ASHREJ
ASIAN SOCIAL SCIENCE AND HUMANITIES RESEARCH JOURNAL

e-ISSN: 2636 – 9109
Volume 5 Number 1 March 2023, 22 ~ 38
DOI: https://doi.org/10.37698/ashrej.v5i1.246

Specialised Attire for Building Construction Workers: The Research Conducted in Tanah Merah Housing Development

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ARTICLE INFO

Article history:

Received Jan 14, 2023
Revised Feb 28, 2023
Accepted Mar 15, 2023

Keywords:

Multi-Functional Fashion,
Temperature of Body,
Housing Construction Workers

Conflict of Interest:

None

Funding:

None

ABSTRACT

Construction sites are known to exhibit hot and harsh environments. Highly physically demanding tasks done by the construction workers made them one of the highest physical to heat stress-related cases globally (Lee, 2020). Besides, jobs such as building construction are precarious and dangerous jobs. A common problem often faced by building construction workers is exposure to the scorching sun's heat while working. There is a need to investigate how to keep building construction workers healthy. The objective is to study the characteristics and type of a construction uniform.

Moreover, it examines creative and innovative functional ideas for controlling body temperature while working in the hot sun. There needs to be more research on housing construction workers to raise awareness of the importance of wearing the proper uniform to maintain health and avoid hazards. This study showed that humans must maintain a body temperature of 37 degrees Celsius and cannot work in hot environments to prevent heat stroke, cramps, and fainting. Researchers produce functional Hi-vis to maintain body temperature in a hot climate to care for workers' health. The concept used is natural ventilation that will be made by manipulating clothing patterns. The idea is from the analysis results done through Google Forms and observation. The development of the findings through Google form shows that the respondent often sweats on the chest and back; this further strengthens the researcher's study to produce Hi-vis clothing for housing construction workers. This Hi-vis clothing is for comfort and durability when housing construction workers work in a high-heat environment.

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1. Introduction

Functional clothing is the next step in developing the technological textile industry, reflecting an environment where clothing transcends traditional boundaries and interacts with realms such as medicine, biotechnology, nanotechnology, physics, and computing to meet the user's multifaceted and dynamic needs. Functional clothing is user-specific and built or engineered to meet the user's performance requirements under severe conditions (Erdemismal et al., 2017). Even though little knowledge about the concepts used in their production is available, several practical clothing items are available on the market, such as protective clothing, medical clothing, or sports clothing. Furthermore, functional clothing will have its aesthetic and value when it meets sustainability. Besides, sustainable fashion refers to clothing designed, manufactured, distributed, and used in environmentally friendly ways (Faye, 2018).

Based on the research that has been made, clothes worn by construction workers are to ensure their safety and health when doing work. Building construction is a high-risk and dangerous job if you wear appropriate clothing. Besides, clothes for construction are already on the market, but many shortcomings need to be improved to ensure the safety of workers. To simplify his work, the construction clothes will be scrutinised for safety and functionality. Furthermore, to enhance construction garments to better versions. Because, in the observation, the job of housing construction is hazardous. Construction workers face discomfort while working in hot weather conditions. Next, this can lead to heat stress when workers are exposed to several combination factors of work type, environmental factors such as airflow and temperature, humidity and ambient heat or radiant heat and the rate of clothing or personal protective equipment that should be used while working. The body's response to these things is called heat strain. In addition, supporting sustainable development goals through local government planning of SDG 3, good health, and well-being; SDG 8, decent work, and economic growth; and SDG 9, industry, innovation, and infrastructure, is to benefit other people while doing work. Moreover, the 2030 Agenda for Sustainable Development (SDGs) has been established to alter our world by addressing humanity's many difficulties to promote well-being, economic prosperity, and environmental protection (Pradhan, 2017). Producing a product that characterises sustainable development and goals (SDGs) can make it easier for people to do their job. In addition, the effect produced has scientific features and is specially designed to work, which has disadvantages that can lead to health problems.

1.1 Problem Identification

Construction sites are known to be hot and harsh environments. Highly physically demanding tasks done by the construction workers made them one of the highest physical to heat stress-related cases globally (Lee, 2020). Jobs in housing construction are precarious and dangerous jobs. A common problem often faced by housing construction workers is exposure to the scorching sun's heat while working. Next, when a person is exposed to the scorching heat of the sun for too long, this can result in a heat stroke. In addition, humans need to maintain an average body temperature to keep the body strong and avoid heat stroke, cramps, and fainting.

Furthermore, clothes worn by housing construction workers do not have a safety function of the health for the workers. Besides, not all workers care about personal safety because they only consider earning a living and supporting their families. Nonetheless, poor people in all cultures have been known to forego necessities to purchase luxuries that they value for reasons other than monetary gain. Outsiders, for whom the commodities in question have less symbolic importance, find this extravagant (Edin et al., 1997). The workers who work in housing construction are made up of people in their 20s and 50s to support their daily family life. Therefore, a functional uniform can at least facilitate the construction workers while doing their job. In addition, construction workers can prevent dangerous risks. Construction and maintenance have one of the highest injury rates among any profession, as reported by the Bureau of Labour Statistics (Abdalla et al., 2017). Besides, the housing construction workers do not take it seriously the clothes they wear; among the clothes they often wear while working are t-shirts and jeans. All workers must wear shirts with sleeves, long pants, and sturdy shoes or boots when working on a construction or renovation site (Solanki, 2021). In terms of fabric, it is not good to wear when doing construction work. Therefore, a functional construction uniform is necessary to facilitate workers and take care of their health.

Furthermore, working or operating in high temperatures and high humidity has a substantial risk of causing heat stress to individuals who work in those situations. Construction workers have the most heat stress since they labour in a hot setting under direct or indirect sunshine (Gupta., 2011). Workers must wear the proper multi-functional uniform to maintain body temperature when building construction. In Addition, wearing inappropriate clothing can be a significant cause of heat stress even when the environment is not hot or hot. Also, the more physical work we do, the more heat we produce. Heat stress is the total heat load on the body, which includes contributions from metabolic heat production and external environmental factors such as temperature, relative humidity, radiant heat transfer, and air movement, as they are affected by clothing. On the other hand, heat strain is a physiological response to remove heat and maintain a constant core body temperature (Lee, 2020).

1.2 Research Objectives

This research aims to produce a Hi-Vi attire for construction workers to keep their body temperature in a hot environment with natural ventilation. Furthermore, this may raise awareness of the importance of maintaining personal safety and health in doing work. In addition, this product is intended primarily for employees who do high-risk work and are exposed to hot environments, which can cause heat stroke.

i. To study the characteristics and type of a construction uniform.

ii. To examine creative and innovative functional ideas for controlling body temperature while working in the hot sun.

iii. To evaluate the design for construction workers and identify problems beforeproduct production.

1.3 Research Questions

i. What are the characteristics and type of construction uniform?

ii. How do we analyse ideas in function that can control the body's temperature while working in the sun's heat?

iii. What is the design's problem, and what steps should be taken beforemarketing the products?

1.4 Scope and Delimitations of Study

1.4.1 Limitation

The study aims to investigate the Hi-Vis for a hot environment at housing construction only but is not concerned about any Hi-Vis for other workers. Next, to focus on the characteristic uniform of housing construction and learn how to make manipulation patterns for Hi-Vis jackets-represented the uniform for construction workers withinnovation and functionality that can maintain body temperature. In Addition, only housing construction workers in hot environments can wear the Hi-Vis's jacket.

1.4.2 Delimitation

This study needs to cover and focus on the whole thing about construction. Besides, this study is limited to textile fabric that can maintain body temperature in a hot environment. Next, this study has excluded the following to determine how workers feel about heat stress and physical exertion.

1.5 Significant Contribution to New Knowledge

This study will benefit construction workers, as construction workers play an essentialrole in the manufacture of buildings for urban development. Therefore, producing products with innovations to maintain body temperature can at least prevent getting dangerous diseases for a long time. In addition, the study was done by collecting data from construction workers about the uniform problems they face when working in a hot environment. Next, study the features of the construction workers' Hi-Vis jackets to apply pattern manipulation. Then, to raise awareness of the importance of wearing the right Hi-Vis while doing work to maintain health and avoid hazards.

2. Literature Review

2.1 The Effects That Will Be Faced by Construction Workers Working in HotEnvironments

Heat stress occurs when the human body is exposed to temperatures higher than it can endure without causing physiological harm (Kjellstrom et al., 2016).Internal body heat, external heat, and clothing heat from muscle physical activity, ambient environmental temperature, and body clothing heat convection and sweat evaporation are three approaches to defining heat stress effects (Kjellstrom et al., 2016). Heat stress develops when the body is unable to expel excessheat.

2.2 PPE Construction Weakness

Construction workers exposed to hot environments or extreme heat can be at risk of heat-related illness (HRIs) and injuries. Heat stress is the combination of a worker's exposure to heat from physical activity, environmental factors, and clothing, which increases the body's heat storage, known as the net heat load. Heat strain is the physiological response to heat stress when the body tries to increase heat loss to the environment to keep a stable body temperature. Core body temperature must be kept within one °C (1.8°F) of normal (about 37°C or 98.6°F) to continue to function normally (NIOSH, 2016).

2.3 Construction Site Safte Uniform Cloth Issue

Construction site accidents always happen. The body needs to be healthy when doing heavy or light work. Therefore, uniforms also play a significant role in protecting the body from high or normal risk hazards.

According to DOSH (2005), PPE is any equipment worn at work to safeguard a person's safety and health and any supplementary item designed to protect him while doing a task. Rosli Ahmad (2008) states that supplying personal protective equipment (PPE) at construction sites is critical. Similarly, Paringga (2010) stated that providing PPE to construction employees is necessary to maintain a safe and healthy working environment.

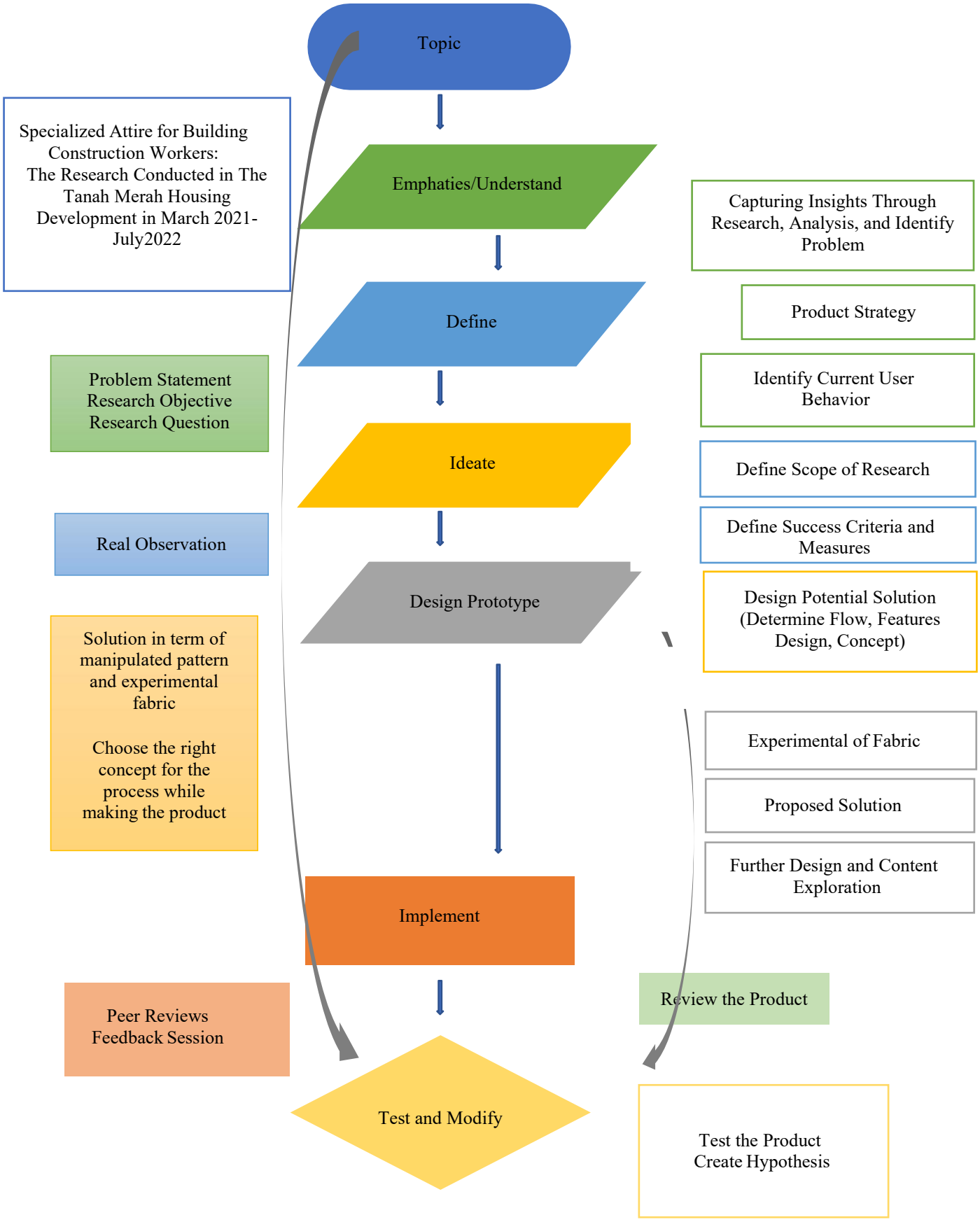


Figure 1. The Research Design Process Specialised Attire for Building Construction Workers

2.4 The Characteristics of Uniform of High Visibility

2.4.1 Three Components of Hi-Vis Clothing

According to CCOHS, EN ISO 20471 specifies the requirements for high-visibility clothing design and performance for each garment component. Typically,there are three primary components: the fluorescent material, the reflective strips, and the contrast material.

2.4.2 The Fabric

Clothing is an essential human requirement that protects the body fromenvironmental and climatic dangers (Motlogelwa, 2018). Fabrics for producing garments play a significant role in ensuring consumer safety. To safeguard the body, high-performance fibres are created with specific qualities (Tasneem Sabir, 2017). Fora garment to impact performance, it must be suitable for the activity (Motlogelwa, 2018). Therefore, the fabric often used for hi-vis clothing has specific features. Next, for example, fire extinguishing fabric is reserved for fire retardants, and fabric for construction usually has durability. High-performance apparel has different requirements than daily clothing, and fabric and garment design are used to ensure comfort in these products (Motlogelwa, 2018). The foundation of composite textiles in high-performance apparel is a variety of composite materials and their structures. Highly inventive and intelligent fabrics canbe related to protection and survival in dangerous environments. Creating such fabrics requires a thorough understanding of high-performance fibres and an appreciation for them (Tasneem Sabir, 2017). Fabrics that are often used by the uniform clothing industry usually use polyester, cotton, twill, and fire-retardant fabrics.

2.4.3 Identifying the High-Visibility Classes

According to Wise Work Safe, Hi-Vis's clothing is divided into three classes, and allclothing must be labelled with the EN ISO 20471 emblem and the associated class number. Below is an example of how this might appear. The selection and wearing of clothing with high visibility should always be based on an assessment of the risks of the situation and the risks faced by a particular employee. The type of high-visibility workwear required depends on the employee's risk zone, which determines the amount of reflective tape and fluorescent material required.

The surface area of both types of materials is used to determine certification, and there are minimum standards for each:

Table 1. Minimum Standard Material

	Class 1	Class 2	Class 3
Reflective Tape	0.10 sqm	0.13 sqm	0.20 sqm
Fluorescent Material	0.14 sqm	0.50 sqm	0.80 sqm

(Source: https://www.wiseworksafe.com/blog/view/understanding-en-iso-20471-high-visibility-clothingformerly-en471-)

According to CCOSH, the CSA categorises clothes into three categories based on the level of body protection they offer. According to the minimum body protection areaestablished for each class, each class covers the body (from the waist to the neck) and limbs.

Table 2. The CSA Categorises Clothes

Class 1	Class 2	Class 3
Offers good visibilityand the lowest recognised coverage	Provides good visibility and moderate body coverage	Gives the highest body protection and visibility in dim light and from a distance

(Source: https://www.ccohs.ca/oshanswers/prevention/ppe/high_visibility.html)

2.4.4 The Different Classes of High Visibility Safety Apparel

Table 3. The Different Low-Risk, Medium Risk and High-Risk

Class	Situation	Job Scope
Class 1 Class 2 Low Risk	Permit maximum visibility when the background ofthe work is not complicated	Employees point drivers inthe direction of parking or service areas
	When the vehicle doesn'tgo faster than 40 km/h (25 mph)	In parking lots, workers retrieve shopping carts

	When workers engage in activities that keep them from seeing oncoming traffic	Personnel engaged in warehouse work Maintenance stafff or sidewalk or "right-of-way" Personnel engaged in shipping or receiving
Class 2 Class 3 Medium Risk	When cars are moving at speeds of 40 to 80 km/h (25 to 50mph), workers need to be more visible in poor lighting orinclement weather Employees engaged inthe activity divert the attention ofthe vehicle from the traffic When job -relatedactivities are performed closer tothe car such as near flowing vehicle traffic	Roadway construction,utility, forestry, or railway workers Manufacturing, plant, ormill workers Survey crews School crossing guards Parking and toll gateworkers Airport baggage handlersand ground crews Emergency response personnel Members of law enforcement Accident site investigators Railway workers
Class 2 Class 3 Medium Risk	Exceeded speed limit of 80 km/h (50 mph) The high workload for pedestrian workers and drivers ofmoving vehicles clearly puts the worker in danger The wearer must beclearly visible while moving through the entire range of motion at a minimum distance of 390 m (1,280 ft) Work activities that take place at night or in dim light	Roadway construction workers Utility workers Survey crews Mineworkers Emergency responders Road assistance orcourtesy patrols Flagging crews Towing operators

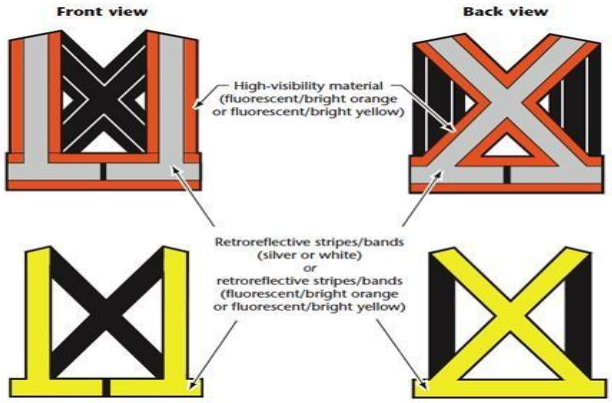
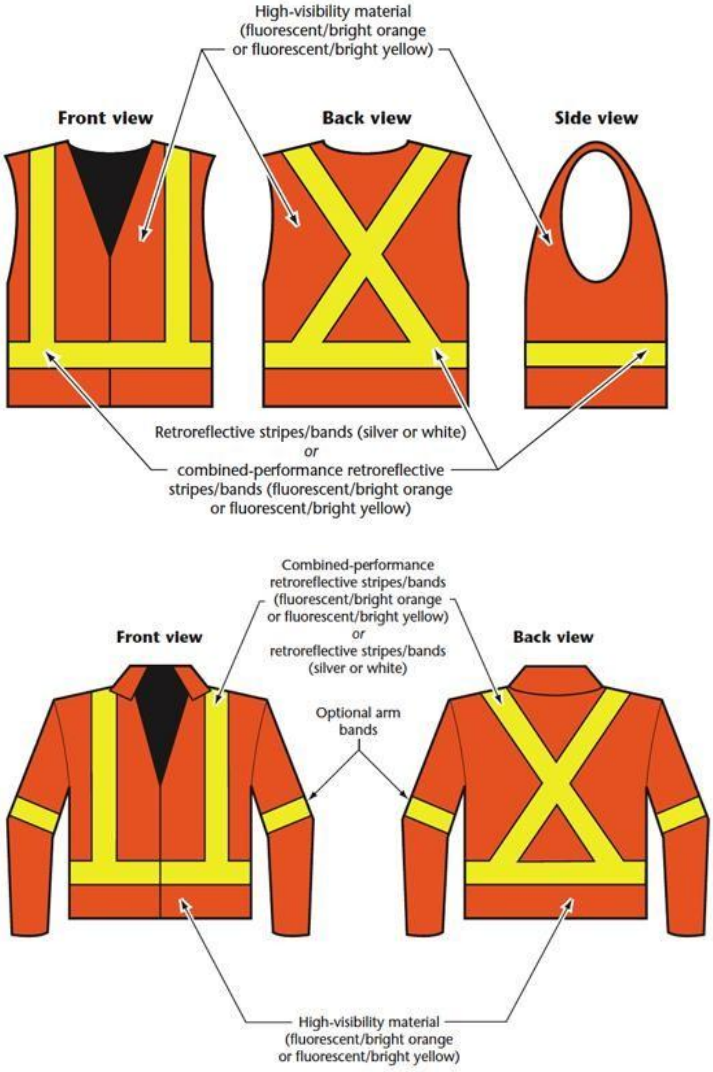


Figure 2. Class 1 Apparel Harness or Colour/Retroreflective Stripes on Other Clothing (Photo By CCOHS)



(Source: https://www.ccohs.ca/oshanswers/prevention/ppe/high_visibility.html)

Figure 3. Class 2 Apparel Vests and Jackets (Photo By CCOHS)

(Source: https://www.ccohs.ca/oshanswers/prevention/ppe/high_visibility.html)

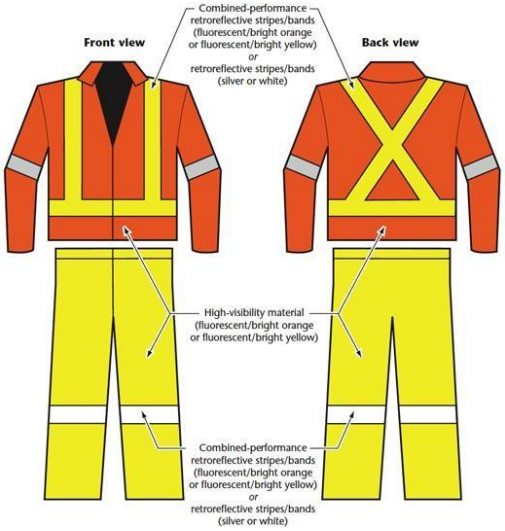


Figure 4. Class 3 Apparel Jackets and Overalls CSA Standard Z96-15 (Photo By CCOHS)

(Source: https://www.ccohs.ca/oshanswers/prevention/ppe/high_visibility.html)

2.5 Types of High-Visibility Clothing

2.5.1 Hi-Vis Jackets

Typically, these are composed of heavy-duty cloth that can endure rain and wind. Short and long-sleeved waistcoats and waterproof jackets with hoods are available. These jackets, often used by people working

outside in dark situations, can be worn with other outfits or on their own (John, 2021).

Figure 5. Hi-Vis Jacket

(Source: https://garmentprinting.com.au/blog/hi-vis-clothing-its-benefits-at-work)

2.5.2 Hi-Vis Vests

This lightweight clothing shields you from the sun's harmful UV rays while increasing your visibility to others. Construction and road workers often wear them (John, 2021).

Figure 6. Hi-Vis Vest

(Source: https://garmentprinting.com.au/blog/hi-vis-clothing-its-benefits-at-work)

2.5.3 Hi-Vis Shirts

Typically, these are composed of heavy-duty cloth that can endure rain and wind. Short and long-sleeved shirts, waistcoats, and waterproof shirts with hoods are available. People working in outdoor construction situations often wearhigh-visibility shirts. They can be worn as part of your uniform or as an extra layer of protection when working outside or in situations where falling objects or vehicles posea significant danger of

injury (John, 2021).

Figure 7. Hi-Vis Shirt

(Source: https://garmentprinting.com.au/blog/hi-vis-clothing-its-benefits-at-work)

2.5.4 Hi-Vis Trousers

These are likewise composed of a rain- and wind-resistant material. Shorts, long trousers, and waterproof trousers with zip-off legs for convenient access are available. Construction and waste management personnel wear hi-vis trousers, which can be worn with a uniform or as an added safety measure when working in

places with a significant danger of injury (John, 2021).

Figure 8. Hi-Vis Trouser

(Source: https://garmentprinting.com.au/blog/hi-vis-clothing-its-benefits-at-work)

3. Methodology

The proper methodologies used in this study and research are mainly qualitative methods. There are two parts to the data collection process: the theoretical and the empirical parts. The theoretical part aims to collect data regarding understanding and conception of problems and issues. In contrast, the empirical part aims to collect data through hands-on methods obtained through first-hand studies such as observations, surveys, and experimental design. Qualitative data will be required to carry out this study. Primary data were obtained quickly and efficiently through efficient materials such as surveys using questionnaires and observations to obtain information and feedback briefly but comprehensively without wasting time. This saves much time because the survey is conducted through questionnaires on many respondents. This research also used in-depth interviews to obtain respondents' feedback after testing the product or design during pilot and post-testing. Therefore, secondary data is used to collect keyword search-related data on topics and issues such as "hi-visibility," "safety jacket," "temperature of the body," "building construction workers," "hot environment," and "healthy workers" in the long term, and a few more terms. The researcher explains how the study's objectives can be achieved by using three data collection instruments, primary, secondary, and case studies, at the study site to identify problems and produce excellent and innovative products for consumers.

3.1 Qualitative Research

Qualitative data collection methods used in the study were questionnaires, observations, and interviews. In addition, researchers also use secondary sources in research, such as books, online journals, newspapers, blogs, product websites, and existing product reviews from the designer's official website. Next, the researcher observed the actual case in a preliminary and pilot study at the research site. Furthermore, the purpose of the research is to collect qualitative data such as understanding problem statements and issues and the behaviour of respondents when facing clothing problems while on construction sites. Researchers can produce valuable and multifunctional products for construction workers from the research.

3.2 Research Objective and Data Collection Instrument

Table 4. Research Objectives, Instruments, and Data Analysis

Research Objectives	Instruments	Data Analysis
To study the characteristics and the typeof a construction uniform	Primary Data (survey questionnaire) Secondary Data (book, journal, article, website,blog, google scholar)	Observation Analysis
To analyse the creative and innovative idea in functional that can control body temperature while working in the heatsun	Secondary Data (book, journal, article,website, blog, Google Scholar) Product Experimentation and Test	Market Trends Observation Analysis Sketching Idea Development
To test the design for construction workers and identify problems before product production	Product Experimentation and Test	Sketching Idea Development Product Experimentation Final Product

3.2.1 Primary Data

Researchers have conducted a preliminary study on this issue with 30 respondents using Google Forms to support and validate problem statements and issues. These respondents are housing construction workers. The findings show that these housing construction workers have trouble working in hot weather. In addition, observations atthe workplace are made to see the situation and the way they work. Most respondents agreed that working in hot situations requires clothing that has natural ventilation. This test focuses on customers' reactions to the designs of clothing patterns that have been processed according to the problems of the study. In addition, with the presence of creative innovations in improving clothing production for construction workers, they can do construction work comfortably and at least be able to maintain health in the long run.

Researchers have also narrowed the focus of respondents to men aged 17 and above because the study found that only men work as homemakers to support their daily needs. The observation method was conducted concurrently with the survey questionnaire during the initial study and pilot test. This method is carried out through two ways, namely direct observation, and photographs, to keep a record of the data. Meanwhile, the observations made during the pilot test were to find out the reactions and responses of the selected respondents while testing the prototype, and pictures and answers to the pilot survey interviews supported their feedback.

3.2.2 Secondary Data

The process is carried out at the product and experimental levels based on developing ideas derived from pilot and actual testing. The idea development process is to make sketches, product sampling and experiments, actual design, pattern processing, and fabric selection. The process involves prototyping and actual design based on survey respondents' feedback and feedback from target customers. This product improves the existing product and reduces thermal stress when working in a high-heat environment. This product has the concept of natural ventilation. Next, of course, this product is affordable for all housing construction workers. User survey, user requirements, garment design, garment assembly, and testing and analysis are the steps of the proceedings after the research work according to the design process framework.

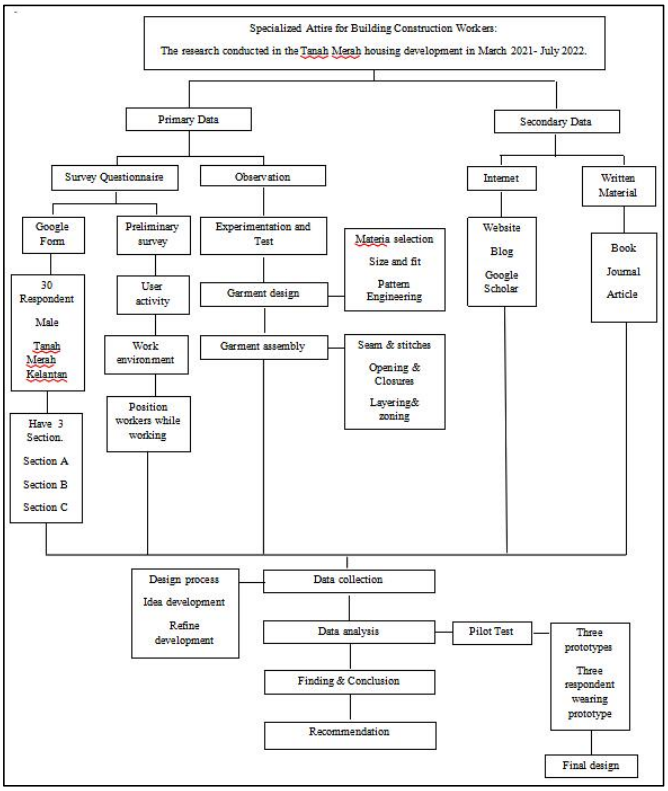


Figure 8. Research Framework of Methodology

4. Results and Discussion

The findings of the research investigations were conducted using the survey questionnaire method of data gathering. The data can be acquired through the research methodology process to produce results that can be referenced and trustedto aid in product design and manufacture. The results provided by the respondents will be utilised as a reference and as solid evidence to support the design reasons for the product developed based on the study's findings.

4.1 Research Questions and Data Collection Instrument

Table 5. Research Question, Instruments, and Data Analysis

Research Questions	Instruments	Data Analysis
What are the characteristic and type of a construction nuniform?	Primary Data	Observation

	(survey questionnaire) Secondary Data (book, journal, article, website, blog, google scholar)	Analysis
How to analyses ideain functional that cancontrol temperaturebody while working onthe heat sun?	Secondary Data (book, journal, article, website, blog, google scholar) Product and Experimentation and Test	Market Trends Observation Analysis Sketching Idea Development
What is the design's problem and step to tackle the problem before marketing the products?	Product and Experimentation and Test	Sketching Idea Development Product Experimentation Final Product

4.2 Survey Questionnaire

This section discusses the data analysis displaying the findings of the study that has been done based on observations and respondents' responses to the Google form filled in by respondents related to the situation while working at the construction site and the problems and characteristics of the High Visibility Uniform. Researchers conducted surveys as preliminary studies to reinforce and support problem statements. The preliminary study was distributed to 30 respondents through an onlineGoogle form as a preliminary study. The respondents of the initial study were male housing construction workers. The findings of this study were to obtain support for hi-vis clothing improvement.

4.3 Observation

The observations carried out by the researchers were in the Tanah Merah area, Kelantan. Researchers studied the environmental conditions of construction workers, the positions often performed by construction workers, and the clothing worn by construction workers when doing construction work, such as the environment of construction workers, the position of construction workers, findings and analysis for garment design and garment assembly, survey findings from Google Form, analysis from Google Form, secondary data, and guideline safety, and pilot test.

Table 6. Finding and Analysis for Garment Design and Garment Assembly

Brand	MR. DIY Safety Vest	M-SAFE Safety Hi-Vis Jacket	Safety Gear Jumpsuit Workwear	Bumi Nilam Safety
Product				
Material Selection	Polyester	Pre-Crimped Cotton	Fire Retardant Cloth	No Information
Size and Fit	Free Size	S, M, L, XL	Free Size	Free Size
Pattern Engineering	Has 3 Panels	Five Pockets 4 Panels for Sleeves 6 Panels for Bodice Front and Back 4 Panels for Collars	Has Pockets and Cargo Pockets for the Trousers 4 Panels for Collars 4 Panels for Sleeves	4 Panels for Collars 4 Panels for Sleeves 6 Panels for Bodice

		4 Panels for Strip	6 Panels for Bodice	
Seam and Stitches	Overlock	NA	NA	NA
Opening Closures	Has Zip at Front Bodices	Has Zip at Front Bodices	Has Zip at Front Bodices	Has Zip at Front Bodices
Layering Zoning	NA	NA	NA	NA

Table 7. Analysis From Survey, Secondary Data, and Guideline Safety

Questions	Google Form Survey	Secondary Data Survey	Guideline Safety
Material Selection	Cotton and synthetic fibre	Polyester pre-crimped cotton fire retardant cloth	100% cotton drill, stretch cotton canvas, cotton back polyester micromesh (Solanki, 2021)
Size and Fit	Size L	S, M, L, XL	The clothing should fit well and should be easy to on and take off (OSHA)
Pattern Engineering	My chest and back are drenched in sweat	NA	To comply with the CSA Standard, anyhigh-visibility safety apparel must meetthe following criteria for the stripes/bands: a. Minimum width of 50 mm b. A waist-level horizontal stripe/band that goes completely around the body at the navel or belly button c. Two vertical stripes on the frontpassing over the shoulders and down to the waist d. A symmetric "X" on the back extending from the shoulders tothe waist e. For class 3 apparel, stripes/bands encircling both arms and legs are added.
Seam and Stitches	NA	NA	The wearer should not be bothered orirritated by any seam or materials (OSHA)
Opening Closures	Collar t-shirt with button	Zip	NA
Layering Zoning	NA	NA	NA
Colour	Dark colours (e.g., black, dark brown, dark red anddark blue	Yellow-green, red, orange, and black	Daytime work: orange, yellow, strong yellow-green, or fluorescent fabric (OSHA)
Features in Term of Fabric			Flame resistance, thermal performance,water resistance, durability, comfort, tear-away

	features, material breathability, and flexibility may be Required bases on other hazards present

4.4 Conceptual Design

This product is hi-vis clothing that is improved in terms of clothing patterns to get natural ventilation and provide comfort design to housing construction workers. This hi-vis garment targets construction workers working in hot situations to at least relieve the heat when working in high temperatures.

4.5 Idea Development and Experimentation

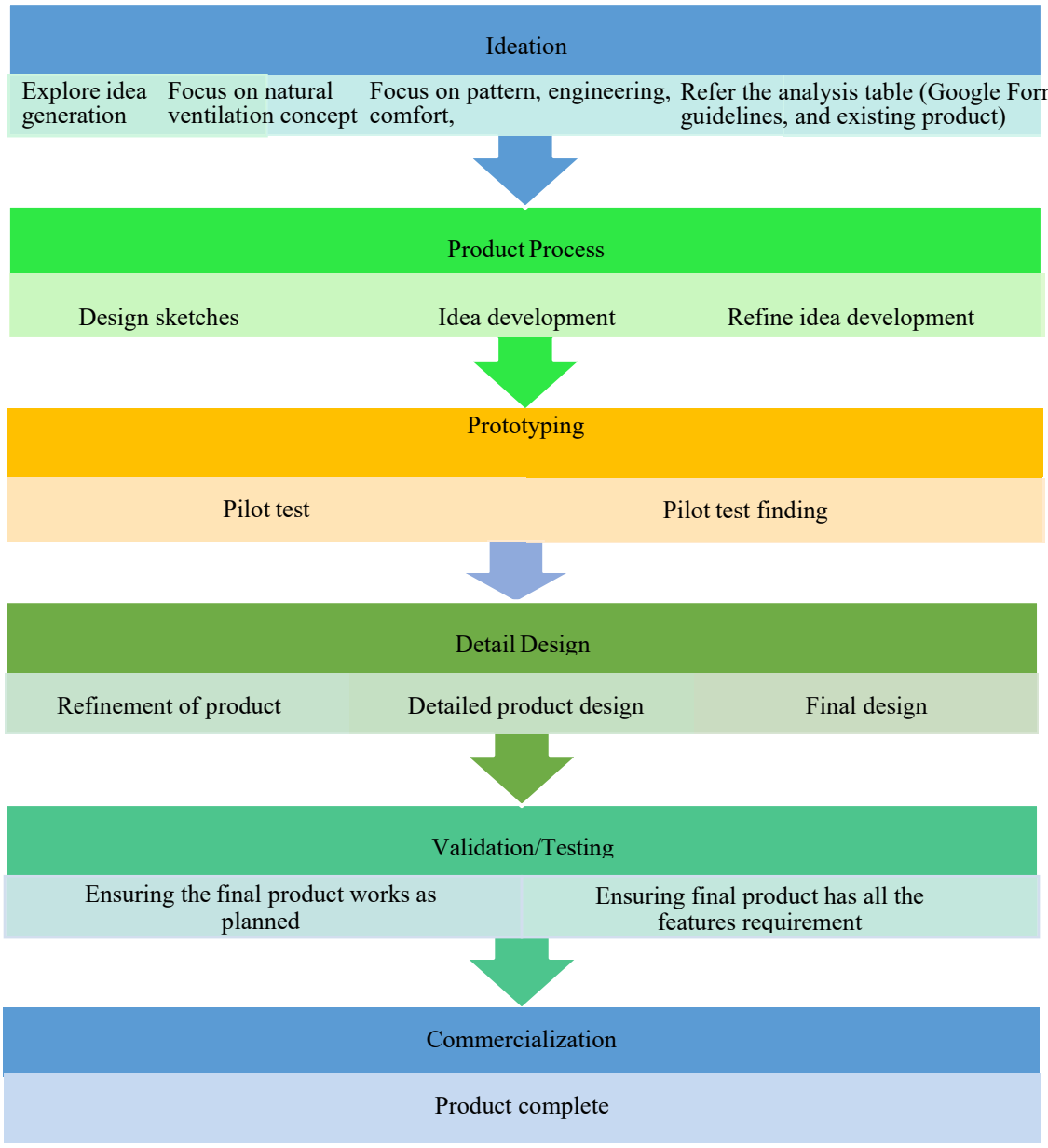


Figure 9. Idea Development Framework

4.6 Post-Test Findings

Construction workers are on high mobility when doing construction work. The weatherconditions at that time were hot and had intermittent air.

Figure 9. Shows The Construction Worker Wearing the Final Product

Figure 10. Construction Workers Work While Unzipping The Front To Get Natural Ventilation

What do you think of the final design of Hi-Vis?

"In my opinion, it is very suitable to be used when doing construction work, in addition to hot weather conditions and environments. This Hi-vis suit was beneficial in reducing the heat when I was doing construction work. I also often work in conditions of high mobility; it makes me close to the sun's heat. However, after I tried these Hi-Vi's for half a day, I liked it."

Is this Hi-Vis's clothing comfortable to wear when doing construction work?

"Yes, construction work is comfortable; the chest and back HI-Vis are open, making me feel light and free. I also feel the wind coming in and out on my skin, making me feel good."

What is your favourite piece of Hi-Vis's clothing?

"The front of the cloth, which has a half zip and can be opened, is my favourite feature.Additionally, although it is open, it still contains pleasant fabric inside."

Is this suitable Hi-Vis's clothing on the market?

Because it benefits people like us who frequently operate in hot environments,it is a product well-suited for the market.

If Hi-Vi's clothing is sold for an expensive price, what do you think about the cost of this apparel?

It does not matter how pricey it is if it can meet my demands and has good comfort, usefulness, and durability under heavy use.

5. Conclusion

The study began when problems were identified among housing construction workers who often needed help working in hot conditions and needed to wear appropriate clothing when they did construction work. This is because they are not exposed to the disadvantages of not wearing proper clothes while doing construction work and the advantages of wearing good clothes while doing construction work. To contribute to construction workers' safety, this study proposes hi-vis clothing with a natural ventilation concept so that they feel comfortable while working and can stabilise their body temperature when the air comes in and out of the shirt while the construction worker is doing the work.

This study examines the characteristics and types of construction uniforms to identify the types of hi-vis garments on the market to strengthen the ongoing research further. This is because, in researchers' observations, construction workers are often exposed to sunlight and are in a hot thermal environment. Furthermore, when frequently exposed to the sun's heat, it can often have effects such as fainting while doing work, dizziness, weakness, and heat stress. Therefore, to maintain body temperature in a stable state, selecting clothing is essential to work in a comfortable and good condition.

To improve upon the current drawbacks of the existing Hi-Vis and be more inventive, researchers analysed the Hi-Vis clothing that is now on the market. Researchers have initiated creating Hi-Vis gear that can at least lessen the heat suffered by housing building workers because construction workers labour in hot climatic circumstances. Additionally, research has resulted in a design incorporating the idea of natural ventilation. To ensure that the design created has the elements that will appeal to the respondents, researchers have also conducted a poll through Google Forms to determine the body parts that frequently perspire. The researchers also created three alternative prototypes and tested them on construction workers.

Based on the framework, the researcher analysed the issues with respondents' responses and high-visibility clothes. Next, specific problems have been discovered and improved based on experiments with the responses. The researcher established a process framework to ensure the design process is always carried out correctly. When the finished product is ready, it might be marketed to those working on it.

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