



A STUDY ON WORKER'S PERCEPTION TOWARDS PPE IN BUILDING CONSTRUCTION ACTIVITIES

Damaraju Lakshmi Lavanya, Research scholar, Dept. Of Civil Engineering, Andhra University College Of Engineering, Andhra University, Visakhapatnam.

Dr T. Usha Madhuri, Associate Professor, Dept. Of Civil Engineering, Andhra University College Of Engineering, Andhra University, Visakhapatnam.

Abstract:

Construction industry involves hazardous, land –based activities where the site workers are exposed to various risks. Activities involve moving machinery, materials handling, power tools, dust, scaffoldings failures and noise causing different occupational hazards like physical, chemical, and biological hazards resulting in injury, disease /health related risks and deaths. PPE is a personal protective Equipment that plays a key role to mitigate the cause of various injuries / occupation hazards and diseases. The Objective of the study is to identify the percentage of workers knowing the suitable PPE required for the task involving, utilizing the PPE. An onsite survey and field study was conducted among the workers working in different levels of construction categorized as high-rise buildings, commercial construction sites. 2991 construction workers were surveyed during their worktime. The workers perception towards the suitability of PPE for the respective work and utilisation of PPE during the worktime were recorded. The study reports the highest suitable PPE in various construction activities as 77.7% Head protection in plastering work ,88.8% Hand protection in plumbing work, foot protection 89.2% in excavation work, 71.4%eye/face protection in foundation work, Hearing protection 50% in carpentry and concrete mixing ,48.9% respiratory protection in flooring work ,60% in formworks.

1.Introduction:

Personal Protective Equipment (PPE) creates a barrier against workplace hazards. Most of the hazards like physical, chemical, and ergonomic hazards can be decreased with proper suitable PPE during work hours in construction sites. The key point involved in PPE usage is that workers should know the suitability of PPE usage in the involved activity. Understanding the suitability and utilization of PPE can be achieved through various training programs and attending toolbox meetings. In India, 7.5% of the total world labour force incurs 16.4% of global occupational accidents (5). International Labor Organization (ILO) statistics show that more than 2.78 million deaths and 374 million non-fatal work-related injuries and illnesses are resulted out of occupational accidents and diseases each year around the world. The economic cost of such number of deaths, injuries and illness is estimated at 3.94 per cent of global Gross Domestic Product each year. (6). The statistics vary across countries and regions. Comparatively a smaller number of occupational injuries and deaths are observed in developed countries, whereas workers in under-developed and developing countries largely face such occupational health issues (7). Less available or non-availability of the PPE to all workers at construction sites may also the reason of not wearing PPE.(8) lack of safety compliance, on-site supervision, common safety guidelines, and safety incentives for law-abiding workers are some of the reasons might makes the worker not to utilize proper PPE (9).Sometimes, workers are forced to work without PPE because the foreman or supervisor has to complete the work in -time or in a short period of time (10)(11)(12).

2.Review of Literature:

Ulang et.al(2014) detailed construction sector is important and contributes to the national development significantly. Most dangerous sector poses to high-risk accident and considers as a dangerous zone to



workers. PPE personal protective equipment helps the worker to protect from hazards in the workplace. Wearing of PPE varies from work to work and is important to select the PPE based on the job. The study explained the level of knowledge and awareness of suitability on the usage of PPE to reduce the construction accidents at the site by implementation of PPE.

Wong et.al(2020) developed a qualitative approach on the attitudes of the construction workers and their experiences on the personal protective equipment (PPE) and gave the reasons of using and not using PPE during the worktime. The qualitative data was collected with face-face interviews in Hong-kong. Study proposed a grounded theory model factors and concluded usage and non-usage of PPE is affected by personal, technological and environmental and recommend a practical solutions to increase the PPE during work-time based on the workers perception.

K.Goh et.al(2021) explained the causes of accidents in the high rise projects. Accidents in the construction sites increase the physical injuries, fall from height and struck by, falling of objects are the most common reasons of the accidents happened in Malaysia. Qualitative methods are followed to obtain the data interviewing the safety officers. Accidents with man-made and environmental factors were observed and concludes that accidents can be prevented by sufficient personal protective equipment with good housekeeping, following safety with investigations, proper training and developing top management by increasing the awareness for preventing accidents.

Gattuso et.al(2015) detailed about the personal Protective Equipment (PPE) an essential component to for the safety of construction workers at job sites. Construction sites reported as highest fatal work injurious jobsites. Wearing of PPE is important during the worktime. Neglecting the PPE, makes the work to keep in the risk by themselves. The present study reported that 64% of construction workers always wear their PPE. The highest ranked non-compliance workers perspective towards causes stress in hot, sunny, poorly ventilated, not comfortable etc.

Jaafar et.al(2018) explains in construction industry is involved with various hazards with high fatality rates. From the previous studies related to the Malaysian legal documents four elements mainly causes the occupational illness and accidents are human, worksite, management and external elements. OSH management approach is required to contain all hazards at construction sites.

Lombardi et.al (2009) studied and identified the array of factors influencing the workers use of protective Eyewear. Groups of workers and supervisors from construction industry and manufacturing industry involved risk towards a potential exposure to eye. Collective data categorized into sought information and emergent themes influencing the use of PPE. Several potentially modifiable factors identified would lead to an increase in workers' PPE use and encourage supervisors to provide ongoing positive feedback on the continuous use of PPE by workers at risk for an eye injury.

3.Methodology:

The study was done in various construction sites classifying from single storey, multi-storey building construction activities. Workers Demography, experience, age, sex are some of the factors affecting the usage of PPE.

The Present study was in two stages.

1) To survey workers perception towards the suitable PPE in the activity.

2) To observe the usage of PPE during worktime in construction sites.

- The first step is to study and identify whether the worker is knowledgeable in hazards involved in the activity, and understanding the consequences related to the activity. This is achieved by the process of interaction with the workers during their free time and short gap taken by the worker during the activity. The second step is observing the usage of different PPE by the worker in completion of his daily task. This is done by physical observation of the worker in worktime. The worker responding to the requirement of the PPE for the task, worker not using the PPE in worktime. The reasons behind the

not using of PPE are also recorded. Workers of different ages, experiences, males, and females are involved in the study.

The following are the different protections generally required for construction workers at the sites during their worktime.

- 1) Head protection – Safety Helmets
- 2) Hand Protection – Safety Gloves
- 3) Foot Protection – Safety boots.
- 4) Eye/face Protection – safety goggles & face shield
- 5) Respiratory Protection – Masks with filters
- 6) Body and fall protection – safety belts.

Table 1: The workers perception towards the PPE and the Usage of PPE during the work times

Sl. no	construction activity & Number of workers involved		Type of Personal protection Equipment (PPE)						
			Head Protection	Hand protection	Foot Protection	Eye/face protection	Respiratory protection	Hearing Protection	Body Protection
1	Excavation work [280]	Required	120[48%]	220[78.5%]	250[89.2%]	200[71.4%]	15[5.35%]	48[17.1%]	20[7.14%]
		Sometimes Required	40[14.2%]	10[3.5%]	10[3.57%]	20[7.14%]	40[14.28%]	54[19.2%]	40[14.2%]
		Not Required	120[42.8%]	50[17.8%]	20[7.1%]	60[21.4%]	235[83.9%]	178[63.57%]	220[78.57%]
		Using in the site during the activity	72[28.8%]	136[54.4%]	197[70.35%]	57[20.35%]	3[1.07%]	6[2.14%]	0[0%]
2	Laying of foundations [400]	Required	280[70%]	300[75%]	280[70%]	200[50%]	20[5%]	10[2.5%]	5[1.25%]
		Sometimes Required	80[20%]	20[5%]	100[25%]	40[10%]	10[2.5%]	100[25%]	10[2.5%]
		Not Required	40[10%]	80[20%]	20[5%]	160[40%]	270[67.5%]	295[73.75%]	385[96.25%]
		Using in the site during the activity	120[30%]	60[15%]	180[45%]	75[18.75%]	0[0%]	0[0%]	0[0%]

3	Bar cutting [220]	Required	60[2 7.2%]	120[54.5 %]	20[9. 09%]	80[36 .3%]	30[13 .6%]	80[36 .3%]	10[4. 54%]
		Sometim es Required	20[9. 09%]	80[3 6.6%]	40[18 .18%]	20[9. 0%]	10[4. 54%]	20[9. 09%]	10[4. 54%]
		Not Required	140[63.3 %]	20[9. 09%]	160[7 2.7%]	120[5 4.5%]	180[8 1.8%]	120[5 4.5%]	200[9 0.9%]
		Using in the site during the activity	18[8. 18%]	87[3 9.5 %]	6[2.7 2%]	2[0.9 %]	0[0%]	4[1.8 %]	0[0%]
4	Column shuttering [300]	Required	100[33.3 %]	220[73.3 %]	120[4 0%]	100[3 3.3%]	10[3. 3%]	20[6. 6%]	60[20 %]
		Sometim es Required	40[1 3.33 %]	20[6. 66%]	80[26 .6%]	20[6. 66%]	20[6. 6%]	40[13 .3%]	40[13 .3%]
		Not Required	160[53.3 %]	60[2 0%]	100[3 3.3%]	180[6 0%]	270[9 0%]	240[8 0%]	200[6 6.6%]
		Using in the site during the activity	90[3 0%]	175[50%]	110[3 6.6%]	0[0%]	0[0%]	0[0%]	0[0%]
5	Bar bending [180]	Required	20[1 1.1%]	80[4 4.4%]	40[22 .2%]	10[5. 55%]	0[0%]	0[0%]	0[0%]
		Sometim es Required	40[2 2.2%]	80[4 4.4%]	20[11 .1%]	20[11 .1%]	10[5. 5%]	0[0%]	0[0%]
		Not Required	120[66.6 %]	20[1 1.1%]	120[6 6.6%]	150[8 3.33 %]	170[9 4.44 %]	180[1 00%]	180[1 00%]
		Using in the site during the activity	10[5. 55%]	20[1 1.1 %]	0[0%]	0[0%]	0[0%]	0[0%]	0[0%]
6	Concrete Mixing & pouring [180]	Required	60[3 3.3%]	90[5 0%]	140[7 7.7%]	100[5 5.5%]	80[44 .4%]	90[50 %]	20[11 .1%]
		Sometim es Required	20[1 1.1%]	20[1 1.1%]	30[16 .6%]	30[16 .6%]	30[16 .6%]	40[22 .2%]	40[22 .2%]


		Not Required	100[55.5%]	70[38.8%]	10[5.5%]	50[27.7%]	70[38.8%]	50[27.2%]	120[66.6%]
		Using in the site during the activity	40[22.2%]	68[37.7%]	102[56.6%]	7[3.88%]	0[0%]	0[0%]	0[0%]
7	Removing Shuttering [280]	Required	101[36%]	120[42.8%]	180[64.28%]	120[42.8%]	40[14.2%]	80[28.57%]	60[21.42%]
		Sometimes Required	48[17.1%]	80[28.5%]	62[22.1%]	38[13.5%]	10[3.5%]	20[7.1%]	120[42.8%]
		Not Required	131[46.7%]	80[28.5%]	38[13.5%]	122[43.21%]	220[78.5%]	180[64.28%]	100[35.7%]
		Using in the site during the activity	68[24.2%]	60[21.4%]	68[24.2%]	68[24.2%]	0[0%]	0[0%]	0[0%]
8	Brick work[270]	Required	160[59.2%]	201[74.4%]	218[80.7%]	101[37.4%]	20[7.4%]	10[3.7%]	20[7.4%]
		Sometimes Required	90[33.3%]	59[21.85%]	30[11.1%]	56[20.7%]	10[3.7%]	40[14.8%]	120[44.4%]
		Not Required	20[7.4%]	10[3.7%]	22[8.1%]	113[41.8%]	240[88.8%]	220[81.4%]	130[48.1%]
		Using in the site during the activity	136[50.3%]	158[58.5%]	111[41.1%]	0[0%]	0[0%]	0[0%]	0[0%]
9	Curing [158]	Required	60[37.97%]	40[25.3%]	45[28.5%]	33[20.8%]	2[1.2%]	18[11.3%]	10[6.3%]
		Sometimes Required	10[6.3%]	20[12.65%]	15[9.49%]	17[10.7%]	8[5.0%]	30[18.9%]	20[12.6%]
		Not Required	88[55.6%]	98[62.0%]	98[62.0%]	108[68.3%]	148[93.7%]	110[69.6%]	128[81.0%]
		Using in the site during	30[50%]	30[18.9%]	30[18.9%]	0[0%]	0[0%]	0[0%]	0[0%]

		the activity							
10	Lintel work [108]	Required	47[4 3.5%]	69[6 3.8%]	78[72 .2%]	34[31 .48%]	20[18 .5%]	25[23 .1%]	8[7.4 %]
		Sometimes Required	23[2 1.2%]	31[2 8.7%]	20[18 .5%]	24[22 .2%]	8[7.4 %]	40[37 .0%]	4[3.7 %]
		Not Required	38[3 5.1%]	8[7.4 %]	10[9. 2%]	40[37 .0%]	80[74 .0%]	40[37 .0%]	96[88 .8%]
		Using in the site during the activity	28[2 5.9%]	35[3 2.4%]	38[35 .1%]	0[0%]	0[0%]	0[0%]	0[0%]
11	Flooring [98]	Required	46[4 6.9%]	30[3 0.6%]	46[46 .9%]	30[30 .6%]	48[50 %]	20[20 .4%]	14[14 .5%]
		Sometimes Required	20[2 0.4%]	10[1 0.2%]	20[20 .4%]	10[10 .2%]	24[24 .4%]	46[46 .9%]	6[6.1 %]
		Not Required	32[3 2.6%]	58[5 9.1%]	32[32 .6%]	58[59 .1%]	26[26 .5%]	32[32 .6%]	78[81 .25%]
		Using in the site during the activity	20[2 0.4 %]	20[2 0.4 %]	18[18 .36%]	0[0%]	0[0%]	0[0%]	0[0%]
12	Electrical work [92]	Required	76[8 2.6%]	70[7 6%]	70[76 %]	56[60 .8%]	14[15 .2%]	8[8.6 %]	4[4.3 4%]
		Sometimes Required	4[4.3 4%]	10[1 0.8%]	10[10 .8%]	10[10 .8%]	8[8.6 9%]	26[28 .2%]	0[0%]
		Not Required	12[1 3.0%]	12[1 3.0%]	12[13 .0%]	26[28 .2%]	70[76 .0%]	58[63 .0%]	88[95 .6%]
		Using in the site during the activity	28[2 9.1 %]	46[5 0%]	54[58 .6%]	12[13 .0%]	0[0%]	0[0%]	0[0%]
13	Plumbing work [108]	Required	84[7 7.7%]	70[6 4.8%]	60[55 .5%]	20[18 .5%]	4[3.7 %]	8[7.4 %]	18[16 .6%]

		Sometimes Required	20[18.5%]	12[11.1%]	20[18.5%]	38[35.1%]	20[18.5%]	8[7.4%]	12[11.1%]
		Not Required	4[3.7%]	26[24.0%]	28[25.9%]	50[46.2%]	84[77.7%]	92[85.1%]	78[72.2%]
		Using in the site during the activity	40[37.0%]	42[38.8%]	38[35%]	0[0%]	0[0%]	0[0%]	7[6.4%]
14	Plastering work [90]	Required	74[82.2%]	80[88.8%]	64[71.1%]	25[27.7%]	34[37.7%]	14[15.5%]	33[36.6%]
		Sometimes Required	101[11.1%]	8[8.8%]	14[15.5%]	13[14.4%]	14[15.5%]	23[25.5%]	38[42.2%]
		Not Required	16[17.7%]	2[2.2%]	20[22.2%]	52[57.7%]	42[46.6%]	53[58.8%]	19[21.1%]
		Using in the site during the activity	44[48.8%]	58[64.4%]	50[55.5%]	17[18.2%]	0[0%]	0[0%]	0[0%]
15	Painting work [107]	Required	57[53.2%]	84[78%]	84[78%]	40[37.3%]	37[34.5%]	10[9.3%]	46[42.9%]
		Sometimes Required	13[12.1%]	14[13%]	14[13%]	12[11.2%]	20[18.6%]	5[4.6%]	58[54.2%]
		Not Required	37[34.5%]	9[8.5%]	7[8.4%]	55[51.4%]	50[46.7%]	92[85.9%]	23[21.4%]
		Using in the site during the activity	18[16.8%]	22[20.5%]	26[24.2%]	14[13.0%]	0[0%]	0[0%]	34[31.7%]
16	Carpentry [120]	Required	10[8.3%]	50[62%]	48[51.6%]	20[16.6%]	40[33.3%]	160[50%]	10[8.3%]
		Sometimes Required	10[8.3%]	48[51.6%]	32[26.6%]	42[35%]	20[16.6%]	20[16.6%]	10[8.3%]
		Not Required	100[83.3%]	10[8.3%]	40[33.3%]	58[48.3%]	40[33.3%]	40[33.3%]	100[83.3%]

		Using in the site during the activity	0[0%]	38[31.6%]	26[21.6%]	0[0%]	0[0%]	0[0%]	0[0%]
--	--	---------------------------------------	-------	-----------	-----------	-------	-------	-------	-------

Table 2 : The response of the worker towards the requirement of PPE and usage of PPE in construction sites .

Usage in %		PPE usage during the work in the construction site	HEAD PROTECTION (Helmets)	construction activities observed in the study	No. of workers responded as required	response in %
	28.8	72	 <p>To protect the Head from Various injuries due to falling of objects, impact of falling construction elements , rain ,debris , electric shocks ,lifting of heavy objects during lifting of loads.</p>	Excavation [280]	42.8	
	30	120		Laying of foundations [400]	70.0	
	8.18	18		Bar cutting [220]	27.2	
	30	90		column Shuttering [300]	33.3	
	5.55	10		Bar Bending [180]	4.1	
	22.2	40		concrete Mixing & Pouring [180]	33.3	
	24.2	68		Removing Shuttering [280]	36.0	
	50.3	136		Brickwork [270]	59.3	
	18.9	30		Curing work[158]	37.9	
	25.2	28		Lintel work [108]	43.5	

	20 .4	20	Flooring work [98]	46	4 6. 7	
	29 .1	28	Electrical work [92]	76	8 2. 6	
	37 .0 3	40	Plumbing Work [108]	84	7 7. 7	
	48 .8	44	Plastering Work [90]	74	8 2. 2	
	16 .8	18	Painting[107]	57	5 3. 3	
	0	0	Carpentry [120]	10	8. 3	

Table 3 :

response in %	PPE usage during the work in the construction site	HAND PROTECTION (Safety Gloves)	construction activities observed in the study	No.O f workers responded as required	response in %	
	54 .4	136	Excavation [280]	280	7 0. 0	
	15	60	Laying of foundations [400]	300	7 5. 0	
	39 .5	87	Bar cutting [220]	120	5 4. 5	
	50	175	column Shuttering [300]	220	7 3. 3	
	11 .1	20	Bar Bending [180]	80	4 4. 4	
	37 .7 7	68	concrete Mixing & Pouring [180]	90	5 0. 0	



	21.4	60	To protect the hands and fingers from cuts , abrasion , chemical contacts , electrical shocks .	Removing Shuttering [280]	120	42.8	
	58.5	158		Brickwork [270]	201	74.4	
	9.49	15		Curing work[158]	40	25.3	
	32.4	35		Lintel work [108]	69	63.8	
	20.4	20		Flooring work [98]	30	30.6	
	50	46		Electrical work [92]	70	76.0	
	38.8	42		Plumbing Work [108]	70	64.8	
	64.4	58		Plastering Work [90]	80	88.8	
	20.5	22		Painting[107]	84	78.0	
	31.6	38		Carpentry [120]	50	62.0	

Table 4 :

Usage in %	PPE usage during the work in the construction site	Foot Protection (Safety Boots)	construction activities observed in the study	no.of workers responded as required	response in %
	54.4		Excavation [280]	250	89.2
	15		Laying of foundations [400]	300	75.0

	39 .5	87	To avoid foot injuries from falling and rolling of objects, punctures by nails and sharp objects, chemical contacts, electrical shocks and provides grip and to avoid slipping and falling action	Bar cutting [220]	120	5 4. 5	
	50	175		column Shuttering [300]	220	7 3. 3	
	11 .1	20		Bar Bending [180]	80	4 4. 4	
	37 .7 7	68		concrete Mixing & Pouring [180]	90	5 0. 0	
	21 .4	60		Removing Shuttering [280]	120	4 2. 8	
	58 .5	158		Brickwork [270]	201	7 4. 4	
	9. 49	15		Curing work[158]	40	2 5. 3	
	32 .4	35		Lintel work [108]	69	6 3. 8	
	20 .4	20		Flooring work [98]	30	3 0. 6	
	50	46		Electrical work [92]	70	7 6. 0	
	38 .8	42		Plumbing Work [108]	70	6 4. 8	
	64 .4	58		Plastering Work [90]	80	8 8. 8	
	20 .5	22		Painting[107]	84	7 8. 0	
	31 .6	38		Carpentry [120]	50	6 2. 0	

Table 5:

















5:Usage in %		PPE usage during the work in the construction site	Eye /Face Protection (Goggles & Face shield)	construction activities observed in the study	No.Of workers responded as required	response in %	
	1.07	3	  Eye /face protection helps from chemical splashes dust , small nails and wooden pieces , heat exposures etc and also from projection objects .	Excavation [280]	200	50.0	
	18	75		Laying of foundations [400]	200	71.4	
	1	2		Bar cutting [220]	80	36.36	
	0	0		column Shuttering [300]	100	33.3	
	0	0		Bar Bending [180]	10	5.6	
	3.88	7		concrete Mixing & Pouring [180]	100	55.6	
	0	0		Removing Shuttering [280]	120	42.9	
	0	0		Brickwork [270]	101	37.4	
	0	0		Curing work[158]	33	20.9	
	0	0		Lintel work [108]	34	31.5	
	0	0		Flooring work [98]	30	30.6	
	0	0		Electrical work [92]	56	60.8	
	0	0		Plumbing Work [108]	20	18.5	
	0	0		Plastering Work [90]	25	27.7	
	0	0		Painting[107]	40	37.3	
			Carpentry [120]	20	16.7		

Table 6:

response in %		PPE usage during the work in the construction site	Respiratory Protection (Mask with filters)	construction activities observed in the study	No. of workers responded as required	response in %	
	1.07	3		 Respiratory protection helps from inhalation of particulate matter and exposing to very fine dust, chemical fumes, etc	Excavation [280]	15	5.4
	0	0	Laying of foundations [400]		20	5.0	
	0	0	Bar cutting [220]		30	13.6	
	0	0	column Shuttering [300]		10	3.3	
	0	0	Bar Bending [180]		0	0.0	
	0	0	concrete Mixing & Pouring [180]		80	44.4	
	0	0	Removing Shuttering [280]		40	0.0	
	0	0	Brickwork [270]		20	7.4	
	0	0	Curing work [158]		2	1.2	
	0	0	Lintel work [108]		20	18.5	
	0	0	Flooring work [98]		48	48.9	
	0	0	Electrical work [92]		14	15.2	
	0	0	Plumbing Work [108]		4	3.7	
	0	0	Plastering Work [90]		34	37.7	
	0	0	Painting [107]		37	34.5	
	0	0	Carpentry [120]		40	33.3	

Table 7:

Usage in %	ppe usage during the work in the construction site	Hearing Protection (Ear Plugs)	construction activities observed in the study	No. Of workers responded as required	response in %

2.	14	6	<p>It provides protection from huge, large sounds and excessive continuous sounds during various construction activities.</p>	Excavation [280]	48	17.1	
0	0	0		Laying of foundations [400]	10	2.5	
1.	8	4		Bar cutting [220]	80	36.4	
0	0	0		column Shuttering [300]	20	6.7	
0	0	0		Bar Bending [180]	0	0.0	
0	0	0		concrete Mixing & Pouring [180]	90	50.0	
0	0	0		Removing Shuttering [280]	80	28.5	
0	0	0		Brickwork [270]	10	3.7	
0	0	0		Curing work[158]	18	11.4	
0	0	0		Lintel work [108]	25	23.1	
0	0	0		Flooring work [98]	20	20.4	
0	0	0		Electrical work [92]	8	8.7	
0	0	0		Plumbing Work [108]	8	7.4	
0	0	0		Plastering Work [90]	14	15.5	
0	0	0		Painting[107]	10	9.3	
0	0	0		Carpentry [120]	60	50.0	

Table 8 :

Usage in %		PPE usage during the work in the construction site	Body/fall Protection (safety belts)	construction activities observed in the study	No.of workers responded as required	response in %	
	0	0		Excavation [280]	20	7.1	
	0	0		Laying of foundations [400]	5	1.3	

	0	0	To avoid slipping and falling action from scaffoldings .	Bar cutting [220]	10	4.5	
	0	0		column Shuttering [300]	60	20.0	
	0	0		Bar Bending [180]	0	0.0	
	0	0		concrete Mixing & Pouring [180]	20	11.1	
	0	0		Removing Shuttering [280]	60	21.4	
	13.33	36		Brickwork [270]	20	7.4	
	0	0		Curing work[158]	10	6.4	
	0	0		Lintel work [108]	8	7.4	
	0	0		Flooring work [98]	14	14.5	
	0	0		Electrical work [92]	4	4.3	
	6.48	7		Plumbing Work [108]	18	16.6	
	0	0		Plastering Work [90]	33	36.6	
	31.77	4		Painting[107]	46	42.9	
	0	0		Carpentry [120]	10	8.3	

4.Results and Observations:

The following are the observations made in the construction sites during the worktime.

- 1) The highest Head protection usage of 53.3% is observed in the Brickwork.
- 2) The Usage of foot protection is high in plastering with 64.4%
- 3) In Plastering work 64.4% with highest usage of hand protection is observed.
- 4) Only 3.88% of workers are using face/eye Protection in concrete mixing and pouring.
- 5) Only 1.07% of workers are using respiratory protection in excavation work.
- 6) 2.14% of workers in excavation are using hearing protection.
- 7) 31.77% of workers in painting work are using fall protection.

5.Conclusions:

From the study and survey the perceptions of the workers were collected

Head Protection: The Plumbing workers of 77.7% and plastering workers of 74% responded as the highest requirement of PPE. But only 37.03% of plumbing workers and 48.8% of plastering workers are using safety Helmets during working conditions.

Hand Protection: The plumbing workers of 88.8% and painting workers of 78% responded as the highest requirement of Hand protection. In the field only 38.8% of plastering and 64.4% of painting workers are using hand protection



Foot Protection: For Excavation 89.2% workers and Plastering 88.8% workers responded as Highest requirement towards foot protection. It was observed that only 54.4% of workers during excavation and 38.8% of plastering workers are using safety shoes.

Eye /face protection : 71.4% workers in foundations and electrical workers of 56% responded as need for eye/face protection. From the observations it was found that only 18% of workers during the foundation works are using face protection and none of the workers are using face/eye protection in electrical works.

Hearing Protection : Carpentry workers and concrete mixing workers of 50% responded as Hearing protection. It was observed that only 2.18% of the workers during excavation work are using hearing protection.

Respiratory Protection: For flooring work 48.9% of the workers and for concrete mixing 44.4% of the workers responded to a need of respiratory protection. It was observed during work time that 1.07% of workers in excavation are using respiratory protection.

Body/Fall Protection: 60% of the need for Fall protection was given by workers involved in formwork (shuttering) and 42.9% was given by painting workers. It was observed that 31.7% of painting workers are using fall protection.

6. References:

- 1) Ahmed, S. M., Azhar, S., Farooqui, R. U., & Panthi, K. Addressing the issue of compliance with personal protective equipment on construction worksites: A workers' perspective. In *ASC 45th Conference. Florida International University Miami, Florida, United State, 2015*
- 2) Gattuso, A. N. Common Issues of Compliance with Personal Protective Equipment for Construction Workers, 2021.
- 3) Huang, X., & Hinze, J. Analysis of construction worker fall accidents. *Journal of construction engineering and management*, 129(3), 262-271. 2003.
- 4) Jaafar, M. H., Arifin, K., Aiyub, K., Razman, M. R., Ishak, M. I. S., & Samsurijan, M. S. Occupational safety and health management in the construction industry: a review. *International journal of occupational safety and ergonomics*, 24(4), 493-506, 2018.
- 5) Joy Debnath *et al.* Fuzzy inference model for assessing occupational risks in construction sites *Int. J. Ind. Ergon*, 2016
- 6) K., Goh, H., Goh, M., Omar, T., Toh and A., Mohd Zin "Accidents Preventive Practice for High-Rise Construction", *MATEC Web of Conferences*, vol. 47, p. 04004. 2016,
- 7) Kaskutas, V., Dale, A. M., Lipscomb, H., & Evanoff, B. Fall prevention and safety communication training for foremen: Report of a pilot project designed to improve residential construction safety. *Journal of safety research*, 44, 111-118, 2013.
- 8) Lombardi, D. A., Verma, S. K., Brennan, M. J., & Perry, M. J. Factors influencing worker use of personal protective eyewear. *Accident Analysis & Prevention*, 41(4), 755-762, 2009.
- 9) S. Kanchana, P. Sivaprakash, Sebastian Joseph, "Studies on Labour Safety in Construction Sites", *The Scientific World Journal*, vol. 2015, Article ID 590810, 6 pages, 2015. <https://doi.org/10.1155/2015/590810>
- 10) Ulang, N. M., Salim, N. S., Baharum, F., & Salim, N. A. Construction site workers' awareness on using safety equipment: Case study. In *MATEC Web of Conferences* (Vol. 15, p. 01023). EDP Sciences, 2014.
- 11) Ulubeyli, S., Kazaz, A., & Er, B. Health and safety perception of workers in Turkey: a survey of construction sites. *International journal of occupational safety and ergonomics*, 20(2), 323-338, 2014.
- 12) Wong, T. K. M., Man, S. S., & Chan, A. H. S. Critical factors for the use or non-use of personal protective equipment amongst construction workers. *Safety science*, 126, 104663. 2020
- 13) <https://www.ilo.org/global/topics/safety-and-health-at-work/lang--en/index.htm>



Industrial Engineering Journal

ISSN: 0970-2555

Volume : 52, Issue 12, No. 1, December : 2023

7. Acknowledgements:

Authors would like to acknowledge the computer centre of Andhra University and construction workers, contractors and site Engineers shown interest towards the study.