Preparedness and Costing on Fire Safety Installation in Commercial Buildings

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ABSTRACT

Purpose: *The study was carried out to analyze the awareness among the management, occupants and concerned authority of selected commercial buildings at Birtamode, jhapa and prepare the tentative cost of additional tools and equipment's needed.*
Design/Methodology/Approach: *This research is focused on two commercial buildings; Hanuman central and One stop mall (Birtamode Jhapa). These building are selected for research as both of the buildings are considered as largest shopping malls and they also vary in planning and construction technology.*
The fire safety preparedness and awareness of management, occupants were analyzed. After then preparedness and awareness of concerned authority like fire fighters, Municipality and Nepal police were analyzed. Data was collected from occupants, management and concerned authority based on the questionnaires survey, site visits with check list and key informant interview. Information regarding fire safety preparedness and awareness was presented in tabular form, charts and Key informants interview and questionnaire.
Findings/Result: *Fire safety preparedness were lacking due to lack awareness on evacuation procedure and equipment's operation. Management seems to be more focused on financial aspect rather than safety. Lack of proper firefighting equipment's, equipment's in poor condition, unmanaged electrical wires is the existing problem in the buildings. Concerned authority (Birtamode Municipality) had a fire Fighting team with a six fire men with a tank and fire fighting vehicle. But the new technologies like GPS were not introduced to firefighter. There were many cases reported where due to communication gap between the fire fighter and residents, the response was late which resulted more damage. Lack of fire hydrant near the major commercial buildings created problem for fire fighter to refill their water tank. Narrow roads inside the municipality, poor implementation of fire safety code were major problem for fire fighters. The tentative cost for the installation of fire safety tools and equipment's Rs 5, 15,000 and Rs 9, 50,000 for one stop mall and Hanuman central respectively.*
Originality/Value: *The study may be a guiding document for professionals, entrepreneurs and occupants for improving awareness and preparedness by obtaining cost components against fire safety.*
Paper Type: *Research paper*
Keywords: Fire safety installation, Safety in commercial buildings, Preparedness and costing.

1. INTRODUCTION :

Design is the mother of construction [1]. Design of Modern Malls and complex in Urban Areas seem to consider the fire safety in some manner. But the available facility and measures are more like a formality for owners. Date expired extinguisher, lack of emergency exit, poor design, more commercial space than flowing space, owners motive of profit maximization, lack of awareness, lack of electrical drawings, poor electrical connection, low quality electrical material, unmanaged use of electrical appliances due to weather, less knowledge on fire safety, etc. are the major issues seen [2, 3].

As the development works are rapidly increasing day by day fire safety should become a topic to be considered. OHS should be given first priority by concerned authority and management. Although firefighting is top priority for management in big metropolitan city like Kathmandu (capital city of Nepal) and Pokhara, newly emerged city like Damak, Biratnagar, Birtamode are seems to be unaware and negligent in this topic. Management, concerned authority and occupants are also seems to be unaware on this topic and fire has been kept on the least priority by them. Firefighting preparedness is not a priority for government compared to earthquake (UNDP, 2009) [4]. Fire wellbeing code was formed in 1994 A.D. what's more, after then it has quite recently turned into a piece of report and furthermore was never overhauled till now. Indeed, UNDP has expressed the requirement for present day and state-of-the-art fire code. Since NBC 107:1994 [5] is definitely not a specialized yet in addition an authoritative record, it should be refreshed in light of changing conditions to guarantee fire safety. So the researcher has selected two commercial building and assessed fire safety in terms of awareness and preparedness of Management, Concerned authority and Occupants and also calculated the tentative cost of installation of fire safety tools and equipment's in the buildings.

2. STATEMENT OF PROBLEMS :

In July 27, 2019 Fire erupted in Hanuman Central at Birtamode which incurred loss of 20 million. The building caught a flame due to short circuit in an air conditioner machine of shoe shop on ground floor of six storey building [6]. A few months back fire erupted in Sri Krishna market which incurred loss of 15 million. Fire was started from an electronic shop go down around 1:00 – 2:00 am and was taken under control only in 7 am in the morning. Fire fighters from Birtamode Municipality and Mechinagar Municipality along with Nepali Army were able to control the fire.

Fig. 1: Fire at Namaste Ply indsurty at chaitubari, Birtamode -2 (RSS) [7]

In Dec 4, 2020 A gigantic fire broke out at the Namaste Handle Industry at Chaitubari, Birtamod-2 in Jhapa locale and destroyed property worth Rs 3 million. According to Representative Director of Police of Region Police Office Jhapa, Rakesh Thapa, a short out prompted the fire.As police got the data, a joint group comprising the Region Police Office Anarmani, the Territory 1 Debacle The board Organization Chandragadhi and the Furnished Police Power Headquarters Sanischare went for the rescue.Locals and security staff cooperated to drench the fire utilizing fire motors from Damak, Bhadrapur and Birtamod.

In case of Nepal, Safety seems to be of less priority either in design or in operational phase. Owner doesn't seem to be aware and prepared of unforeseen situation. Concerned authority seems weak in implementing the fire safety awareness and fire safety code. NBC Fire code has become just a document. This research mainly focuses on current fire safety condition existing commercial building and awareness and preparedness of management, occupants and concerned authority and prepare a tentative budget for installation of fire safety tools and equipment's.

The study area is one stop mall and Hanuman Central located at Birtamode, Jhapa, Nepal. It can be important document for all three parties for increasing their awareness and preparedness in case of emergency. It can be helpful for the management about the cost of additional fire safety tools and equipment's that can be quickly installed. It can be helpful for new Designers and Developers about the fire safety practice and importance of it in case of emergency.

3. OBJECTIVES :

The Objective is to assess the status of awareness and preparedness of management, concerned authority and occupants along with the cost of installation of fire safety tools and equipment's for Selected Commercial Buildings at Birtamode, Jhapa, Nepal.

4. LITERATURE REVIEW :

4.1 Fire Safety Preparedness:

Readiness involves adjusting one's conduct to decrease the effect of catastrophes on people (Drabek, 1986) [3, 8]. It is a constant pattern of arranging, making due, sorting out, preparing, preparing, working out, making, assessing, checking, and further developing exercises to guarantee powerful coordination and the improvement of capacities of concerned associations in forestalling, safeguarding against, answering, recuperating from, making assets, and moderating the impacts of catastrophic events, demonstrations of psychological oppression, and other man-made calamities [3, 9]. During the preparedness phase, emergency managers create strategies to manage and mitigate their risks, as well as take steps to acquire the required capabilities to put those plans into effect.

Common preparedness measures include:

- Communication plans that use vocabulary and methods that are simple to understand.
- Emergency services should be properly maintained and trained.
- The creation and testing of emergency population warning systems, as well as emergency shelters and evacuation strategies.
- Establish and maintain an emergency communication system that can assist in determining the nature of an emergency and providing instructions as necessary (Ogajo, 2013) [3, 10].

4.2 Fire Safety Management:

In terms of fire prevention and safety, management is critical. A building's fire safety design consists of a range of measures relating to the layout, structure, and other requirements, some of which are activated in the event of a fire (Malhotra, 1993) [11].

Standard investigation, support, posting of notification and exit coordinated signs, normal fire works out, departure methodologies, and the presence of fire superintendents are all essential for fire security the executives (Ogajo, 2013) [10].

The essential objective of fire security the board is to ensure that all open fire wellbeing measures are accessible for people to use in order to aid their escape (Baker, 2003) [12].

4.3 Fire Safety Management Roles and Responsibilities:

In a business facility, pre-planned processes for dealing with a fire emergency are required. The roles and responsible of fire safety management are listed below.

Roles and Responsibilities:

Select a fire security chief to guarantee that fire wellbeing conventions are followed and that upkeep needs are met. Guarantee that staff knows about the wellbeing strategies and the tenants complete their work in a protected way.

An upkeep timetable ought to be produced for all fire recognition/caution frameworks, fire dousers, hose reels, and other comparable things, and records of their review and fix ought to be safeguarded.

Hold regular fire drills for representatives to guarantee that they know about the legitimate method for get out, leave areas, and courses to take in case of a fire.

Make arrangements for evacuation, fire suppression, and aid to the fire department when they arrive. The strategy should be addressed with the fire department, and their agreement on the planned processes should be acquired [2, 3, 11].

4.4 Fire Safety Code:

A building code is a rule or guideline that establishes the minimum standards for the design and construction of structures and buildings. The goal of establishing those basic requirements is to safeguard society's health and safety [13].

In new and existing buildings, structures, and processes, the fire safety code addresses fire prevention, fire protection, life safety, and the proper storage and use of hazardous materials. They give a comprehensive approach to hazard control in all structures and sites (International Code Council, 2009). The fire safety requirements for buildings were researched using NBC 107: 1994 [2, 5].

4.5 Nepal National Building Code NBC 107: 1994:

Nepal national building code NBC 107:1994 provides fundamental requirements for fire safety in ordinary buildings (GoN, 1994). Summary of NBC 107: 1994 are listed below [2, 5].

Exit Requirement:

An entryway, hall, or path prompting an inside flight of stairs, an outside flight of stairs, a verandah going to the road, the top of a structure, or the road is viewed as an exit. The egress could perhaps lead to another structure in the area. The exit should

- Meet the minimum size criteria and enable for the evacuation of all people in a reasonable amount of time.
- Be devoid of any impediments and provide no resistance to movement.
- Be easily seen, especially with appropriate indicators.
- Be consistent and do not encroach on personal space.

Stairs:

- At least two fire escape staircases, one internal and the other external.
- When a building's plinth area reaches 500 m2, more steps must be built in proportion to the increased plinth space.
- The minimum width is 1.5 meters.
- The distance between any point in a hallway and a building's stairway must not exceed 20 meters.

Fire Escapes:

- The Building having 5 or more stories must provide a separate escape with of at least 75 cm width.
- Each riser on the fire escape must be no more than 19 cm high and 20 cm width.
- The number of risers each flight must not exceed 15.
- This type of fire escape should lead users to an open area.

Exit Doors:

Leave entryways should open to a way or a hallway, however not to a way or a passageway, and they should open outwards without impeding the development of individuals passing external the entryway. The greatest distance between any point in the course and such a leave entryway is 20 meters. The width and level of the leave entryway should not be under 90 cm and 180 cm, separately.

5. METHODOLOGY :

5.1 Study Area:

To assess the awareness and preparedness of Management, concerned authority and occupants Buildings selected were one stop mall and Hanuman Central Birtamode.

One Stop Mall:

One stop Mall is Located at Birtamode, Jhapa. It is located at North- west side from mukti chowk (Central part of Birtamode). The building, which is a shopping complex with six stories above ground, was finished in 2016. Three floors including the ground are used for shops and top three floors are used for Cinema purpose. Building is U-shaped with a large steel structure at front connecting to building. The structure has a variety of shops selling various goods and services, as well as leisure venues such as a movie, a game center, and a pub. Underground Parking Facility is also available but the building structural components don’t have any connection with the parking below. Vertical circulation is assisted by escalators, elevators, and stairwells, while horizontal circulation is assisted by walkways and lobby.

Hanuman Central:

Hanuman central is also located at Birtamode, Jhapa touching national highway (Mahendra Highway). It is also known as Hanuman Complex. It was the first Commercial complex build in Birtamode. It was opened in 2012.
It is a Rectangular shaped building with atrium in the center. Vertical circulation is aided by elevators and stairwells, whereas horizontal circulation is aided by walkways and lobby. There are 3 staircases in the building with 3 elevators.

5.2. Research Philosophy:

The descriptive along with field based empirical research design was adopted in this research work. Figure 1 depicts the different stages applied in the research [14].

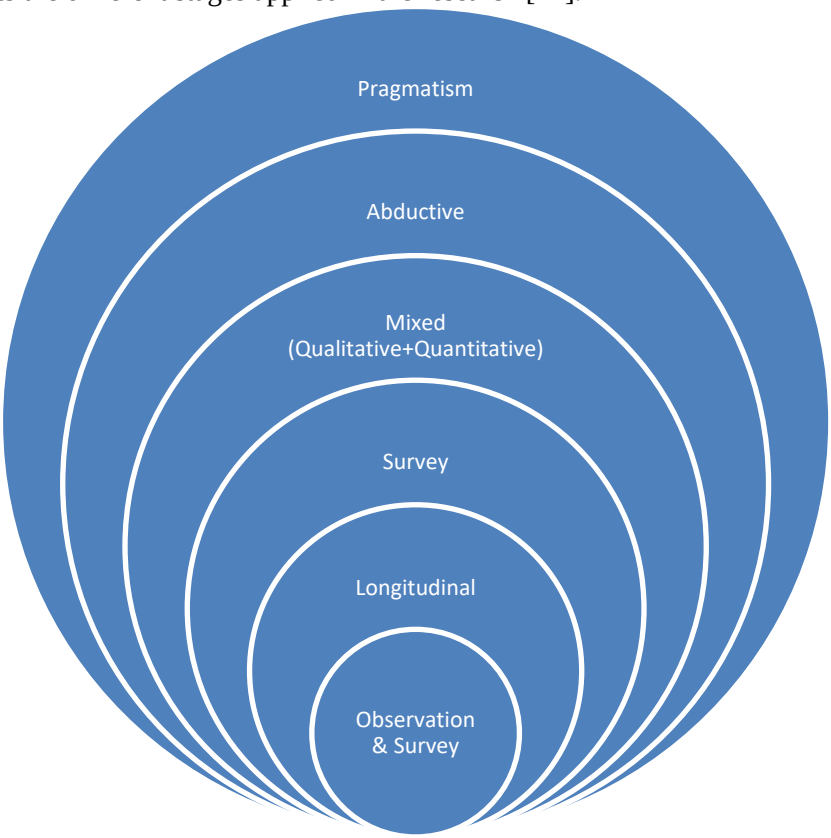

Fig. 1: Research Onion

The overall research philosophy is Pragmatism is in which only "solution" obtained from observation with reliable assessment and objective interpretation. The study outcomes in these sorts of investigations are frequently apparent and quantitative.
Abduction approach for logical reasoning was followed through inductive and deductive ways. Regarding methodological choice, both qualitative as well as quantitative methods were followed. So it's a mixed method. The research strategy was survey. As the data were collected through the different Key informant Interview, Survey and observation, this study was ex-post facto field based. The survey was done on longitudinal time horizon. The data collection methods were observation method, survey, and interview.

5.3 Data Collection:

Questionnaire Survey
Based on the information from the literature review questionnaire was formulated. A survey of the occupants of selected business buildings was done. Management of selected commercial buildings and concerned authority. It was conducted to understand fire safety awareness and preparedness of all three parties. Several references were takes into considerations [15, 16, 17, 18, 19, 20, and 21].
Key Informants Interview

Key informants interview was done with Head of management of Hanuman central and One stop mall, head of fire department(Birtamode Municipality) and Engineer of Birtamode Municipality(Building Department) [15, 16, 17, 18, 19, 20, and 21].

5.4 Methodology in Brief:

Table 1: Summary of Methodology

Objective	Activities	Analysis
1. To identify the level of awareness among management, occupants and concerned authority.	1. Key Informant Interview 2. Questionnaire survey	1. Qualitative Analysis 2. Quantitative Analysis
2. To calculate the tentative cost of installation of fire safety tools and Equipment's.	1. Rate collection and calculation of cost.	1. Qualitative Analysis

6. RESULTS AND DISCUSSION :

6.1 Fire Safety Preparedness of Management, Occupants and Concerned Authority:

The data from the questionnaire was used to create the graphs below, which show the inhabitants', management's, and concerned authority's level of fire safety readiness.

6.1.1 Awareness and Preparedness of Occupants on Fire Safety:

The table 2 shows the level of fire safety readiness among the tenants of all chosen business buildings, i.e., one Stop Mall and Hanuman Central Birtamode.

Table 2: Awareness on Building Feature

	Hanuman Central			One stop Mall		
Awareness on building feature	**Yes**	**No**	**Can't Say**	**Yes**	**No**	**Can't Say**
Building Design	10	12	18	20	19	1
Location of exit	28	11	1	27	13	0
Visibility of emergency sign	4	22	14	26	10	4

Respondents were asked to state whether or not they were aware of a certain building feature. The respondent's response is shown in Table 4.21. Ten Hanuman Central respondents were aware of the building design, 28 were aware of the position of the exit, and four respondents had emergency signs visible. 12 respondents were unfamiliar of the building layout, 11 were unaware of the position of the escape, and 22 respondents did not see an emergency sign. 18 respondents had no clue about the structure plan, 1 had no data about the position of the exit, and 14 had no clue about the crisis sign.

6.1.2 Awareness of Building Feature:

Twenty one-stop mall respondents were aware of the building design, 27 were aware of the position of the exit, and 26 respondents reported that emergency signs were visible. The building design was

unknown to 19 respondents, the location of the exit was unknown to 13 respondents, and the emergency sign was not visible to 10 respondents. One individual had no clue about the structure format, 0 had no clue about the position of the exit, and 4 had no clue about the crisis sign.

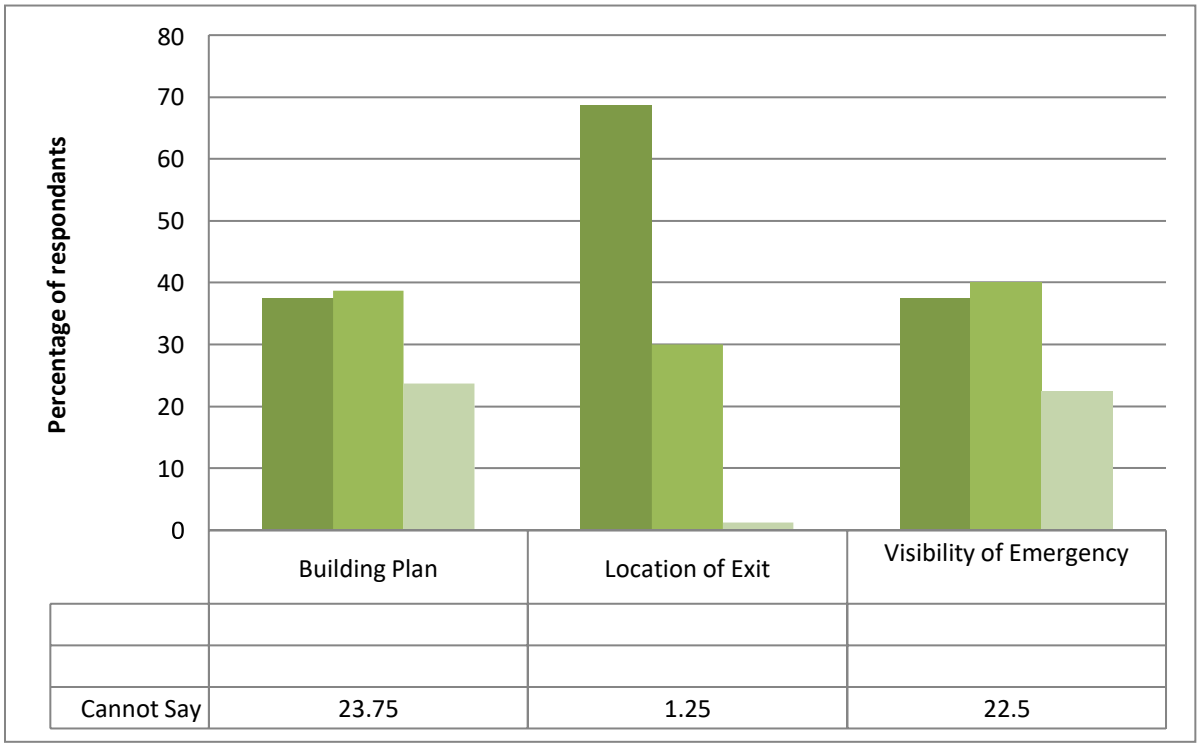

Fig. 2: Awareness of Building Feature

37.5% of respondents knew about building Plan, 38.75% of respondents don't know about plan and 23.75 cannot say. 68.75% have knowledge about exit, 30% don't know and 1.25 cannot say about it, similarly 37.5% knows about emergency sign, 40% haven't seen and 22.5% cannot say about that.

6.1.3 Awareness of Emergency Egress:

20 respondents of Hanuman Central knew about crisis clearing, 12 respondents knew about get together point. 18 respondents didn't know crisis clearing, 16 were uninformed about gathering point. Though, 2 respondents had no clue about crisis departure, 12 respondents had no clue about gathering point.

Table 3: Awareness of Emergency Egress

	Hanuman Central (nos. of occupants)			**One stop mall (nos. of occupants)**		
Awareness on emergency Egress	**Yes**	**No**	**Can't Say**	**Yes**	**No**	**Can't Say**
Emergency evacuation	20	18	2	22	7	11
Assembly point	12	16	12	14	20	6

52.5% of respondents were found aware, 31.25% of respondents were not aware and 16.25% can't say about emergency evacuation. 32.5% were aware, 45% were aware and 22.5% cants ay about Assembly point. It shows that tenants needed mindfulness on crisis departure.

Supervisory group ought to much of the time arrange normal fire drills to guarantee that inhabitants stay mindful of the proper method for get out and where they will stand by after crisis departure. The results are in similar trends to that of study conducted in Kathmandu [3], 22 respondents of LABIM Shopping center knew about crisis clearing, 14 respondents knew about get together point. 7 respondents didn't know about crisis clearing, 20 were uninformed about gathering point. Though, 11 respondents had no clue about crisis departure, 6 respondents had no clue about gathering point.

6.1.4 Provision of Assistance:

15 respondents of Hanuman Central assumed they need help to arrive at spot of security, 12 respondents expected help will be given during fire crisis to arrive at spot of wellbeing. 10 respondents needn't bother with help to arrive at spot of wellbeing, 17 respondents expected help won't be given during fire crisis to arrive at spot of security. Though, 15 respondents couldn't say assuming they required help, and 16 respondents had no clue in the event that help would be given during fire crisis.

Table 4: Provision of Assistance

	Hanuman Central(nos. of occupants)			**One Stop Mall (nos. of occupants)**		
Provision ofassistance	**Yes**	**No**	**Can'tsay**	**Yes**	**No**	**Can'tsay**
Need emergencyassistance	15	10	15	5	21	14
Assistance provided	7	17	16	8	12	20

5 respondents of One stop Shopping center required help to arrive at spot of security, 8 respondents expected help will be given during fire crisis to arrive at spot of wellbeing. 21 respondents needn't bother with help to arrive at spot of wellbeing, 12 respondents accepted help won't be given during fire crisis to arrive at spot of security. Though, 14 respondents couldn't say assuming they required help, and 20 respondents had no clue in the event that help would be given during fire crisis.

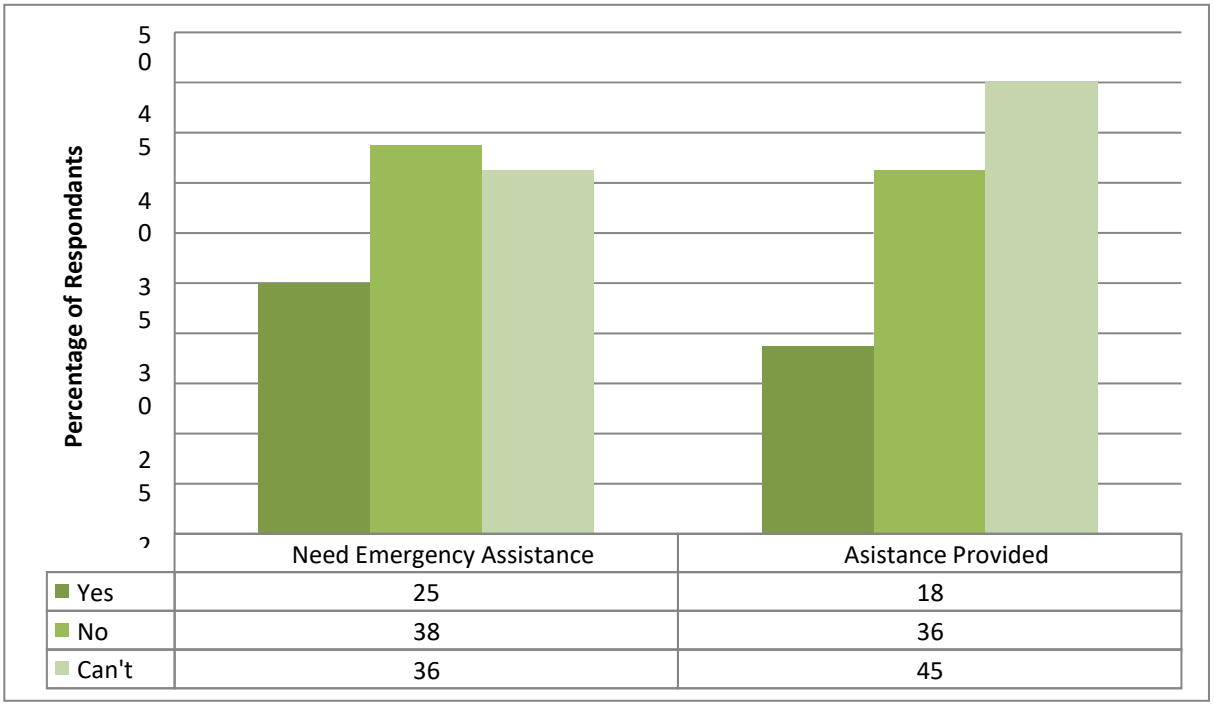

Fig. 3: Awareness on Assistance

25% of respondents expected help to lead them to place of wellbeing during fire crisis, 38.75% needn't bother with any help and 36.25% tenants can't say regarding that. 18.75% accepted that help would be given to during crisis, 36.25% of respondents imagine that help wouldn't be given during crisis and 45% can't say regarding that.

6.1.5 Awareness on Fire Safety Measures:

Respondents of Hanuman Central were mindful about the presence of fire douser, 10 respondents knew about the presence of water Hydrant in building. 10 respondents were uninformed about the presence of fire quencher, 12 respondents were ignorant about the presence of water hydrant and 16 respondents didn't know about fire douser, 18 respondents didn't know about water hydrant.

Table 5: Awareness on Fire Safety Measures

	Hanuman Central(nos. of occupants)			**One Stop Mall (nos. of occupants)**		
Fire safetyMeasures	**Exist**	**Do not exist**	**Not sure**	**Exist**	**Do not exist**	**Not sure**
Fire extinguisher	14	10	16	15	3	22
Water hosereel/water hydrant	10	12	18	12	10	18

Respondents of One stop knew about the presence of fire douser, 12 respondents knew about the presence of water hose reel in building. 3 respondents were uninformed about the presence of fire quencher, 10 respondents were ignorant about the presence of water hose reel and 22 respondents didn't know about fire douser, 18 respondents didn't know about water hose reel.

6.1.6 Ability to Operate Fire Safety Equipment:

10 respondents of Hanuman Central think they had the option to work fire quencher, 5 respondents expected they had the option to work water hose reel/water hydrant. 22 respondents couldn't work fire douser, 25 respondents couldn't work water hose reel. While, 8 respondents were don't know whether they could work fire quencher, 10 respondents were don't know whether they could work water hose reel.

Table 6: Ability to Operate Fire Safety Equipment

	Hanuman Central(nos. of occupants)			**One Stop Mall (nos. of occupants)**		
Ability To Operate Fire Equipment	**Ableto**	**Notable to**	**Not sure**	**Ableto**	**Notable to**	**Not sure**
Fire extinguisher	10	22	8	13	18	9
Water hose reel/waterhydrant	5	25	10	2	30	8

13 respondents of One stop Shopping center accepted they had the option to work fire douser, 2 respondents expected they had the option to work water hose reel/water hydrant. 18 respondents

couldn't work fire douser, 30 respondents couldn't work water hose reel. While, 9 respondents were don't know whether they could work fire quencher, 8 respondents were don't know whether they could work water hose reel/water hydrant.28.75% of respondents had the option to work fire quencher, half of respondent couldn't work and 21.25% were don't know. 8.75% had the option to work water hose reel/water hydrant, 68.75 couldn't and 22.5% were don't know. Table 6 shows that of tenants needed capacity to work the firefighting hardware's. Consequently, appropriate preparation on it will be given to the inhabitants habitually so the misfortune during fire can be decreased. Equipment's with sensor system could be also an effective way as in case of theft most of shopkeeper have found to install sensor based siren which alerts the police on real time about its unauthorized opening. For this step, direct interview was conducted with management. Management seems more focused on financial part of building. Fire extinguisher was only tool for fire safety. There was smoke detector and alarm system installed in One Stop Mall. Management of both the buildings have requested for installation of fire hydrant to Municipality many times. Water hydrant installed in both the building weren't in working condition.

Fire fighter of fire department of Birtamode had many problems regarding communication, training and information about new technology. Concerned authority (Birtamode Municipality) seems weak in implementation of code and law. They are not aware about the fire safety condition of existing commercial buildings. No any seminar or awareness program has been conducted by municipality for fire safety. Even the Municipality building didn't have proper sign for safe evacuation. Fire fighter seems always prepared but due to lack of direct communication they find hard to locate the site. Training for firefighter has been very often. Municipality seems just happy in collecting the fire tax while registration of new house.

6.2.1 Cost estimate For One Stop Mall:

Rates are collected from different website like (Daraz.com and sastodeal.com) and other rates are collected from expert and experience of researcher.

Table 7: Cost estimate For One Stop Mall

S. No.	Description	No	Unit	Rate	Quantity	Remarks
1	Exit Signs and boards(Digital)	10	per piece	2500	25000	
2	Underground water tank for water hydrant (maintenance)	1	L/s	100000	100000	for functioning of existing watertank
3	Fire extinguisher (4.5 kg) CO2	5	per piece	12000	60000	
4	Fire Blanket	5	per piece	5000	25000	for each floor
5	Foam fire extinguisher	5	per piece	5000	25000	for each floor
6	Smoke detector	40	per piece	2500	100000	10 for each floorup to fourth floor
7	Smoke detector Accessoriesand installation charge	1	job	50000	50000	
8	Fire drills	1	job	100000	100000	expert fee, management, accessories fee
9	Awareness program	1	job	25000	25000	expert fee, management, accessories fee
10	Coordination with concerned authority	1	job	5000	5000	regular visit for firefighter, interaction

				Total	**515000**	

Amount in words: - *Five lakh fifteen thousand Only*

Note: - *The above estimates are done on current market rate which may subject to change anytime. As mentioned it is a tentative estimate, so for exact estimate detail cost calculation should be done.*

Table 8: Cost estimate For Hanuman central

S. No.	Description	No	Unit	Rate	Quantity	Remarks
1	Exit Signs and boards(Digital)	20	per piece	2500	50000	-
2	Overhead water tank forwater hydrant	1	L/s	250000	250000	for functioning of existing water tank on top floor
3	Fire Blanket	12	per piece	5000	60000	for 4 floor , at staircase i:e, 3 staircase
4	Foam fire extinguisher	5	per piece	5000	25000	for each floor
5	Smoke detector	150	per piece	2500	375000	for each shop
6	Smoke detector Accessoriesand installation charge	1	job	10000	10000	-
7	Fire drills	1	job	100000	100000	expert fee, management, accessories fee
8	Awareness program	1	job	25000	25000	expert fee, management, accessories fee
9	Coordination with concerned authority	1	job	5000	5000	regular visit for authority(Fire brigade)
10	Emergency alarm system	1	job	50000	50000	
				Total	**950000**	

Amount in words: - *Nine lakh fifty thousand Only*

Note: - *The above estimates are done on current market rate which may subject to change anytime. Asmentioned it is a tentative estimate, so for exact estimate detail cost calculation should be done. Rates are collected from different website like (**Daraz.com and sastodeal.com)** and other rates are collected from expert and experience of researcher.*

The cost of installation is not meaningful in comparison to that of safety assured. This once again verifies the standard theory of safety is investment with positive return, not expenditure as extra burden. Assume chance of fire is very less but the impact once caught is very high so we must assure fire safety system.

7. CONCLUSION :

All three parties (occupants, management, and concerned authorities) lacked awareness and preparedness. The residents of commercial buildings lacked fire safety knowledge and preparedness. They were uninformed about the building's general features, such as the floor plan and egress placement. In the same way, the residents were unaware of the assembly point and emergency evacuation method. They will also require aid in getting to a safe location. They were completely unaware of the building's safety features and were unable to use them. There was no proper fire safety

management in existing commercial buildings, no fire drills were held, and inhabitants received no awareness or training. There was huge communication gap between all three parties. Management and occupants don't have direct communication (phone number) with fire brigade. In case of emergency people use to call Nepal police and Nepal police then call the fire fighter. The gap creates the delay for response. Also due to lack of new technology fire fighter finds hard to find the exact location. There was a problem for refilling the tank as there was no any fire hydrant installed by municipality. Fire fighters have to travel at least one kilometre to refill their tank. Due to unmanaged planning and narrow road fire fighter find hard to reach the location. There was no any coordination among the management, occupants and concerned authority.

Lack of fire expert in the Birtamode area was also a major problem for management to perform fire drills for occupants. The addition of fire safety tools and equipment's to the existing buildings seems less as compared to the loss that had occurred in the past due to fire in the buildings. Also the weakness of Municipality in implementing fire safety codes and guidelines for the large commercial buildings was a major problem seen during study. Fire extinguisher and Fire-fighter from municipality seems to be only tool to fight in case of emergency.

8. RECOMMENDATIONS :

The following points can be recommended for the Management:

(1) The calculated cost of the addition of fire safety tools and equipment's seems less as compared to loss that might occur, so more fire safety tools and equipment's should be added as soon as possible.
(2) Fire drill and awareness program should be conducted frequently in coordination of concerned authority with the help from expert.
(3) The installed system (Water hydrant and water hose reels) should be made functional as soon as possible in both buildings.
(4) Management should also focus on safety of occupants and put safety on top priority list.
(5) Different signs and boards should be installed for awareness of occupants. For occupants
(6) Occupants should always involve in safety program organized by authority and management.
(7) Occupants also should be aware about building features, fire safety tools and equipment's.
(8) Occupants should coordinate with the management for safe and healthy environment.

For concerned authority:

(1) Fire safety code NBC 107:1994 should be strictly implemented.
(2) Municipality should develop their own guideline according to the geography and literacy.
(3) Municipality should organize site visit for firefighter to important commercial and public buildings.
(4) Municipality should strictly implement the fire safety code for newly registered buildings inside its area.
(5) The narrow road should be expanded as soon as possible.
(6) New technology should be introduced to firefighter so that they can find exact location, should organize regular training to the fire fighters.
(7) Municipality should organize regular awareness program and seminar using different media.
(8) Municipality should install fire hydrant in front of important commercial and public buildings.

Recommendation for further research work:

Some issues were identified for future research:
• Construction and specification of fire resistance.
• Problems based on human behavior.
• Importance of fire safety for all the party.
• Cost of fire safety before and after the incidence.

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