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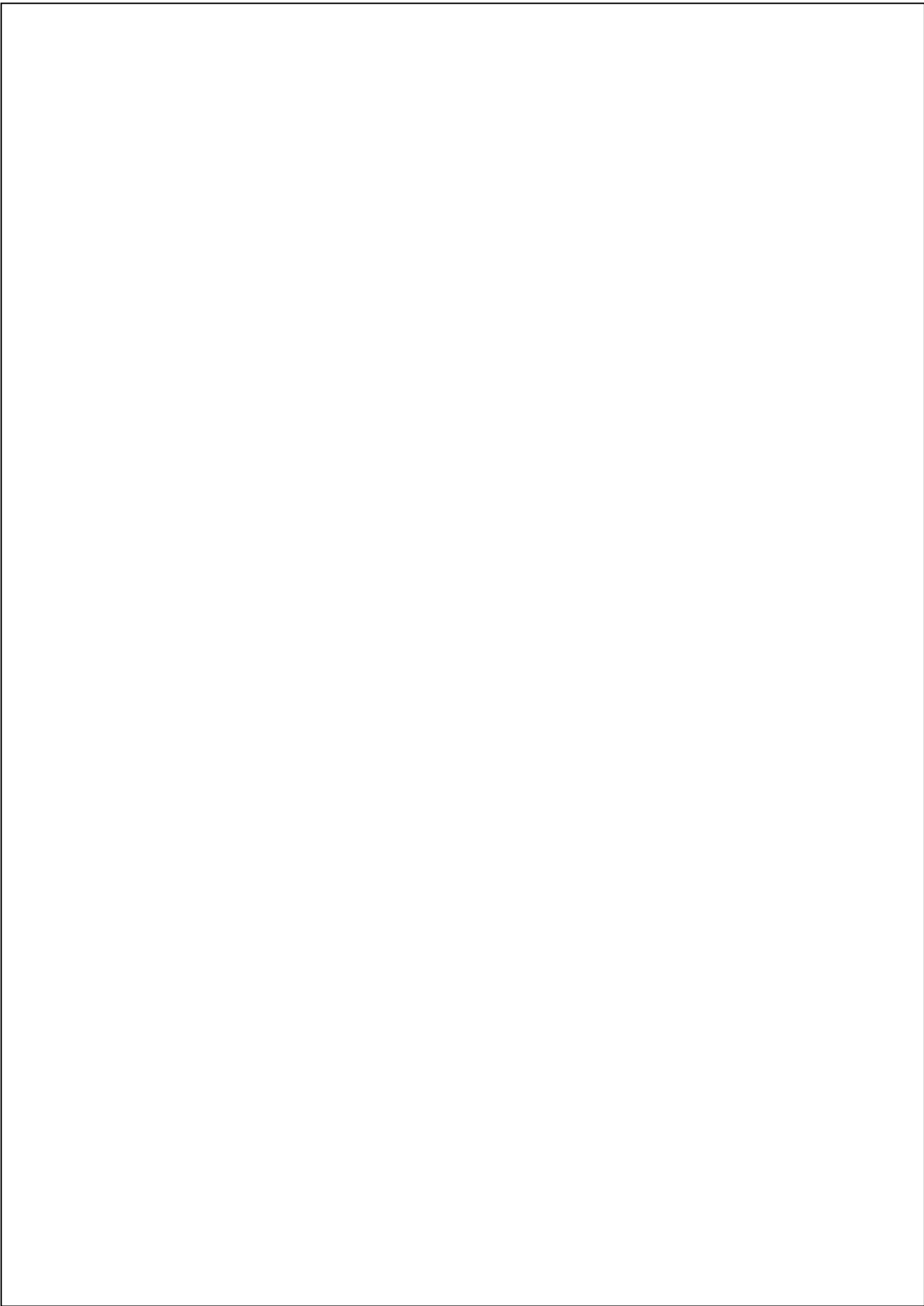


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TECHNICAL MEMORANDUM

TO Miss Nabila, Senior Manager of Gamuda Engineering
FROM Nur Atirah Husna , Project Manager
DATE June 6, 2024
SUBJECT Recommendation for a Safety Helmet

1.0 INTRODUCTION

Introducing two essential head protection solutions for industrial and construction environments, the Honeywell North Zone™ Hard Hat Full Brim and the 3M Hard Hat Orange 4 PT stand as pillars of safety in their respective fields. The Honeywell North Zone™ Hard Hat Full Brim prioritises comfort and durability, boasting a patented suspension system that evenly distributes weight to reduce pressure points during extended wear. Its easy-to-adjust ratchet system ensures a secure and personalised fit for diverse head sizes. Crafted from high-density polyethylene, this hard hat offers exceptional resistance to impacts and harsh conditions while featuring a full brim design that shields against sun and rain and enhances ventilation with strategically placed vents.

On the other hand, the 3M Hard Hat Orange 4 PT emphasises visibility and cost-effectiveness. Its vibrant orange colour enhances worker visibility in bustling job sites, complementing its four-point suspension system for comfort and stability. With an adjustable suspension system, it ensures a secure fit for various head sizes. Made from durable high-density polyethylene, the 3M hard hat offers a lifespan of up to three years, translating into fewer replacements and lower long-term costs. While both prioritise safety, the Honeywell North Zone™ Hard Hat Full Brim excels in comfort and fit, making it ideal for scenarios where compliance and added safety features are paramount. In contrast, the 3M Hard Hat Orange 4 PT provides a budget-friendly option without compromising essential safety standards, catering to companies with strict budget constraints (3M, n.d.).

1.1 Background of Current Situation

Complaints from construction staff about one of the PPEs utilized by the company, which is GAMUDA BERHAD has been reported. Our company is Gamuda Berhad, the biggest infrastructure companies in Malaysia, with projects both inside and outside the country. It specializes in construction, engineering, property development, and infrastructure concessions. Our company total of workers is 3000 from all management and we have 300 construction workers for construction sites that have priorities for using PPE during work.

In our previous project review meeting, Ms. Amelia Sim Hui Jin, the project manager, raised a concern about the head protection PPE currently used in our company. Staff have reported various issues, including discomfort, poor fit, and lack of durability, which have affected their overall safety and productivity. So, ensuring employee safety is crucial, and addressing these PPE issues is a priority. The technical consultant team initiated a comprehensive research effort to thoroughly examine the two high-quality PPE options. After meeting and discussion, the team considered factors such as Safety Standards Compliance, Comfort and Fit, Durability, and cost-effectiveness.

1.2 Statement of Problem

The current head protection PPE used by Gamuda Berhad's construction workers is failing to meet essential safety and comfort standards, posing significant risks to worker safety and productivity. Reports from staff indicate that the helmets suffer from poor fit, causing discomfort during extended wear, which not only diminishes worker compliance but also increases the likelihood of workplace injuries (Safety+Health Magazine, 2021). Additionally, the helmets lack durability, necessitating frequent replacements and contributing to higher operational costs (Occupational Health & Safety, 2020). These deficiencies are particularly concerning given the company's commitment to maintaining high safety standards and the critical nature of head protection in the construction industry (Gamuda Berhad, 2023). Addressing these PPE shortcomings is imperative to ensure the well-being of the workers and the efficiency of project execution (National Safety Council, 2022).

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1.3 Purpose of Report, Options, and Points of Comparison

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The purpose of this report to compares two head protection product which is Honeywell North Hard Hat (Honeywell North A79R) and 3M Hard Hat Series (3M H-701V).The objective is to evaluate their features, performance and overall value to recommend the best option for industrial and construction use. The Honeywell North A79R was produced in 2016 while the 3M H-701V was introduced in 2022. We research their strong reputations in the market and their compliance with industry safety standards. Both models are designed to offer reliable head protection but they also have distinct features that may make one more advantageous over the other depending on specific needs.

Safety Standards Compliance is evaluating whether each hard hat meets or exceeds the necessary safety standards which is ANSI/ISEA Z89.1-2014 for United State, CSA Z94.1-15 for Canada to ensure they provide adequate protection against impact (Hard Head Veterans, n.d). Both products have similar comfort and fit but in different types of padding, weight, suspension system and adjustability. A comfortable hard hat can reduce fatigue and increase worker compliance in wearing the protective gear consistently (Occupational Health & Safety ,2016).

Comparing the materials used in each hard hat and their durability to withstand harsh working conditions. This includes the type of plastic or composite material used and the helmet's overall construction quality. ¹Cost-effectiveness means the provider offers a solution that fits the budget and provides optimal value. These four criteria help us make a balanced decision, considering financial, safety, comfort and functionality for users. By examining the Honeywell North A79R and 3M H-701V against these criteria, we aim to provide a clear and comprehensive comparison that highlights the strengths and weaknesses of each model. A summary table of this evaluation is in Table 1 below:

Table 1 *Comparison of Safety Hard hat*

Options	Points of Comparison/Criteria
<div>3</div> Honeywell North Hard Hat (Honeywell North A79R)	1. Safety Standards Compliance 2. Comfort and Fit 3. Durability 4. Cost-Effectiveness
3M Hard Hat Series (3M H-701V)	

1 2.0 STATEMENT OF REQUIREMENTS

The Executive Committee has set criteria for the safety head. The total cost for the safety head must not exceed RM 40,000, aligning with cost-effective principles in organizational budgeting and financial management(Sitinjak et al., 2023).

The safety head must be long-lasting, made of high-quality materials, and include a warranty of at least two years. This requirement ensures the safety and reliability of the equipment for an extended period of time, aligning with best practices in occupational health and safety standards.(Personal Protective Equipment (PPE) Safety, 2018).

The new head protection PPE must meet international safety standards such as ANSI/ISEA Z89.1 or EN 397 to ensure effective protection. This requirement ensures that the PPE meets rigid safety criteria designed to protect workers from head injuries in a variety of industrial settings, in line with best practices in occupational safety(A longitudinal study on the impact of occupational health and safety practices on employee productivity, 2024).

Lastly, the safety head's PPE should be lightweight and have comfortable padding to ensure prolonged wearability without causing discomfort or fatigue (Johnson & Gallagher, 2018).

3.0 DISCUSSION

3.1 Safety standard compliance

Table 2 Comparison of safety head : safety standard compliance

Criterion	Honeywell North Hard Hat	3M Hard Hat Series
International safety standard	Does not have any	America National standard Institute (ANSI)
Type of safety standard	Does not have any type	Type I
Class of safety standard	Does not have any class	Class G and E

Compliance with safety standards is an important consideration when selecting head protection. When choosing head protection, it is crucial to ensure that the equipment meets recognized safety standards. These standards establish performance and reliability benchmarks, thereby ensuring worker safety in a variety of hazardous environments. Safety supervision is also necessary to enforce compliance with safe work practices. Otherwise, workers may display a negligent attitude and disregard safety rules (PPE non-compliance among construction workers, 2021). By comparing the safety standards followed by various brands, you can make an informed decision about which brand provides the best value in terms of safety and protection.

The 3M Hard Hat Series complies with international safety standards, meeting the requirements of ANSI/ISEA Z89.1-2014 Type I, Class G, and E, while the Honeywell North Hard Hat does not comply with any international safety standard. It is important to meet international safety standards because they ensure that head protection PPE provides adequate protection against common workplace hazards, such as falling objects, electrical shocks, and impacts. This reduces the risk of serious injuries or fatalities (American National Standards Institute, 2016). Since Gamuda experiences more incidents on building sites, there are many possible things that can hit our workers' heads while working. A Type I helmet is

only intended to provide top impact protection (Application of air-bubble cushioning to improve the shock absorption performance of type I industrial helmets, 2020). To effectively reduce risks, it is imperative to give top priority to head protection that complies with the relevant international safety standards. By complying with these guidelines, employees will be able to trust the dependability and efficiency of their safety equipment, ultimately improving workplace safety.

Furthermore, according to the American National Standards Institute (2016), Class G helmets are made to protect workers from electrical hazards that are frequently present in environments like construction and utility maintenance. Class G helmets would be necessary to protect workers from electrical shocks, especially since Gamuda's operations frequently involve working near electrical installations or equipment. Adherence to this particular class guarantees that employees are sufficiently safeguarded when handling electrical hazards. Class E helmets offer a higher level of electrical insulation compared to Class G helmets, making them suitable for environments with greater electrical hazards (American National Standards Institute, 2016). Class E helmets would be required in some Gamuda operating conditions to offer sufficient protection against potentially hazardous electrical currents, such as working close to high-voltage power lines or electrical substations.

While Honeywell North Zone™ Hard Hat Full Brim does not offer any international safety standard, it is clear that this brand does not meet our requirements. The Honeywell North Zone™ Hard Hat Full Brim's level of protection is questionable if it doesn't follow commonly accepted international safety standards like ANSI/ISEA Z89.1-2014. Inconsistencies in safety performance may result from this lack of standardisation.

In conclusion, prioritising head protection that meets the international safety standards, such as the ANSI/ISEA Z89.1-2014, is essential for ensuring worker safety in hazardous environments. The 3M Hard Hat Series is the preferred choice because it meets these standards and provides strong protection against common workplace hazards. As a result, selecting the 3M Hard Hat Series is critical for increasing workplace safety and lowering the risk of serious injury.

3.2 Comfort and Fit

Table 3 Comparison of safety head : Comfort and Fit

Criterion	Honeywell North Hard Hat	3M Hard Hat Series
Weight	14.46 ounces (410 grams)	12.8 ounces (363 grams)
Padding	cushioned brow pads	Foam or fabric sweatband
Design	Ergonomically	Streamlined

⁴ Safety helmets can prevent or minimise injuries to the head and brain, protecting against falling objects, impact with other objects, electric shock and rain. Most head injuries can be avoided if the proper head protection is selected, used and maintained.(Huzieh,M, 2023) When choosing the right head protection, the weight must be considered. The Honeywell North Hard Hat is heavier at 14.46 ounces (410 grams) compared to the 3M Hard Hat Series which weigh only 12.8 ounces (363 grams).(Amazon.ca,n.d) This weight difference can significantly affect user comfort, especially during prolonged use.

Both Honeywell North and 3M Hard Hat offer effective and comfortable padding. However, because foam and fabric sweatband are softer and more effective at absorbing moisture, 3M hard hats made of them may be marginally more comfortable. With extended use, this kind of cushioning may feel softer and more comfortable against the skin. Because of that, 3M Hard Hat fulfils the requirement and it will be chosen. ² To improve a wobbly hat's retention, a worker is likely to overtighten its suspension, which leads to pinching and painful pressure. Likewise, working in an ill-fitting hat commonly leads to ergonomic strain as workers tense their muscles and avoid natural movement to help keep the hat in place, causing muscle strain.(Occupational Health & Safety ,2016)

Furthermore, by using different design approaches, the Honeywell North Hard Hat and the 3M Hard Hat Series both meet the specified requirements for safe head protection. Because of its ergonomic design, the Honeywell North Hard Hat fits the wearer's head and body form comfortably and securely, improving both comfort and safety over extended use.

(Robert,2023)However, the streamlined design of the 3M Hard Hat Series minimises resistance to movement through the air and lowers the chance of snagging on objects.(Wiktionary, n.d) This is especially advantageous in busy and dynamic work settings. Every design approach complies with fundamental safety and functionality standards and provides dependable protection suited to various user requirements and work environments.

In conclusion, the 3M Hard Hat Series is recommended due to its reduced weight, better moisture-absorbing padding, and streamlined design that reduces resistance and snagging, even though both the Honeywell North Hard Hat and the 3M Hard Hat Series exceed all necessary safety and operational standards. The 3M Hard Hat Series is the best option for providing efficient and comfortable head protection in any sort of work conditions because of these features, which also improve overall comfort and usability.

3.3 Discussion of Criterion/Point of Comparison 3

Table 4 Comparison of Cloud Service Providers: Capacity

Criterion	Honeywell North Hard Hat	3M Hard Hat Series
Warranty	2 year of warranty	3 year of warranty
pressure resistance	Does not have any	Securefit pressure diffusion technology
suspension system durability	Does not have any	4-point ratchet suspension system

Durability is a critical factor in selecting safety helmets, as they play a pivotal role in protecting workers from head injuries in hazardous environments. Evaluating the durability features of safety helmets involves considering factors such as warranty coverage and pressure resistance capabilities. Let's delve deeper into the durability comparison between the Honeywell North Hard Hat and the 3M Hard Hat Series based on these criteria.

The warranty for a safety helmet serves as a crucial assurance of quality, reliability, and durability, especially in environments where workers face potential hazards daily. especially for worker at GAMUDA BERHAD that involve work at construction site.For the warranty,3M Hard Hat Series have more year of warranty better than Honeywell North Hard Hat. for the helmet that will always use regularly in GAMUDA BERHAD company,the best choice is 3M Hard Hat Series because safety helmet should have warranty at least 3 years to make sure it safe to use for work and have higher resistance (Hard Hats - Do They Last for Ever?, n.d.).then,the long term warranty can make sure the safety helmet safe from material degradation from uv exposure,temperature and chemical that can cause hazard for the construction worker in gamuda's company(When Should I Replace My Safety Helmet?, n.d.).

Pressure resistance is a critical feature of safety helmets, especially in environments where workers are exposed to potential impacts or crushing forces. only 3M Hard Hat Series has the pressure resistance criteria that is securefit pressure diffusion technology while Honeywell North Hard Hat don't have this features at all.this feature function is it will flexes and self-adjusts to the size of the wearer's head. Reduces pressure and increases comfort for all day wear. Fits head sizes from 6-1/4 to 8 (50-64 cm)(3M Malaysia. (n.d.)).so,it will protect the wearer's head from impacts caused by falling objects, collisions, or accidents and ensures that the helmet can withstand the force of impact without deforming or collapsing, thereby reducing the risk of head injuries.so,it suitable and meet gamuda's company requirement for the construction worker.

The suspension system of a safety helmet is its backbone, providing crucial support, comfort, and impact absorption for the wearer. Serving as the interface between the hard outer shell and the wearer's head, the suspension system plays a pivotal role in ensuring the helmet's effectiveness in protecting against head injuries in hazardous environments.Suspensions are mechanisms in the top of the hat that allow for adjustment to ensure the hat fits correctly(Use Your Head: Choosing the Right Hard Hat, n.d.).3M Hard Hat Series has this suspension system that is 4-point ratchet system while Honeywell North Hard Hat don't have any suspension system for the protection. with this feature it will make sure the safety of garuda's company construction worker ensures a secure and comfortable fit for all head sizes (UV Hard 4-point Ratchet Suspension, 2024)

In conclusion,the 3M Hard Hat Series is recommended due to the long warranty,have pressure resistance and have the suspension system that Honeywell North Hard Hat does not have any .The 3M Hard Hat Series is the best option for providing efficient and durability of head protection from any hazard.

3.4 Cost-effectiveness

Table 5 Comparison of safety head : Cost-effectiveness

Criterion	Honeywell North Hard Hat	3M Hard Hat Series
Initial Cost	MYR 112.50 per unit	MYR 58.89 per unit
Annual Replacement Cost	MYR 16,875 for 300 unit	MYR 5,889 for 300 unit
Non-Compliance Cost	MYR 225	MYR 675
Total Annual Cost	MYR 34,950	MYR 12,509

³ The Honeywell North Zone™ Hard Hat Full Brim and the 3M Hard Hat Orange 4 PT both serve as essential PPE options for Gamuda Berhad's construction workers, but they differ significantly in cost-effectiveness. The Honeywell hard hat, priced at approximately MYR 112.50 per unit, features a patented suspension system for enhanced comfort and a ratchet system for a secure fit, offering an estimated 95% compliance rate due to its superior design. This hard hat's durability ensures a lifespan of one year, leading to an annual replacement cost of MYR 33,750 for 300 units. Factoring in a non-compliance cost of MYR 225, the total annual cost amounts to MYR 67,725 (Honeywell, 2023).

In contrast, the 3M Hard Hat Orange 4 PT, costing around MYR 58.89 per unit, includes a four-point suspension system and an adjustable fit, with a compliance rate of 85%. Although its lower durability necessitates 1.25 replacements per year, resulting in the same annual replacement cost of MYR 5,889 for 300 units, the initial cost is lower at MYR 17,667. However, the non-compliance cost is higher at MYR 675, bringing the total annual cost to MYR 12,509 (3M, 2023).

Initial Cost for 300 Workers

- **Honeywell North Zone™ Hard Hat Full Brim:** 300 workers × MYR 112.50 per unit = MYR 33,750
- **3M Hard Hat Orange 4 PT:** 300 workers × MYR 58.89 per unit = MYR 17,667

Annual Replacement Cost

- **Honeywell North Zone™ Hard Hat Full Brim:** $300 \text{ workers} \times \text{MYR } 112.50 \text{ per unit} / 2 \text{ years} = \text{MYR } 16,875$
- **3M Hard Hat Orange 4 PT:** $300 \text{ workers} \times \text{MYR } 58.89 / 3 \text{ years per unit} = \text{MYR } 5,889$

Cost of Non-Compliance and Injuries (Assuming 2 incidents/year)

- **Honeywell North Zone™ Hard Hat Full Brim:** $2 \text{ incidents} \times \text{MYR } 2250 \text{ per incident} \times (1-0.95) = \text{MYR } 225$
- **3M Hard Hat Orange 4 PT:** $2 \text{ incidents} \times \text{MYR } 2250 \text{ per incident} \times (1-0.85) = \text{MYR } 675$

Total Annual Cost

- **Honeywell North Zone™ Hard Hat Full Brim:** $\text{MYR } 33,750 / 2 \text{ years initial cost} + \text{MYR } 16,875 \text{ replacement cost} + \text{MYR } 225 \text{ non-compliance cost} = \text{MYR } 34,950$
- **3M Hard Hat Orange 4 PT:** $\text{MYR } 17,667 / 3 \text{ years initial cost} + \text{MYR } 5,889 \text{ replacement cost} + \text{MYR } 675 \text{ non-compliance cost} = \text{MYR } 12,509$

Despite the higher initial cost, the Honeywell hard hat's superior comfort and fit can lead to higher compliance and reduced risk of injuries, potentially offering better long-term value in terms of safety and productivity (National Institute for Occupational Safety and Health, 2021). However, the 3M hard hat provides a significantly more budget-friendly option with adequate protection, making it suitable for situations with strict budget constraints. Given the total annual cost of the 3M Hard Hat Orange 4 PT is below MYR 20,000, it offers substantial savings while still ensuring worker safety (Safety+Health Magazine, 2022). Therefore, for Gamuda Berhad, the 3M Hard Hat Orange 4 PT is recommended due to its cost-effectiveness, longer lifespan, and adequate safety features, making it a more practical choice for the company's budget constraints.

4.0 RECOMMENDATION

4.1 ³ Summary

The Honeywell North Hard Hat (Honeywell North A79R) and 3M Hard Hat Series (3M H-701V) are thoroughly evaluated for safety standard compliance, comfort and fit, durability, and cost-effectiveness. These factors have been crucial in overcoming Gamuda Berhad's challenges in providing adequate head protection to its construction workers.

The 3M Hard Hat Series ⁷ excels in safety standard compliance, meeting international safety standards such as ANSI/ISEA Z89.1-2014 Type I, Class G, and E, whereas the Honeywell North Hard Hat does not comply with any international safety standard. This compliance ensures effective protection against common workplace hazards, which significantly improves workplace safety.

In terms of comfort and fit, the 3M Hard Hat Series is the clear choice due to its lighter weight, superior moisture-absorbing padding, and streamlined design. These features provide increased comfort and usability, addressing concerns about discomfort and ergonomic strain during extended use.

Durability considerations highlight the superiority of the 3M Hard Hat Series, which provides a longer warranty period, superior pressure resistance via Securefit pressure diffusion technology, and a dependable 4-point ratchet suspension system. These features provide long-term protection and reduce the risk of workplace injuries caused by insufficient head protection.

In terms of cost-effectiveness, the 3M Hard Hat Series offers a low-cost option while maintaining essential safety standards, making it the preferred choice for Gamuda Berhad, especially given the company's commitment to cost-effective principles in organisational budgeting and financial management.

Finally, the comprehensive evaluation indicates that the 3M Hard Hat Series (3M H-701V) is the best choice for head protection at Gamuda Berhad. Its compliance with international safety standards, lightweight design, superior comfort and fit, increased durability, and cost-effectiveness make it the best option for ensuring worker safety and productivity in

hazardous construction environments. Thus, selecting the 3M Hard Hat Series ensures Gamuda Berhad's dependable, comfortable, and legal head protection.

Table 6

Comparison of Safety Standard Compliance, comfort, durability and cost between Honeywell North A79R and 3M H-701V

Criteria	Sub Criteria	³ Honeywell North Hard Hat (Honeywell North A79R)	3M Hard Hat Series (3M H-701V)
Safety Standard Compliance	International safety standard	X	✓
	Type of safety standard	X	✓
	Class of safety standard	X	✓
Comfort and Fit	Weight	X	✓
	Padding	✓	✓
	Design	✓	✓
Durability	Warranty	X	✓
	Pressure resistance	X	✓
	suspension system	X	✓
Cost-Effectiveness	Initial Cost	X	✓
	Annual Replacement cost	X	✓
	Non-Compliance Cost	✓	X
	Total Annual Cost	X	✓

4.2 Recommendation

In conclusion, because of its conformity with international safety requirements, lighter weight, superior pressure resistance, and efficient suspension system, a complete examination recommends the 3M Hard Hat Series (3M H-701V) as the best option for head protection. The 3M Hard Hat Series is especially well-suited for dynamic work conditions because of its streamlined design, which lowers snagging risks and movement resistance while providing greater comfort with foam and fabric headband padding. Thus, choosing the 3M Hard Hat Series guarantees GAMUDA BERHAD dependable, cosy, and legal head protection.

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