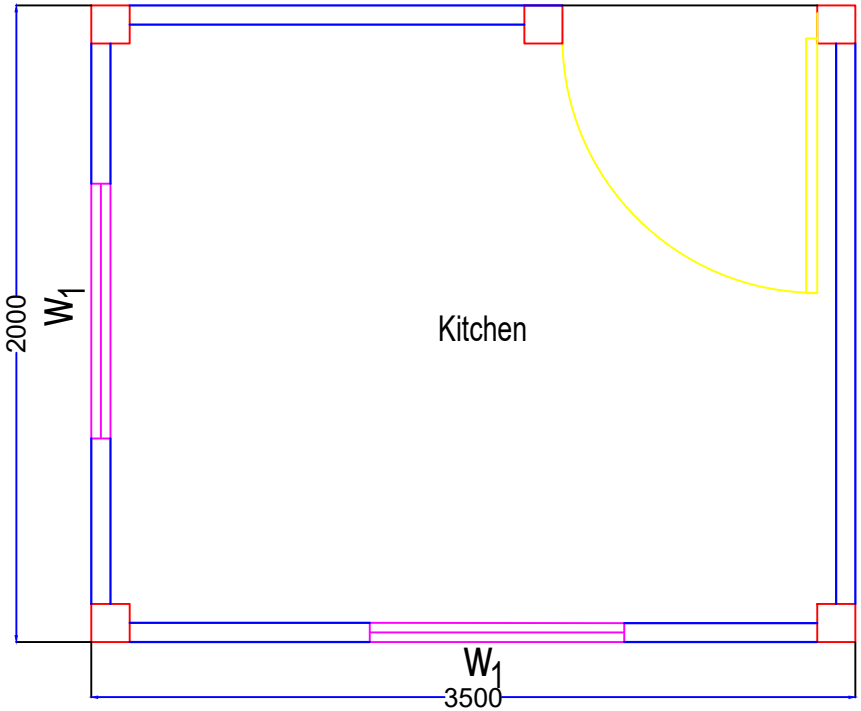
The construction shall be durable taking into account local conditions, such as liability to earthquakes, flood and landslide. The materials used for accommodation will remain as the property of the bidder upon completion of the project. The reuse of the materials may be permitted as long as these reused items serve the intended purpose or as approved by the procuring agency.

Notes:

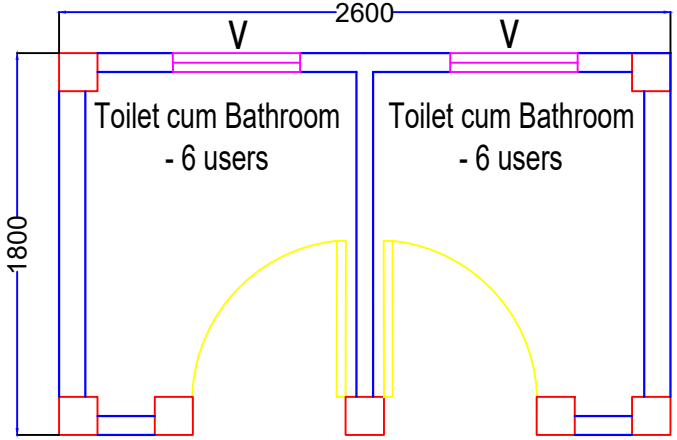
1. *In case the contractor fails to provide specified temporary living accommodation, then the procuring agencies will construct accommodation facilities as specified above. The actual cost of construction will be recovered from the first running bill with the condition that the useful materials of the accommodation facilities can be taken ownership by the contractor.*
2. *No additional payment for accommodation shall be made for variations (Change of rate, time extension, deviation, price adjustment, additional works, etc.).*
3. *The quoted rate shall be inclusive of shifting and rebuilding cost of the accommodation facilities if required.*


12000
3966.67
3966.67
3966.67
W1
W1
W1
W1
W1
3500
Room 1
for 4 occupants
Room 2
for 4 occupants
Room 3
for 4 occupants

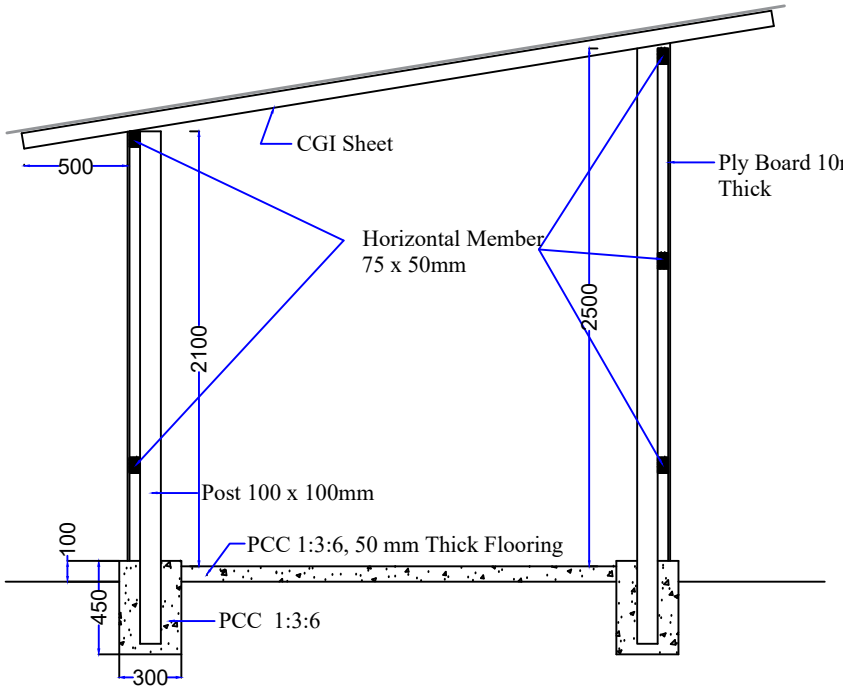
Bed Room



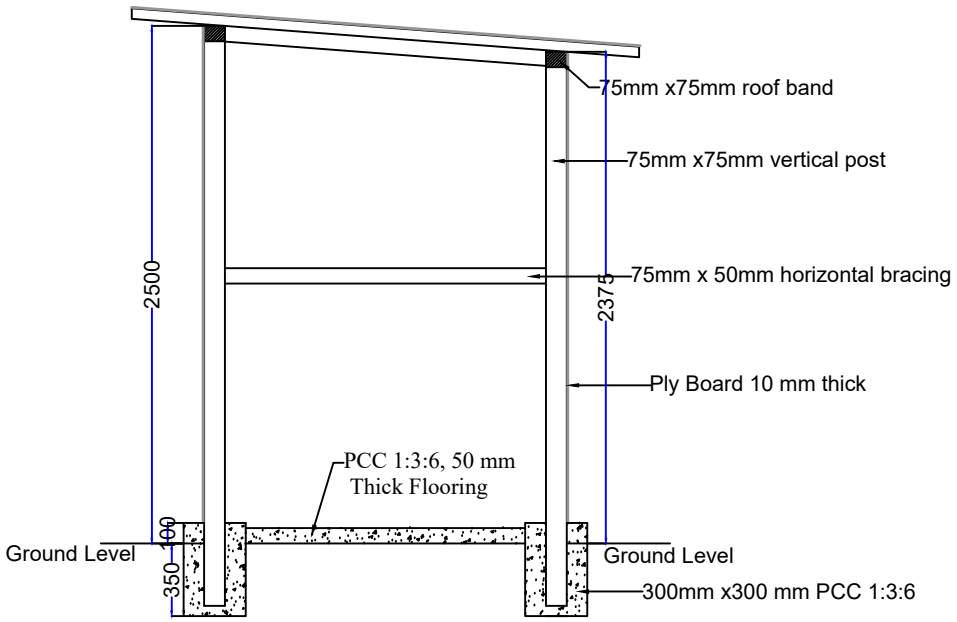
Kitchen



Toilet and Bathroom

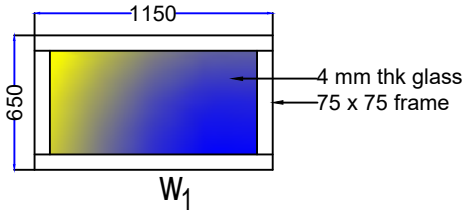


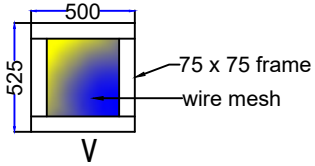
Section for Bed Room and Kitchen



Section for Toilet

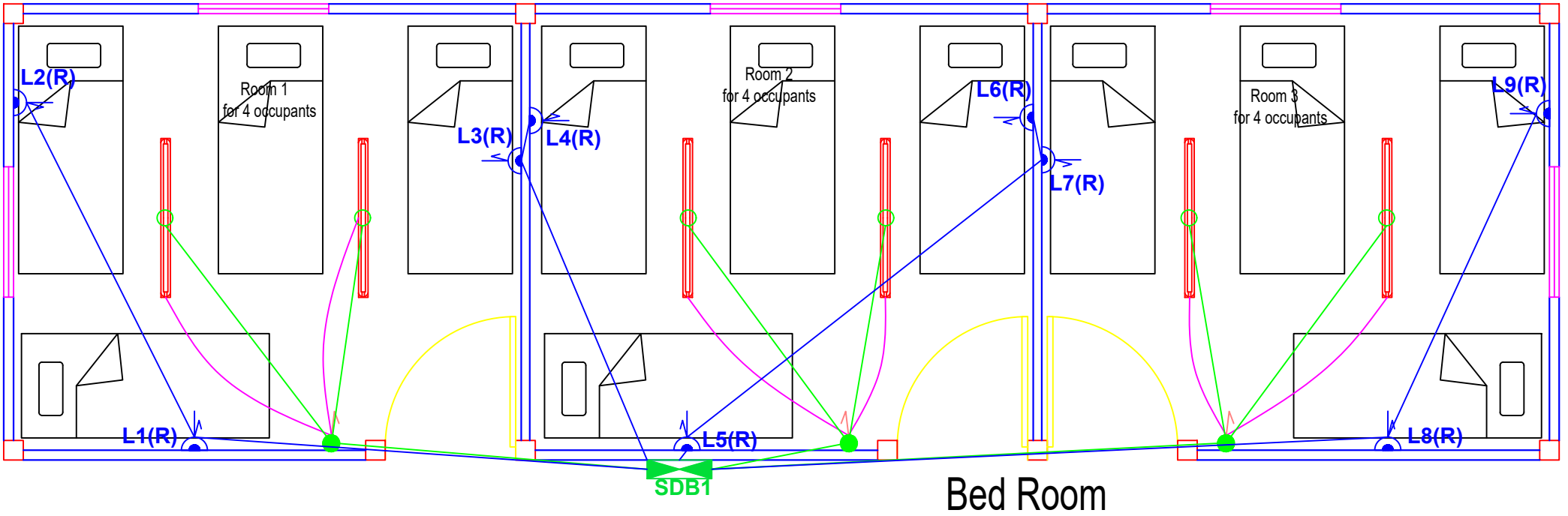
Note: Door size: 750mm x1900mm



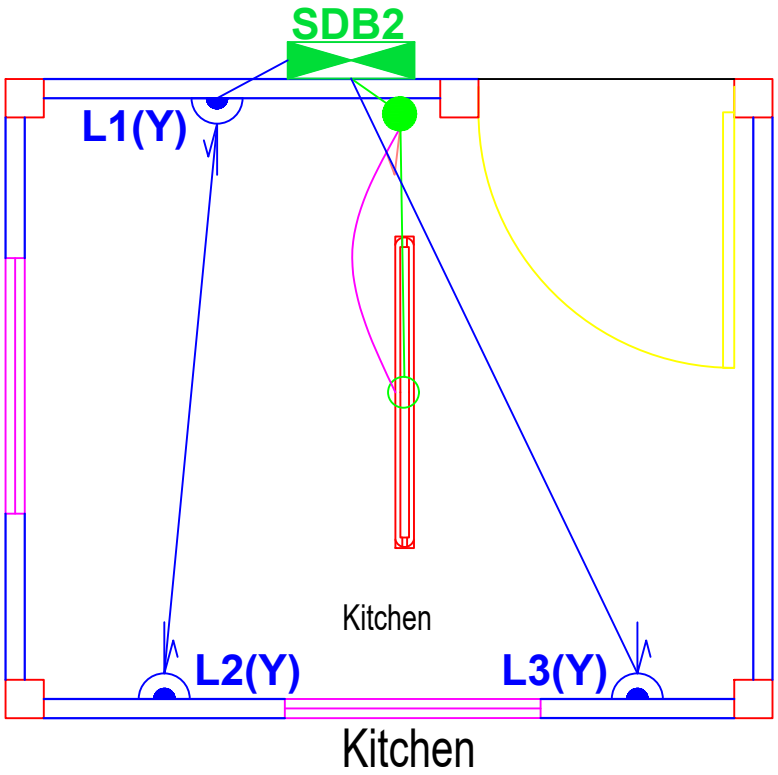


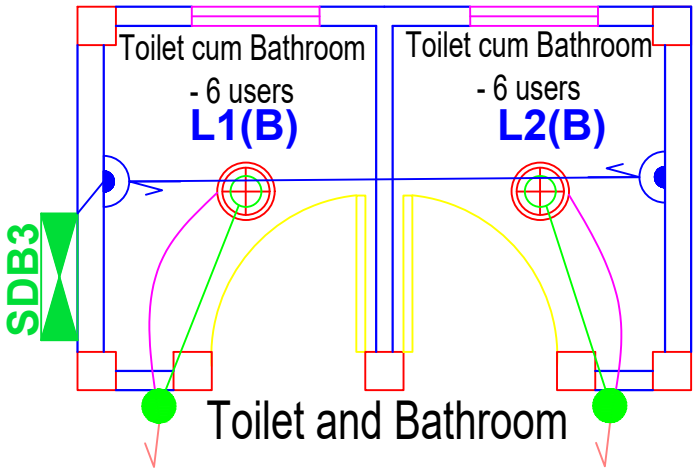
LEGENDS

SL.NO.	DESCRIPTION	SYMBOL
1	INDOOR SURFACE/RECESS IN NORMAL TUBE FRAME WITH LED LAMP OF 1X15W	
2	SURFACE/RECESSED CEILING FOR OUTDOOR WITH LED LAMP OF - 1X12 W	
3	MODULAR POWER SOCKET OUTLET WITH 16A SWITCH FOR 2000W	
4	6A 1-WAY & 2-WAY SWITCH AT 1.5M HEIGHT	
5	WALL MOUNTED MAIN DISTRIBUTION BOARD AT 1.8 M HEIGHT IN GROUND FLOOR	
6	SUB DISTRIBUTION BOARD AT 1.8M HEIGHT FROM FINISHED FLOOR LEVEL	
7	SWITCH BOARD INDICATION IN CONDUIT LAYOUT	

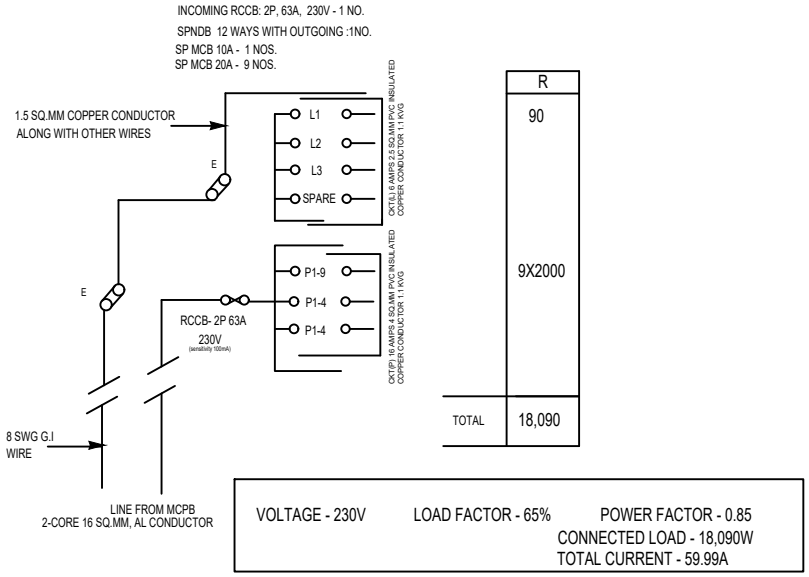

L2(R)
Room 1
for 4 occupants
L3(R)
L4(R)
Room 2
for 4 occupants
L6(R)
L7(R)
Room 3
for 4 occupants
L9(R)
L1(R)
L5(R)
L8(R)
SDB1

Bed Room

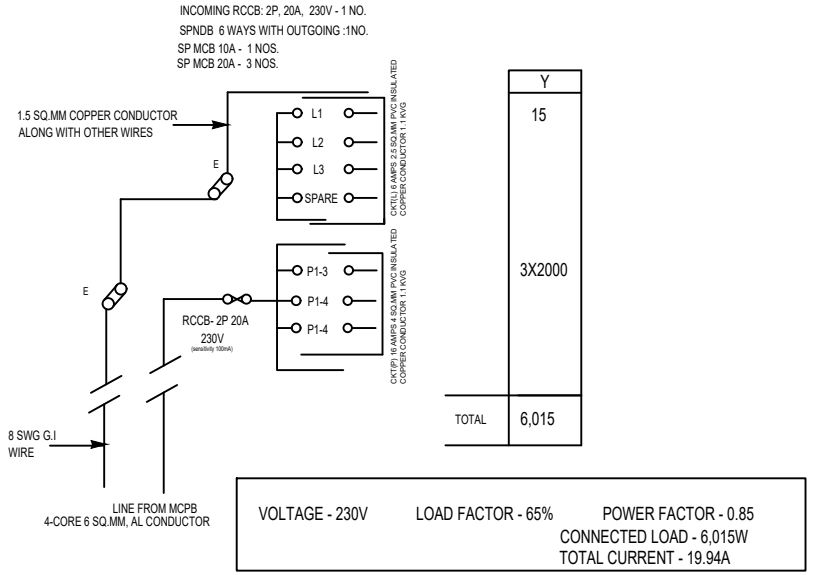

SDB2
L1(Y)
Kitchen
L2(Y)
L3(Y)
Kitchen


Toilet cum Bathroom
- 6 users
L1(B)
Toilet cum Bathroom
- 6 users
L2(B)
SDB3
Toilet and Bathroom

DETAIL DIAGRAM FOR SUB DISTRIBUTION BOARD-1



DETAIL DIAGRAM FOR SUB DISTRIBUTION BOARD-2



DETAIL DIAGRAM FOR SUB DISTRIBUTION BOARD-3