

Journal of Fashion Business
Vol.27, No.6

ISSN 1229-3350(Print)
ISSN 2288-1867(Online)

J. fash. bus. Vol. 27,
No. 6:37-46, December. 2023
[https://doi.org/
10.12940/jfb.2023.27.6.37](https://doi.org/10.12940/jfb.2023.27.6.37)

Corresponding author

Ga Young Huh
Tel : +82-31-659-8271
E-mail : gyhuh@ptu.ac.kr

A Study on Workwear Prototype Development: Based on the Functional, Expressive, Aesthetic (FEA) Model

Huh Ga Young*

*Assistant Professor, Dept. of Fashion Design and Branding, Pyeongtaek
University, Korea

Keywords

workwear, functional,
prototype, design process,
FEA model, pattern-making

Abstract

This study aims to develop workwear prototypes by applying a systematic approach considering the characteristics of workwear. A case study was conducted before this study to derive workwear's four characteristics: 'Ergonomic Pattern-Making, Certified Fabric, Specialized Color, and Customized Details.' a prior study proposed the integrated framework combining these characteristics with the FEA model. The new framework identified that these characteristics are considered in terms of functionality, expression, and aesthetics; it can increase workers' satisfaction and meet the market demand without concentrating on only particular aspects. Before prototype production, the requirements for each characteristic of workwear were analyzed through theoretical research of previously published related papers. The study primarily gathered workwear requirements data and sources from consumer satisfaction surveys and investigations into the wearing conditions of work clothes. When considering all aspects of pattern-making, fabric, color, and detail in functionality, 'comfort movement, body protection, improved work efficiency' were identified as necessary. Expressive requirements were fundamental, including 'reflecting the wearer's preferences, expressing a sense of belonging and identity. It was clear that incorporating design elements and applying current trends to the aesthetic requirements of work clothes was necessary. Four prototypes comprised two top and bottom sets and two overalls using these requirements. The framework was used throughout the entire process of planning, producing, and evaluating prototypes, and through this, the results fulfilled the requirements. This study is significant because it produced workwear prototypes using an integrated approach that considered functional, expressive, and aesthetic aspects.

I. Introduction

This paper was conducted based on the previous study, A Research on the Development of Design Framework through Case Analysis of Workwear(Huh, 2023), which examined the concept and features of workwear and global market trends, focusing on theoretical research. Five representative workwear brands were selected to analyze items, and four workwear characteristics were derived from the previous study(Huh, 2023). In order to propose a new design framework for workwear, the FEA model(Lamb & Kallal, 1992) was adopted to include expressive and aesthetic aspects in addition to the functional aspects of workwear.

This study aims to produce four sets of workwear prototypes using the new workwear design framework. The new FEA model will be used in the planning and final evaluation stages of developing prototypes and will serve as a standard to meet workwear's integrated and balanced requirements.

In order to develop four prototypes, the requirements for three core workwear characteristics, such as functionality, expression, and aesthetics, were confirmed through existing related research. Four prototypes were developed using pattern-making, material, color, and detail to satisfy all those aspects.

This study will contribute to providing a systematic approach to developing functional clothing, especially workwear. The prototypes developed through this process are expected to lay the foundation for workwear that comprehensively considers functionality, expression, and aesthetics. This approach will be applied to both the production and evaluation stages of the design process, contributing to the systematic development of workwear.

II. Workwear Requirements

The demand for workwear is increasing due to growing interest in worker safety and more stringent regulations. Additionally, workwear has gained attention in the fashion world and has evolved into a contemporary fashion trend beyond its traditional functional purpose.

As a representative example, the hashtag recorded 51.8 million views on TikTok, and the #utilityfashion hashtag recorded 1.9 million views(Polo and Lifestyle Magazine, n.d.). It indicates that workwear is becoming increasingly popular in the fashion industry, and its influence is expanding. According to a new design framework for workwear (Huh, 2023), workwear must meet functional, expressive, and aesthetic requirements.

The FEA model was developed to address the basic requirements of fashion design when designing functional clothing to harmonize expressive and aesthetic aspects. In this study, considering the three criteria of functionality, expressiveness, and aesthetic appeal, we investigate four characteristics derived from existing research: 'ergonomic pattern-making, certified fabric, specialized color, and customized detail'(Huh, 2023) through related research. The previous research, such as worker satisfaction surveys, wearability evaluations, and reports, has been analyzed to identify areas for improvement. This examination provides a comprehensive understanding of how the new FEA model contributes to exploring the four characteristics of workwear design that meet functional, expressive, and aesthetic criteria.

1. Functional Requirements for Workwear

Functional requirements in workwear pattern-making demand careful consideration of workers' posture and range of activities. In industrial settings, work motions involve various postures, including raising arms front, side, or overhead, bending the waist, flexing or lifting the knees, squatting, and lifting one foot to different heights (Kim & Kim, 2007).

Material functionality is paramount; factors like sweat absorption and breathability are especially significant (Kim & Seo, 2003).

Visibility is an essential criterion for workwear in terms of color functionality. High chromaticity contrasts are suitable, and higher brightness differences improve visibility (Park, 2013). For example, high chromaticity colors are appropriate for both tops and bottoms when brightness differences are minimal. Darker colors are

more resistant to stains, essential for areas prone to frequent dirt accumulation, such as elbows and knees.

To make workwear more practical, it should have a variety of pocket shapes and sizes, reflective tape, customized adjustment bands for wrists and hem, waist belt loops, and knee protectors (Park & Park, 2008).

2. Expressive Requirements for Workwear

The design of workwear plays a significant role in ensuring user satisfaction and preference. In order to fulfill these requirements, it is crucial to have a thorough understanding of the various elements that make up workwear and how they can be used to express different ideas and messages. During the design process, it is vital to consider the satisfaction and preferences of workers. According to a study conducted by Park and Park(2008), workers generally prefer basic, sporty, and casual styles, especially in customized, cargo, and training pants, particularly in the trouser category.

Regarding materials, workers favor wrinkle-resistant fabrics that are easy to launder and require minimal maintenance. These fabrics should reflect the workers' image and the company's corporate identity. Color selection is equally important, with workers generally favoring subtle, stable colors and vibrant and lively shades (Park & Park, 2008). Workers tend to prefer darker colors when visibility is not critical.

Workers in the workplace typically prefer neat and professional images, resulting in the prevalent choice of basic shirt collar and sporty band-style necklines as design details. On the other hand, young professionals prioritize a sense of belonging and pride, necessitating the incorporation of these aspects in workwear design (Kim & Kwon, 2009). To create functional and expressive workwear, adopting a user-centered design approach that prioritizes worker satisfaction and preferences is essential.

3. Aesthetics Requirements for Workwear

The association of workwear with physical labor is changing, and it has become a significant trend in the

fashion industry. Fashion Journal in 2023 highlights that workwear is no longer just for laborers; it has become an influential trend in fashion(Bammant, 2022). The S/S 2023 showcases how functionality and fashion converge in utility workwear. Brands such as Carhartt and Dickies are transforming into fashionable staples for fashion enthusiasts and celebrities. Inspired by workwear, Stone Island is elevating the tech-wear style with high-quality materials. Loose-fit and diverse pattern trends extend to work shirts, outerwear, zip-up vests, and craft workwear, emphasizing the need for consideration during pattern-making. Material choices align with denim and nylon trends, emphasizing sustainability in fabric organization, texture, and durability according to WGSM in 2023.

The current fashion trends are focused on adding natural elements, incorporating organic textures, and using comfort stretch fabrics. Knit fabrics are also gaining popularity for their ability to enhance functionality and aesthetics. Regarding color trends, neutral colors such as gray, beige, and brown remain dominant in workwear. However, eco-friendly colors inspired by nature are becoming more popular, reflecting a growing preference for sustainable fashion. Pairing neutral colors with strategic Point Colors can add a touch of freshness and individuality to any outfit.

Cargo and bellows pockets are stylish and functional, adding to the street-style vibe. The oversized pockets are not only for aesthetics but also serve utility purposes, emphasizing the importance of thoughtful design. The requirements for each workwear characteristic are summarized comprehensively in Table 1.

III. Workwear Prototype Development

The study has developed four sets of prototypes for workwear production, each considering functionality, expression, and aesthetics. These prototypes were developed with two separate top and bottom types and two connected top and bottom overall types (Kim & Kweon, 2009), the types most workers prefer. Products in seasons and thicknesses that can be worn universally

Table 1. Requirements for each Workwear Characteristic

	Ergonomic Pattern-Making	Certified Fabric	Specialized Color	Customized Detail
	• Comfort Movement / Body Protection / Improve Work Efficiency			
Functional	free movement comfortable fit ergonomical design	durability stretchability insulation weather-resistant	fluorescent colors stain-resistant hues strong contrast	various size & shape pockets reflective tapes adjustable details
	• Reflecting the Wearer's Preferences / Expressing a Sense of Belonging and Identity			
Expressive	basic, sporty, casual style, formal, chino, training fit	wrinkle-free easy-care and maintain	stable and modern color Bright and cheerful atmosphere color	sense of belonging & pride shirt & sports stand collar
	• Incorporating Design Elements / Applying Current Trends			
Aesthetic	utility wear tech wear casual streetwear	sustainable fabric recycled fabric Natural touch & texture	neutral colors eco-friendly colors Point colors	cargo & bellows pockets Trimming & piping

in general work environments, not for extreme cold or winter use, have been developed. The first set includes a jacket with a stand-up collar when zipped up, a shirt collar when unzipped, and pants designed as regular cargo pants. The fabric used in the jacket is suitable for spring and fall wear. The second set is formal, including a top and bottom with a shirt collar and patch pockets. This also includes slim-fit cargo pants slightly slimmer than the first. This versatile set is designed for year-round wear with durable materials, suitable for casual workwear. Two types of workwear are available to protect workers during on-site tasks. The spring and fall versions utilize stretchy knit fabrics to enhance mobility and address the drawbacks of overalls. The summer overalls are designed in a sporty casual style, using fabrics that are suitable for summer and have excellent antibacterial and deodorizing properties.

To design a pattern-making for workwear, the sizes of men aged 25 to 29 were taken from the 8th Korean Human Body Dimension Survey Report, which was

published by the Korea Agency for Technology and Standards under the Ministry of Trade, Industry and Energy. The following sizes were used for making the pattern: height of 175cm, chest circumference of 102.5cm, back length of 42.9cm, waist circumference of 85.6cm, shoulder width of 40cm, hip circumference of 97.6cm, hip length of 27.2cm, arm length of 59cm, and outseam length of 107cm(Korea Institute of Science and Technology Standardization [KISTS], 2022).

The new FEA-based framework was utilized in the design and evaluation process of workwear to ensure all four characteristics, including functionality, expression, and aesthetics, are considered.

1. Prototype #01

1) Pattern-Making: The pattern-making of the jacket and trousers prioritized the functional aspects. Special attention was given to creating a 3D effect in the pants, providing ample room for the knees, hips, and waist. A

short front-length pattern was adopted for efficient tool use. The pattern-making also embraces a comfortable fit, highly favored by workers, while expressing a simple, straight silhouette that captures the essence of utility wear.

2) Fabric: A polyester blend consisting of 57% PE and 43% Sorona Polyester was chosen for its durability, stretchability, UV resistance, breathability, and anti-static properties. The fabric uses crimped yarn to maintain its shape, avoid wrinkles, and provide a smooth texture of moderate thickness. Crimped yarn is a type of yarn with elastic structural characteristics that are achieved by combining it with a curved shape. This is opposed to standard synthetic fibers, which have a straight shape(Vlakna, 1999). The fabric both meets the functional requirements of the workers and is aesthetically pleasing.

3) Color: The primary colors used are dark navy and fluorescent yellow, chosen for their high visibility in the work environment. The color selection aims to balance a bright and cheerful atmosphere while satisfying the

functional requirement of easy worker recognition. The initial prototype balances the usage of these two colors proportionally and places them well to create a harmonious and balanced color scheme.

4) Detail: Functional details, such as pockets, D-ring attachments for shoulder lines and belts, wrist and ankle adjusters, and belt loops, play an essential role in garment design. The company logo can be included through printing or embroidery to promote a sense of belonging. Adding silver reflective tape to the elbow and back is a way to improve safety and add a unique design element to the garment. Table 2 summarizes the prototype, encompassing its sketch, pattern making, color, material, actual wearing photo, detail images, and strengths highlighted within the new FEA model.

2. Prototype #02

1) Pattern-Making: Prototype #02 is a shirt-style jacket that incorporates various pattern elements to meet functional requirements. The jacket has a neat casual

Table 2. Prototype #01

Prototype #01		
Flats	Pattern-Making	Color /Fabric
		 <p>Polyester 100 crimped yarn 350 g/m2, 56/58* durability, stretchability, UV resistance, breathability, anti-static</p>
		

(taken by author)

style, featuring a shirt collar and plackets. Its modern slim fit is aligned with current tech wear trends, enhancing its aesthetic appeal. To ensure comfort, the jacket includes back panel allowances, three-dimensional sleeves, and an ergonomic armhole line.

2) Fabric: The fabric used in Prototype #02 is the same crimped yarn as the first prototype. This material has no spandex but provides long-lasting elasticity, making it suitable for workwear worn to withstand prolonged use. Its wrinkle resistance ensures a consistently polished appearance, which adds to the overall aesthetic satisfaction.

3) Color: Prototype #02 features a color scheme suitable for general workwear. The colors used are dark gray and navy, known for resisting stains and meeting functional requirements. Combining these two modern yet subdued hues aims to enhance worker satisfaction. Using similar shades of colors in tonal harmony can enhance the aesthetic appeal of a design.

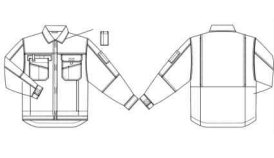
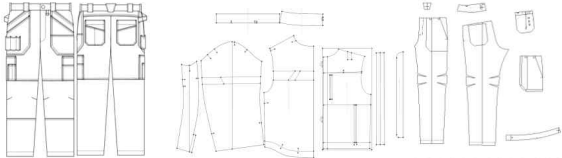

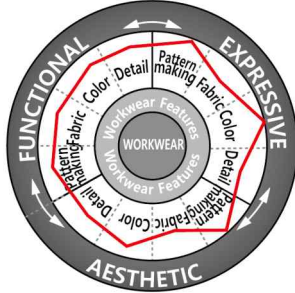
4) Detail: The jacket comprises functional elements like adjustable Velcro wrist straps that offer a personalized fit

and chest pockets for storing various tools and accessories. The incorporation of logos on the chest not only enhances wearer affiliation but also adds to a sense of belonging. The neon yellow reflective tape details applied to the back neck, back panel, hammer loop, and belt loop D-rings add to the jacket's functionality and aesthetics. Table 3 outlines the information on prototype #02.

3. Prototype #03

1) Pattern-Making: Prototype #03 has been designed with a regular fit pattern and sufficient allowance in the crotch area to ensure comfort during various work activities. The three-dimensional pattern has been created by segmenting the pattern, which minimizes hindrance to leg movement and enhances the functionality of the workwear. The pattern-making process has been carefully balanced to improve aesthetic satisfaction by balancing the upper and lower body proportions. It has been designed with the characteristics of a casual and

Table 3. Prototype #02

Prototype #02		
Flats	Pattern-Making	Color /Fabric
		Polyester 100 crimped yarn 350 g/m2, 56/58" durability, stretchability, UV resistance, breathability, anti-static
		

(taken by author)

active worker.

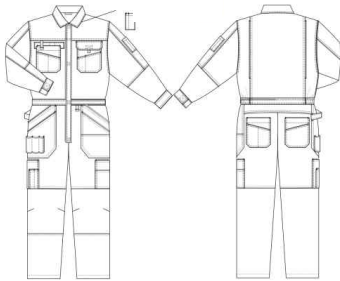
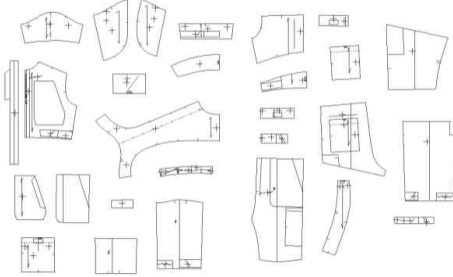



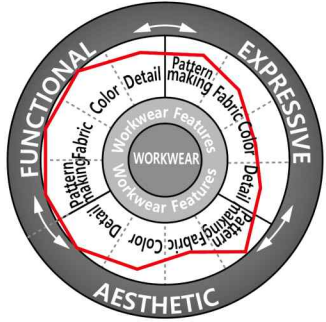
2) Fabric: For this prototype, a 100% polyester fabric has been used, slightly lighter than the material used in the previous version. This fabric has functional properties, feels light to wear, and is suitable for outdoor use due to its UV resistance, breathability, and anti-static properties. It not only conveys an active message but also complements other design elements seamlessly for a cohesive appearance.

3) Color: A combination of high-saturation orange and dark navy, used in complementary and tonal contrast, improves visibility for workers in different environments and conveys a bold and clear image, providing a satisfying aesthetic experience through distinct complementary contrasts.

4) Details: The garment has various features that enhance its functionality and professional look. These include three-dimensional chest pockets for added convenience, reflective tape handles on pocket flaps for improved visibility, pockets of varying sizes, hammer loops, adjustable sleeves and hem, elastic waistbands, and reinforced knee details. Combining these details enhances the overall satisfaction and professionalism of the garment.

In conclusion, Prototype #03 is an excellent example of how functionality and aesthetics can be meticulously integrated to offer versatility in seasonal wear for active workers. The thoughtful design elements contribute cohesively to this workwear prototype's utility and visual appeal. Table 4. provides details regarding Prototype #03.

Table 4. Prototype #03

Prototype #03		
Flats	Pattern-Making	Color /Fabric
		 <p>Polyester 100 crimped yarn 270g/m2, 56/58" durability, stretchability, UV resistance, breathability, anti-static</p>
		

(taken by author)

4. Prototype #04

1) Pattern-Making: The fourth prototype's design is focused on a comfortable, relaxed fit that is perfect for hot weather, allowing for easy movement and overall comfort. The garment's training fit gives off a youthful and liberated vibe, which aligns with the casual streetwear look. The lower fit is loose, adding to the overall and the casual streetwear style.


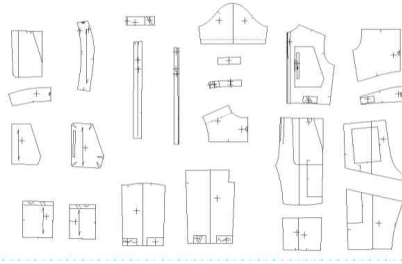


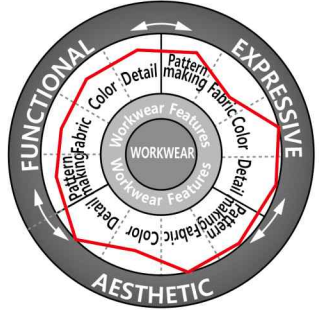
2) Fabric: The fabric used for these clothes has wash-less properties, so it does not require frequent washing, making it convenient for workers. It is also Anti-Microbial, Anti-Odor, Anti-Static, and Anti-Dust, providing added protection and comfort. The fabric's moisture-wicking properties prevent pilling and ensure the clothes retain their soft drape, lovely sheen, and melange texture, making them visually appealing. The fabric is in line with sustainable fashion trends, catering to the functional, expressive, and aesthetic aspects of

clothing.

3) Color: The design utilizes a versatile color palette that features blue tones and black accents, creating a subdued yet universally wearable combination. This particular choice aims to communicate sophistication and trustworthiness. Using dark black as a focal point adds uniqueness to the design, elevating its overall visual impact.

4) Detail: This prototype #04 has practical and functional features, such as sleeve roll-up loops, adjustable Velcro fastenings at the waist and ankles, and a hammer loop. These details enhance the garment's usability and make it unique. The prototype is distinctive due to its angular polygon-shaped dimensional pockets and shaped placket detail, which sets it apart from traditional workwear and emphasizes its unique specialty. Please refer to Table 5 for further information about Prototype #04.

Table 5. Prototype #04

Prototype #04		
Flats	Pattern-Making	Color /Fabric
		<div style="background-color: #0056b3; width: 100px; height: 20px; margin-bottom: 5px;"></div> <div style="background-color: #1a1a1a; width: 100px; height: 20px; margin-bottom: 5px;"></div> <p>Polyester 80/ Rayon 15/ Acrylic 5 TRV, MVS 60/62"/ 330g/yd Anti-Microbial, Anti-Odor, Anti-Static, Anti-Dust</p>
		

(taken by author)

The workwear prototypes developed through this study differ from existing workwear development research in that they were systematically planned and produced from an integrated aspect, including functionality. Furthermore, since it was based on the recently announced Korean standard size, it is meaningful to consider the average human body's measurements. All materials used met functional requirements and worker needs. Additionally, knit stretch material was used to increase activity. Four sets were produced for selection based on the work environment: two with excellent visibility and two with dark colors resistant to contamination. Related prior studies were utilized to add features like pockets, adjusters, and storage hooks to work clothes, increasing their practicality.

These prototypes are limited in that they were only intended for general workwear rather than specific situations. Therefore, further research may be necessary to consider workplaces with extreme weather conditions or hazards and their unique characteristics. Also, as the prototype is designed for men in their 20s, further research on different age groups and genders is necessary. It is expected that additional surveys and clothing experiments on the prototype will help develop more improved prototypes in the future.

IV. Conclusion

Through a theoretical approach and a comprehensive framework, four physical prototypes were developed. These prototypes were designed to cater to various requirements evenly, without focusing on only certain aspects. The prototypes exemplify the integration of functionality, expressivity, and aesthetics in workwear design. Each prototype addresses worker needs, emphasizing safety, comfort, and adaptability across various industrial environments.

These prototypes represent innovative solutions that comprehensively meet workwear's diverse preferences and demands in industrial workwear. Through this research, it became evident that every element in developing workwear prototypes is interconnected, with each

component influencing and interacting with others cohesively.

This study is significant as it has developed a prototype using a systematic framework for designing and verifying workwear. Workwear produced through this process will meet industrial environments' varied preferences and requirements.

This study has limitations in that it focused on general work clothes rather than particular clothes, so research on specialized work clothes according to the work environment will be necessary. In addition, to scientifically and objectively verify the developed prototype, workability evaluation, clothing and sensory evaluation, color psychological sufficiency evaluation, suitability evaluation for each work environment, etc., should be studied according to the working environment of work clothes.

References

- Bammant, H., (2020, March 12). Workwear is the biggest trend of 2020 and here's proof. *Fashion Journal*, Retrieved September 29, 2023, from <https://fashionjournal.com.au/fashion/workwear-is-so-on-trend-right-now-and-here-is-runway-proof/>
- Huh, G.-Y. (2023). A research on the development of design framework through case analysis of workwear. *Journal of Fashion Business*, 27(5), 135-145. doi: 10.12940/jfb.2023.27.5.135
- Korea Institute of Science and Technology Standardization[KISTS]. (2022). *The 7th Korea anthropometric size survey project: Anthropometric measurement results report*. Retrieved September 27, 2023, from <http://sizekorea.kats.go.kr>
- Kim, H., & Seo, M. (2003). A study on satisfaction of worker's uniform in the mechanical industry. *The Research Journal of the Costume Culture*, 11(6), 867-878.
- Kim, J.-H., & Kweon, S.-A. (2009). The wearing satisfaction and demand of improvement for working uniform in car service firms. *Korean Association of Human Ecology*, 18(2), 407-418. doi:10.5934/kjhe.

- 2009.18.2.407
- Kim, S-S., & Kim, H-E. (2007). Transactions: The evaluation of movement functionality on improved pattern-design working uniform of construction site worker. *Fashion & Textile Research Journal*, 9(2), 237-242.
- Lamb, J. M., & Kallal, M. J. (1992). A conceptual framework for apparel design. *Clothing and Textiles Research Journal*, 10, 42-47.
- Park, H. (2013). The functional color arrangements for industrial safety in machinery work site 1: Focusing on lightness value from top and bottom. *Journal of Fashion Business*, 17(5), 45-56.
- Park, H., & Park, J. (2008). The actual wearing condition and preference of the working uniform design in the industrial complex. *Journal of Fashion Business*, 12(2), 134-152.
- Polo and Lifestyle Magazine. (n.d.). Why workwear is dominating the fashion landscape. Retrieved September 19, 2023, from <https://poloandlifestylemagazine.com/why-workwear-is-dominating-the-fashion-landscape>
- Vlakna, K. P. (1999). Crimped polypropylene yarns. *Kovine, Zlitine, Tehnologije*, 33(6), 523.
-

Received (November 13, 2023)

Revised (December 12, 2023; December 19, 2023)

Accepted (December 26, 2023)