

WRITTEN REPORT

Group 3-40

PROJECT TRIHAZARD

We identified the problem that road hazards are not always clearly visible to drivers and that the current triangle hazard signs used for breakdowns cannot be clearly seen. Thus, we decided to create an improved vehicle breakdown sign.

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Problem Finding

We identified the problem that road hazards are not always clearly visible to drivers and may result in tragic accidents. We came up with the idea after seeing a group of delivery workers standing in front of a broken-down truck, waving their hands due to their lack of a breakdown sign. We evaluated the identified problems based on considerations such as, originality, cost, and feasibility. Our project had to be original as we did not want to encounter any issues with plagiarism. Cost was an issue as the cost of the material could not be too high in order to make the product commercially viable if it went to market. The project had to be feasible to complete within the one-year timeframe and able create a working product. The breakdown sign achieved a score of 4 points for originality, 3 for cost, and 3 for feasibility, beating our other ideas.

Define the Problem

Firstly, we researched and discussed the problem before crafting a problem statement.

- **Research**

Our team combed through government data from Data.gov.sg, the Singapore Police Force and the Land Transport Authority. We also conducted a baseline survey on 111 members of the public. The data shows that most (92.8%) of the respondents had a driver in their family, and that 60.4% of the respondents had experienced a vehicle breakdown. However, only 49.5% know what a correct breakdown sign looks like, and with just 5.4% knowing the correct distance to deploy the sign. On top of that, 46.8% under-estimate the time needed to deploy a breakdown sign. We also tested the respondents' knowledge on traffic accident statistics. Only 16.2% of them knew the fatalities statistics (124 fatalities in 2018) and 21.6% knew the accident statistics (7,690 traffic accidents in 2018).

- **Discussion**

There are approximately 2 million drivers in Singapore (2018) and over 7000 accidents in Singapore annually since 2012, with fatalities exceeding 120 since 2014 (range of 2.16 – 3.80 fatalities per 100,000 population) After our survey, we can infer from the data surveyed that there is a sizable problem with the current vehicle breakdown signs, and its proper usage.

Current breakdown signs are very small, with an average one measuring 40 cm in height after testing. On top of that, our testing showed that it took around 2 minutes to set up the said breakdown sign. On the other hand, mannequins used by government road works were around 1.8 metres in height and were more visible. However, they were much bulkier and more costly.

We can extrapolate that this is a very relevant problem as a large percentage of our sample size drives and have experienced a vehicle breakdown. This shows that there is a problem with the current vehicle breakdown sign and that it is a very pressing issue.

- **Problem statement**

From our research, we can tell that the current triangle hazard signs used for breakdowns cannot be clearly seen, especially in the dark. On top of that, they are below drivers' eye level, making them hard to see up close.

We then compared the existing solutions to road hazards.

After looking through the market for existing solutions, we found 2 solutions.

1. Standard vehicle breakdown signs.
2. Robotic traffic marshals.

Both solutions are used to warn drivers of approaching road hazards in front of them. A comparison table of these two solutions can be found in Annex 1.

Your BIG IDEA

Our idea is to build an improved vehicle breakdown sign that is larger and is deployable at the eye-level of drivers. It will most likely involve a sheet of reflective material and a stand which can be compacted down to fit into the user's car.

It will help drivers whose vehicles have already broken down by reducing the risk of other drivers crashing into them through addressing the weaknesses of current breakdown signs to improve overall road safety.

The product would be larger than all other current breakdown signs available on the market, and it aims to be more eye-catching. On top of that, it will aim to be compactable in order to retain the portability essential for practical usage.

It is expected that our invention may be plagued with problems such as:

- (a) The problem of stability, as producing a larger sign that stands at 1.2 metres in height will make the sign much more unstable.
- (b) The problem of compactness, as we need to make it compact enough to fit into a car trunk and not take up too much space to make it an unviable solution for daily commuters.
- (c) The problem of visibility, as we will have to improve the sign's visibility without compromising statutory requirements set by the authorities.

The first major milestone in the process of invention would be building our first prototype after proposal evaluation, starting somewhere in May, followed by testing and getting feedback on it once it is done, then improving it. After mid-term evaluation, we would use the feedback from the evaluators to again improve the prototype, before again testing and getting and getting feedback from potential users. The final version would then be presented at the final evaluation. A graphic is in Annex 2.

Construction Process

There are two parts to the prototype; the sign and the stand. The sign has to be visible, inexpensive and easily available in order to be practical. The stand needs to be tall enough, stable and also affordable. We, therefore, scored the various materials against the evaluation criteria and finalized the materials to be used for making the prototype.

We evaluated the different possible materials and based on the criteria and the scores, paper was chosen for making the sign as it came in the bright catching colour at fairly inexpensive costs which could be procured easily. Easel was chosen for the stand as it reached the desired height and would be sufficiently stable that could be easily bought at a reasonable price. The chart of the evaluation can be found in Annex 3

Modification and Evaluation

We did some testing on the product by going out onto the streets at night and in the day, surveying them and asking them for their opinion of the different prototypes. We also tested in windy weather, to test the stability of the stand. The details of the tests can be found in Annex 5 and Annex 6. Due to time and material constraints, we were unable to create a product that would pass both our practicality and functionality expectations. If given more time to gather resources, we would surely be able to continue improving our product.

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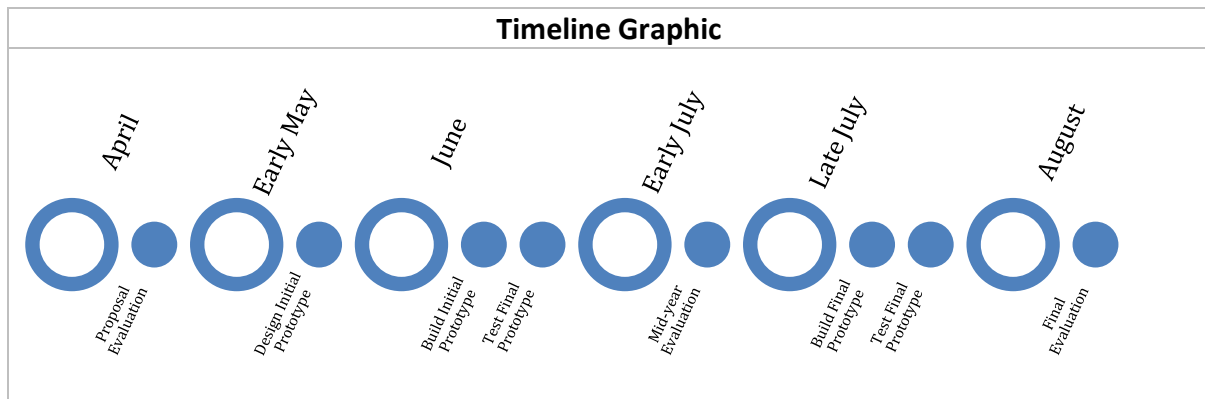
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Annexes

Annex 1

| Comparison of existing solutions | | |
|----------------------------------|---|---|
| |  |  |
| Solution | Standard Vehicle Breakdown Sign | Robotic Traffic Marshal |
| Cost | \$7.50 - \$20.00 | ~\$2000.00 |
| Size | 0.4m | 1.8m |
| Portability | Easily packed and moved. | Bulky, not easily moved. Comes with attached battery kit |
| Visibility | Visible in daytime up to a distance of ~30m, poor visibility in night-time | Highly visible, both in day-time and night-time |






Annex 2



Annex 3

| Choice of Material | | | | | | | |
|---------------------|------------|------|------|---------------|--------|-----------|------|
| Sign | Visibility | Cost | Time | Stand | Height | Stability | Cost |
| Paper | 2 | 3 | 3 | Selfie Stand | 1 | 1 | 3 |
| Reflective Material | 3 | 1 | 1 | Camera Tripod | 2 | 3 | 1 |
| Plastic | 1 | 2 | 2 | Easel | 3 | 2 | 2 |

Annex 4

| The Prototypes | |
|-------------------------|---|
| Mark I |   |
| Mark II |   |
| Mark III (Final) |  |

Annex 5

| Test Iteration: | Tick | | | Remarks |
|----------------------|------|------|-------------------|--|
| Test Date: 23/6/2019 | Pass | Fail | Potential Failure | Test details We tested and compared both the Mark I and the Mark II against each other and the current breakdown sign by surveying passers-by on the different models and what they thought of them. Many of them said that the Mark II was better than the Mark I, thus we used that for the next test with the Mark III. |
| Visibility | √ | | √ | At night, paper is not as visible as reflective plastic due to the lack of light. |
| Size | √ | | | |
| Height | √ | | | |
| Stability | | √ | | Strong winds caused the sign to blow and fall over multiple times. |
| Cost | √ | | | |
| Portability | √ | | √ | The prototype is a two-piece set-up. |

Annex 6

| Test Iteration: | Tick | | | Remarks |
|----------------------|------|------|-------------------|--|
| Test Date: 14/7/2019 | Pass | Fail | Potential Failure | <p>Test details</p> <p>We tested and compared both the Mark II and the Mark III against each other and the current breakdown sign by surveying passers-by on the different models and what they thought of them. In the end, the Mark III was shown to be the best model although there were some downsides to it compared to the Mark II and the current breakdown sign, which we hope to have been able to fix.</p> |
| Visibility | √ | | √ | <p>Flashing and changing coloured lights might distract drivers and they might think they are just decorations or something similar, defeating the purpose of the sign. This can be solved by using single coloured lights.</p> <p>Brightness was eye-catching and causes drivers to look up and pay attention, so as to not crash into the stationary vehicle.</p> |
| Size | √ | | | |
| Height | √ | | | |
| Stability | | | √ | <p>Strong winds caused the sign to flap and show signs of instability. However, the sign did not topple.</p> |
| Cost | √ | | | |
| Portability | √ | | √ | <p>The prototype is a two-piece set-up.</p> <p>The LEDs might be problematic when folding or rolling while attempting to make the product more portable.</p> |