

DESIGN A FOLDING TRAFFIC CONE FROM DUMPED ADVERTISING VINYL BANNERS.

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ABSTRACT

Natural resources are being depleted on a rapid scale while production and consumption are rising in nations. The waste production worldwide is enormous and if we do not do anything we will soon have turned all our resources into one big messy landfill. This research paper is focused on the investigation of the alternative approach to waste prevention. This encourages the redesign of resource life cycles that products from industry could be reused until the optimum level of consumption. The large industry like advertising banner printing consumes huge of petroleum base resources such as producing vinyl banners which are used in a moment of the campaign. After this short period time of use, the used vinyl canvases become trash to be sent to landfills. Used printing vinyl banners could be turned to a new resource for new products that call for an equivalent in some material properties. The matching material property exhibit that traffic cone is one of the products that its material properties need to be a fit outdoor condition as it is provided in vinyl banners.

The purpose of this article is to identify the possibility of a new idea for sustainable production and consumption that will change the way of thinking about the lifecycle of their products through the case study of printing vinyl media.

Keywords: PVC, Design-by-Analogy, SCAMPER, traffic cones, waste prevention

INTRODUCTION

Polyvinyl chloride (PVC) is a thermoplastic of about 800-1500 monomer units long. Due to its low cost, desirable properties and versatility, PVC can be processed into a wide range of short-life products [1]. As a result of increasing consumption of PVC-made products, the quantity of used PVC items entering the waste stream is gradually increased. One application of PVC is as either a thin or thick coating for flexible polyester advertising banners and also traffic cones [2].



Fig.1. Current PVC traffic cones in road works

The first stimulus of PVC application product is traffic cones. Traffic cones are road traffic control markers that are used to temporarily direct traffic. Traffic cones, also called pylons, road cones, highway cones, safety cones, construction cones, are usually cone-shaped markers that are placed on roads or footpaths to temporarily redirect traffic in a safe manner. They are often used to create separation or merge lanes during road construction projects or automobile accidents, although heavier, more permanent markers or signs are used if the diversion is to stay in place for a long period of time [3].

In a developing country like Thailand, purchasing a set of traffic cones make a big influence on the operation cost of traffic and road work operation especially in the provincial area. Cost for a set of 100 mid-size traffic cones may up to 70,000 THB or about the US \$ 23. Coast for traditional plastic traffic cone is too high due to the production and material. Each mid-size traffic cone consumes 2kg of PVC material through the mould processing. This industrial process also requires three costly components, PVC plastic, mould and plastic injection machine [4, 5].



Fig.2. Vinyl banner used for the election in Thailand

Vinyl banners are another stimulus of PVC application product in view of the fact that they have many uses and applications. They are most often used to promote a company's logo, a special promotion, event, and also in the election campaign. Since vinyl is a very flexible as well as portable material you can see vinyl banners just about anywhere. Vinyl banners are commonly seen as billboards, table banners, trade show banners, building banners, street banners, festival banners, as well as stadium flags [6].

The whole life cycle of PVC products releases a lot of solid wastes, air wastes, water wastes and other environmental toxins. It would be nice if waste from industry would become food for the others in the same way as they are reused before they are dumped in landfill. As above described, Vinyl banners are often used short time in a moment of the campaign [3]. That would be nice if they can be reused as traffic cones for roadwork and emergency traffic direction? If this idea is applicable, the number of waste for global could be reduced and this waste prevention system could become beneficial for the planet [7].

MATERIALS AND METHODS

The conceptual framework is designed to find an optimal match between two stimulus products manufactured by Polyvinyl chloride (PVC). To enhance the possibility in the analogy approaches across these two products, the competencies and opportunities available between industrial processes and handiwork available in local communities are also analyzed to find out possibility in production transforming.

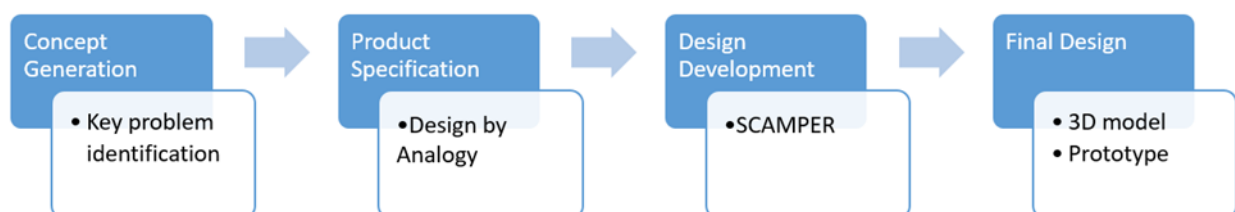


Fig.3. Conceptual Framework

This method begins with the identification of key problem descriptors or task analysis which can be functional requirements, user's needs and clarifying descriptions of the design problem. After that Design-by-Analogy (DbA) is used to identify potential product specification. In this stage, the analogies between industrial processes and handiwork available in local communities are employed to solve design problems of transform vinyl banners to traffic cones. Then the new conceptual design is developed through the SCAMPER technique to achieve successful design development and final design afterwards.

Design-by-Analogy (DbA) is the process of developing solutions for design problems through the mapping of attributes, relations and purposes that a source problem or situation may share (or at least partially share) with an existing target solution or situation. Most of the existing DbA applications have been in product domains such as engineering and architecture. There is a range of available DbA methods that have been developed to assist designers during the ideation stage to identify potentially useful analogies to solve design problems. However, generally, these methods have been developed and applied in the product domain rather than in the service and product-service systems domains [8].

SCAMPER technique provides designers with seven sets of questions to steer the finding of analogies to solve a design problem. The seven sets are called operator categories. These are (S) Substitute, (C) Combine, (A) Adapt, (M) Modify/Magnify/Minimize, (P) Put to other uses, (E) Eliminate, and (R) Reverse/Rearrange. Each operator category comprises a set of questions that allows redirecting the analogical search to solve a problem [9].

RESULTS AND DISCUSSION

The result from studying the possibility in analogy approaches across these two stimuli polyvinyl chloride (PVC) products are in brief following. To eliminate this concern, the processes of transforming used vinyl banners to create a folding traffic cone are exhibited in three design stages Design by analogy (DbA), SCAMPER technique and Final design.

Traffic cones are manufactured from a flexible polymer, often polyvinyl chloride (PVC) with plasticizer additions. This material is also used for vinyl banner, hoses and piping, and the traffic cone has a similar texture and flexibility, while still maintaining a rigid, durable form when in the upright position. Mid-size cones for road works mainly in sizes 72 cm. tall. The cones are hollow, which makes them more lightweight and prevents serious damage to vehicles or people that might come into contact with them.

In brief, to replace conventional moulded plastic traffic cone, the basic requirement for general traffic cone is including good in outdoor conditions, lightweight, easily transportable and highly visible, making them a cheap, efficient and effective method of alerting drivers to new traffics and directions and prevents serious damage to vehicles. The traffic cone is a traffic facility for all road hazard areas, construction sites and large-scale event sites to reduce road traffic accidents and stampede in large-scale field events. In creating traffic cone from used vinyl banners, design by analogy (DbA) requires accessing and then transferring elements from an existing solution for a design problem to the solution for another design problem [8].

Table 1. Task analysis for basic requirement of traffic cone through Design-by-Analogy

Tasks	Current industrial production processes	Handiwork available in Local communities
Outdoor conditions	Anti-UV and rain resistant material	Anti-UV and rain resistant material
Lightweight	Hollow structure	Foldable structure
Easily transportable	Stacking	Collapsible
Highly visible	Vivid colour adding in the inner plastic layer	Vivid colour sticker and reflective tape
Making them a cheap	Mass production through plastic injection moulding	Local labour through sewing and patching techniques with reused material
Prevents serious damage to vehicles	Cone will be caved in after a crash	Cone will be collapsed after crash

After the basic requirement of traffic cone is identified and developed to meet handiwork conditions available in local communities, the SCAMPER technique has been applied in product. They include functional as well as relational and attribution components. SCAMPER drivers are linked to the problem description.

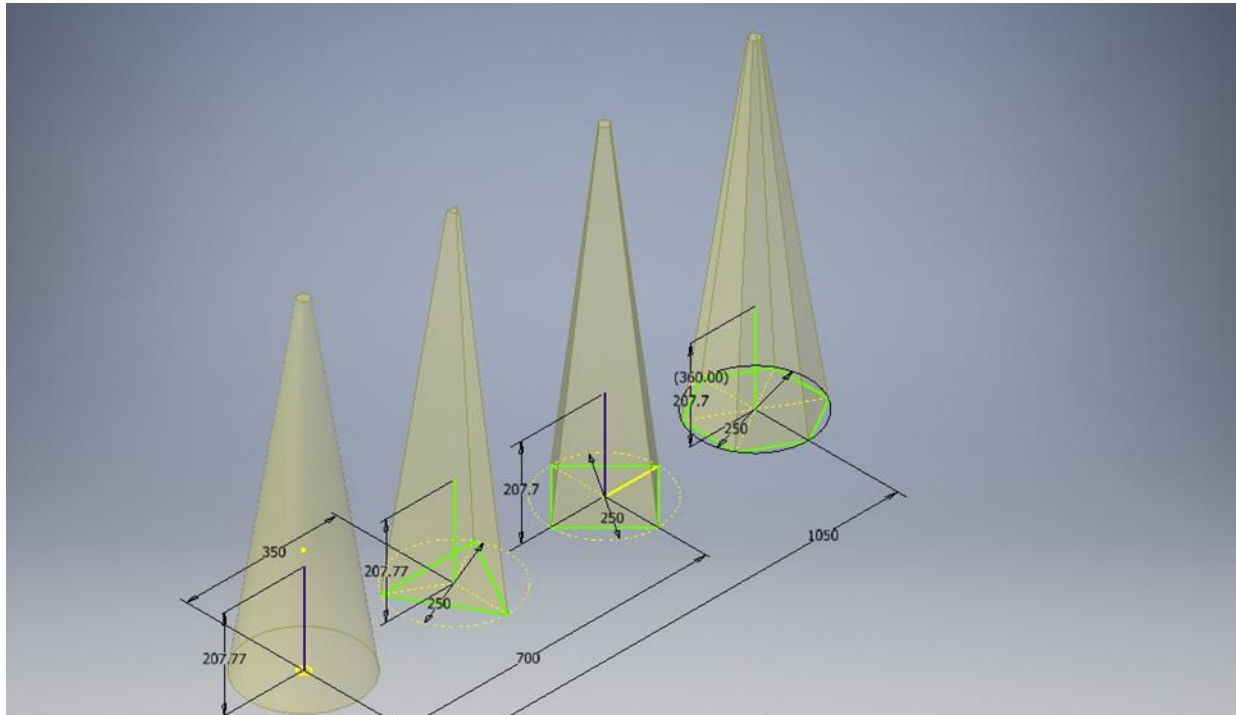


Fig.4. Developing from of vinyl cone through SCAMPER techniques

The final design is the last stage that turns the idea of transforming used vinyl banners to traffic cones become tangible outcomes. The results of this stage are presented as folding pattern and assembly of the traffic cone. After the design of the traffic cone is approved, the prototype model of vinyl traffic cone is made for physical function testing and prove the basic function of the traffic cone.

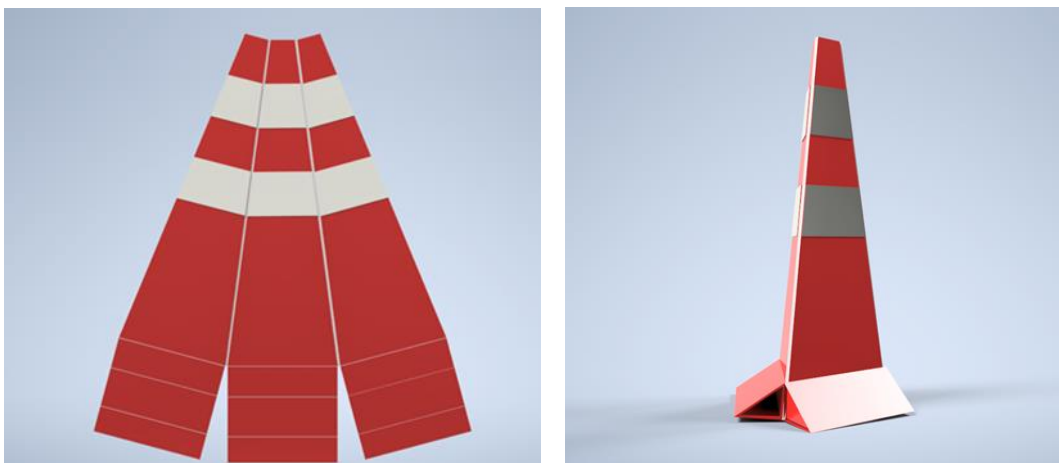


Fig.5. Computer generating images of the vinyl traffic cone

In the production process, adhesive for PVC vinyl floor or heat welding techniques are used for increasing thickness that enhances rigidity in a panel and makes folding traffic cone upraise. In the final stage, the hems technique is the most common form of finishing for vinyl banners.

Due to the smaller surface area influence to lower material consumption and also the weight of folding traffic cone, the weights of each vinyl traffic cone is light as about 1.5 Kg. which is about three fourth lighter than the traditional mid-size PVC traffic cone (2 Kg.).



Fig.6. Prototype of the vinyl traffic cone

The prototype of vinyl traffic cone could be pressed in 180 degrees. It could also reinstate when it is flatted down, with high flexibility against the run over and impact of the cars. Because of good weather resistance, it won't deform in high temperature 65°C and craze in low temperature -30°C. The vinyl traffic cone delivers good warning effects at both day and night, anti-UV, aging resistance and durable.

CONCLUSION

The new idea in extending life cycles of products made by PVC is another ecological alternative addressing the problem of waste surging in the environment. Transforming used vinyl banners to vinyl traffic cones are game-changing for a road traffic control system.

Based on these ideas the production and consumption of single used plastic products such as printed vinyl media will change the way of thinking about the lifecycle of their products. A concept that is seen as the next industrial revolution. Design for sustainability in such a way that they produce eco-friendly products and become a friend to the environment. This idea may transfer to design other products in such a way that at the end of its lifecycle the component materials become a new resource [10].

For further work, the vinyl traffic cone may be improved for working together with traffic cone bar, traffic cone ring, safety chain, traffic cone solar warning lamp, so that it can do better work of warning and isolation. On occasion, traffic cones may also be fitted with LED strap flashing lights for the same reason.

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