

COMPARISON OF PPE COST VS. ACCIDENT COST FOR BUILDING CONSTRUCTION

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Abstract: Nowadays safety assessment on construction site is totally neglected to reduce the overall cost of the project. We are conducting a study to check that whether cost of safety is less than that of accidents, which ultimately reduces the cost of project. Safety assessment may be thought as the front end of the development of integrated safety analysis. There is cost which is to be incurred to perform the safety operations and use PPE accordingly. The various causes of accident, most probable accidents, and most probable injuries occurring while carrying out the activities are found out using journal papers, magazines, by visiting sites. The cost of probable accidents is carried out using Workmen's Compensation Act 1923, depending upon the type of injury caused to the injured person. The cost of PPE used against probable accident is calculated by visiting various suppliers, stores, industries etc. The cost of PPE required is compared with the cost of accident. The article shows that using PPE on construction site against various probable accidents not only saves life of worker but also saves money and makes the project more economical and safer. The cost comparison shows that in more than 95% of activities the cost of PPE is less than that of accident, ensuring the safety of the worker. Hence it is advisory to use PPE on construction site to make the project safe and economical.

Keywords: Accident Cost; Building Construction; PPE Cost; Safety; Workmen compensation act (WCA) 1923.

I. INTRODUCTION

The building operations and works of engineering construction industries in India have made tremendous progress in recent years and the increase in their activities have affected the general public's as well as worker's safety and health. Construction sites create a risk not only for the construction worker, but also for the public who move around the site or who may live adjoins them. The Occupational Safety and Health Ordinance, which came into operation on 23 May 1997, cover most workplaces in order to protect the safety and health of employees at work. The Department of Occupational Safety and Health (DOSH) and other government agencies have regulations that lay down the legal requirements to ensure the safety and health of not only the workers at the place of work but also the public as well. This guideline applies to all place of work in building operation and work of engineering construction activity in India covered by the Occupational Safety And Health Act 1994 (Act 514) and all the regulations made there under. Most accidents can be prevented by taking simple measures or adopting proper working procedures. If we work carefully and take appropriate safety measures, there will definitely be fewer work injury cases, and our sites will become a safe and secure place to work in.

II. WORK DETAILS, DATA COLLECTION & ANALYSIS

Work was carried out on different construction sites in Nashik, BKC & Thane in Maharashtra, Western India. For this study activities were chosen randomly. The work was carried out on PCC for Foundation, Plinth Work, RCC Work, Plumbing, Welding activities. For the

calculation of accident cost, the monthly wages were considered as Rs. 8000/- (According to amendment in the act).

2.1 PCC for Foundation

Table 1: PPE cost & Probable accident cost of PCC for Foundation according to WCA 1923

Sr. No.	List of Activities	Probable Accidents	PPE Used	Most Probable injuries	Calculation of accident cost	PPE Cost in rupees	Accident cost (range) in rupees
1	Foundation-PCC work	sliding of earth	helmet, respirators, gloves, footwear, clothing	17. Amputation at hip(90%)	90% of 8000/-=7200	1280	80-1086624#
				29. Loss of— A—Fingers of right or left hand			
				i) Whole(14%)	14% of 8000/-=1120		
				ii) Two phalanges(11%)	11% of 8000/-=880		
				iii) One phalanx (9%)	9% of 8000/-=720		
				iv) Guillotine amputation of tip without loss of bone(5%)	5% of 8000/-=400		
				32. B-Toes of right or left foot Great toe			
				i)through metatarsophalangeal joint(14)	14% of 8000/-=1120		
				ii) Part, with some loss of bone (3%)	3% of 000/-=240		
				33. Any other toe			
				i) Through metatarso-phalangeal joint(3%)	3% of 8000/-=240		
				ii) Part, with some loss of bone(1%)	1% of 8000/-=80		
				*= death, #= permanent dissablement			

2.2 Plinth Work

Table 2: PPE cost & Probable accident cost of Plinth Work according to WCA 1923

Sr. No.	List of Activities	Probable Accidents	PPE Used	Most Probable injuries	Calculation of accident cost	PPE Cost in rupees	Accident cost (range) in rupees
2	Plinth work a) Casting of columns upto plinth b) Casting of plinth c) Casting of plinth beam upto floor Pcc level d) Placing/fitting of formwork e) Tieing/placing of reinforcement	defective scaffolding, improperly assembled scaffolding, objects,	helmet,gloves, footwear, clothing	17. Amputation at hip(90%)	90% of 8000/-=7200	1097.5	80-1086624#
				29. Loss of— A—Fingers of right or left hand			
				i) Whole(14%)	14% of 8000/-=1120		
				ii) Two phalanges(11%)	11% of 8000/-=880		
				iii) One phalanx (9%)	9% of 8000/-=720		
				iv) Guillotine amputation of tip without loss of bone(5%)	5% of 8000/-=400		
				32. B-Toes of right or left foot Great toe			
				i)through metatarsophalangeal joint(14)	14% of 8000/-=1120		
				ii) Part, with some loss of bone (3%)	3% of 8000/-=240		
				33. Any other toe			
				i) Through metatarso-phalangeal joint(3%)	3% of 8000/-=240		
				ii) Part, with some loss of bone(1%)	1% of 8000/-=80		
				*= death			
#= permanent dissablement				#= 1086624			

2.3 RCC Work

Table 3: PPE cost & Probable accident cost of RCC Work according to WCA 1923

Sr. No.	List of Activities	Probable Accidents	PPE Used	Most Probable injuries	Calculation of accident cost	PPE Cost in rupees	Accident cost (range) in rupees
3	RCC work (setting up of scaffolding)	defective scaffolding, improperly assembled scaffolding, objects	helmet, gloves, footwear, clothing	17. Amputation at hip(90%)	90% of 8000/-=7200	1097.5	80-1086624#
				29. Loss of— A—Fingers of right or left hand			
				i) Whole(14%)	14% of 8000/-=1120		
				ii) Two phalanges(11%)	11% of 8000/-=880		
				iii) One phalanx (9%)	9% of 8000/-=720		
				iv) Guillotine amputation of tip without loss of bone(5%)	5% of 8000/-=400		
				32. B-Toes of right or left foot Great toe			
				i)through metatarsophalangeal joint(14)	14% of 8000/-=1120		
				ii) Part, with some loss of bone (3%)	3% of 8000/-=240		
				33. Any other toe joint(3%)	3% of 8000/-=240		
				ii) Part, with some loss of bone(1%)	1% of 8000/-=80		
				*= death	*= 905520		
				#= permanent dissablement	#= 1086624		

2.4 Plumbing

Table 4: PPE cost & Probable accident cost of Plumbing according to WCA 1923

Sr. No.	List of Activities	Probable Accidents	PPE Used	Most Probable injuries	Calculation of accident cost	PPE Cost in rupees	Accident cost (range) in rupees
4	Plumbing work	fall from ladder, harness malfunctioni-ng	helmet,safety belts,gloves ,footwares	1)Amputation through shoulder joint (90)	90% of 8000/-=7200	6827.5	1120-1086624#
				23) Amputation of one foot resulting in end bearing(50)	50% of 8000/-=4000		
				29) Loss of finger/s of the left or right hand(14)	14% of 8000/-=1120		
				*= Death	*= 905520		
				#= Permanent Dissablement	#= 1086624		

2.5 Welding

Table 5: PPE cost & Probable accident cost of Welding according to WCA 1923

Sr. No.	List of Activities	Probable Accidents	PPE Used	Most Probable injuries	Calculation of accident cost	PPE Cost in rupees	Accident cost (range) in
5	Welding work	welding accidents (sparks, skin burn, irritation to the eyes)	Welding helmet, eye protector	26. Loss of one eye, without complications, the other being normal(40%)	40% of 8000/-= 3200	963	800-3200
				27. Loss of vision of one eye, without complications or disfigurement of eye ball, the other being normal(30%)	30% of 8000/-=2400		
				28. Loss of partial vision of one eye(10%)	10% of 8000/-=800		

III. COST OF PPE

The various types of PPE available in the market along with the price range [5]

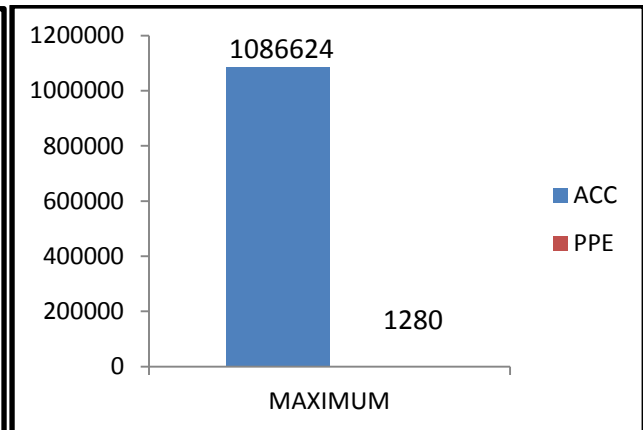
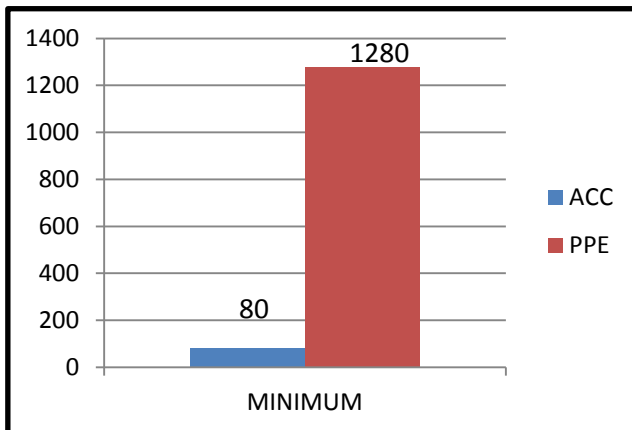
Table 6: List of PPE's used in construction site with their price list.

SR.NO	NAME OF PPE	COST (RANGE in Rs.)
1.0	HELMET	
1.1	Pin lock	75-140
1.2	Ratchet belt	240-300
2.0	GOGGLES	
2.1	China make	75-250
2.2	Standard quality	400-700
3.0	EAR PLUGS	
3.1	Foam type- disposable	15
3.2	Reusable	50
3.3	Ear muff	250-25000
4.0	WELDING HELMET	
4.1	3M European Standard	800-15000
5.0	REFLECTIVE JACKET	
5.1	Standard	95-2000
6.0	HAND GLOVES	
6.1	Cut resistant	140/pair-750/pair
6.2	Rubber gloves	40-300
7.0	SAFETY BELT/NET	
7.1	Roof fall arrestor(100m*40m)	2,50,000
7.2	Full body harness	850-10,000
7.3	Fall arrestor	350-2,00,000
7.4	Descender	19,000
8.0	SAFETY SHOES	
8.1	PVC sole synthetic leather	300-500

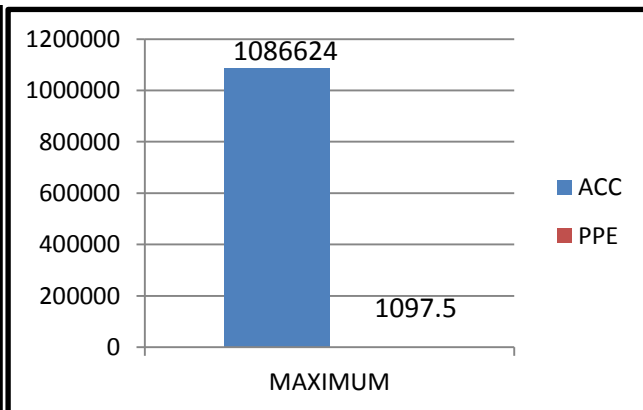
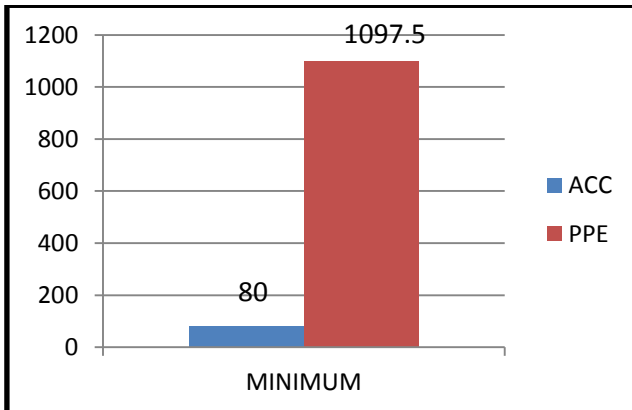
8.2	PV-polyurethane	700-10,000
8.3	Single density	700
8.4	Double density	1000
8.5	Gum boots	200-700
9.0	SAETY NET(Standard)	100/m ²
10.0	RESPIRATORY	
10.1	Dust mask	9-50
11.0	BARICATE TAPE(Standard)	400/Role

IV. COST COMPARISON

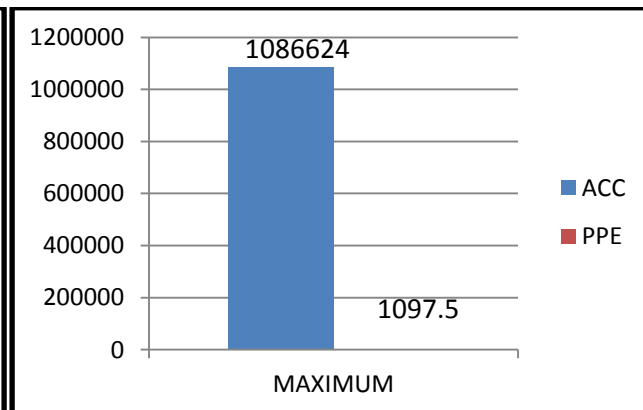
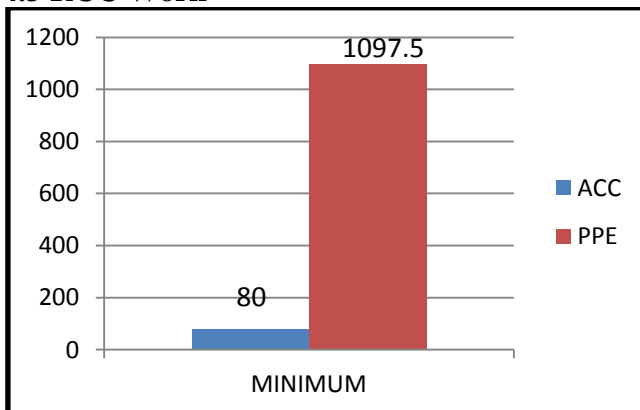
4.1 PCC for Foundation



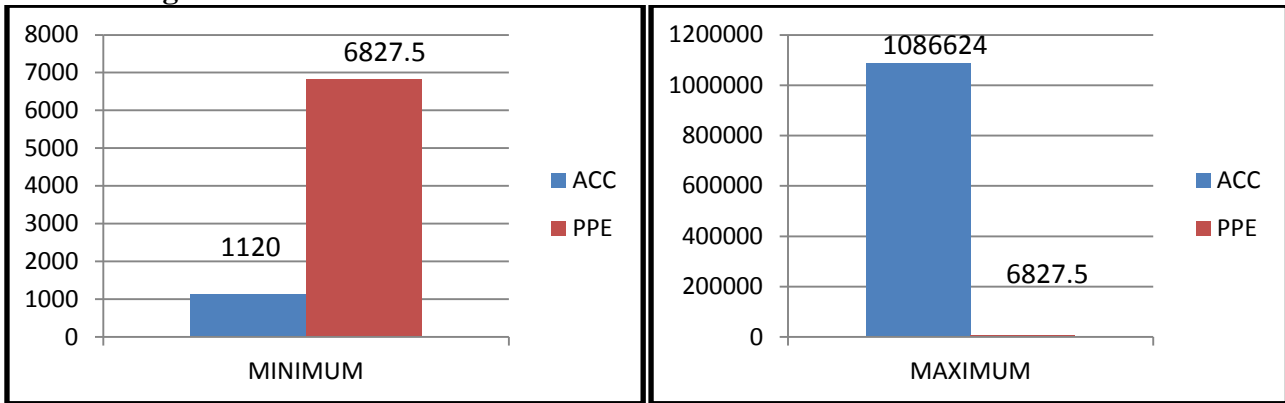
4.2 Plinth Work



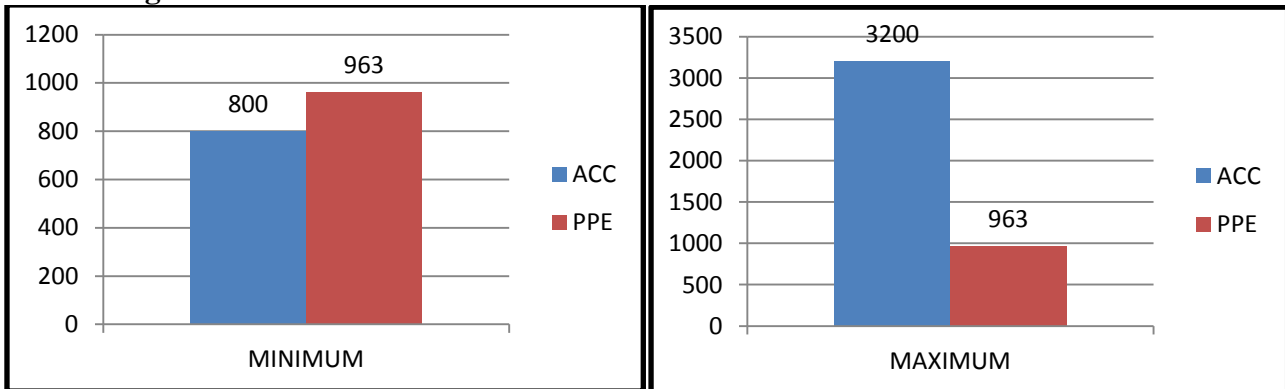
4.3 RCC Work



4.4 Plumbing



4.5 Welding



*All values in graph are in rupees.

**Minimum graph shows graph of minimum accident cost (ACC) vs. cost of PPE (PPE).

***Maximum graph shows graph of maximum accident cost (ACC) vs. cost of PPE (PPE).

V. RESULTS & DISCUSSION

1. From the table and graphs, it is clear that there is significant difference in the accident cost and PPE cost.
2. In some activities PPE cost is more than accident cost as the injuries caused during these activities are not much severe but still PPE is recommended as severity of injury is uncertain.
3. From the table it was observed that for all the activities PPE cost is greater than the accident cost for minor injury.
4. Accident cost is max., when the injury resulting from accident causes permanent disablement.
5. From graph of PPE cost vs. Maximum Accident Cost it is clear that, PPE cost is negligible as compared to the Maximum Accident Cost.
6. This shows that considering worst conditions it is always economical and healthier to go with PPE rather than insuring workers against health insurance.
7. Insurance only ensures the owners to transfer the financial risk against workers accident but it doesn't keep workers healthy or saves workers' lives.
8. Maximum cost of [5]
 - Death is Rs 9, 05, 520/-.
 - Permanent disablement is Rs 10, 86, 624/-.
 - Temporary disablement
 - Major injury is Rs 3, 600/-.
 - Minor injury is Rs 40/-.

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