AUTOMOBILE DESIGN MODIFICATION BY THE APPLICATION OF TRIGONOMETRY

Neeraj Jasher[1], Nirav Patel[2], Blesson Prakash[3]

Abstract: ***To reduce the drag or air resistance of any automobile by introducing modification and supporting it by trigonometry.***

In today's trending world, we eventually face heavy price on anything that we buy, starting from simple pen till petrol and land. Hike in fuel not only makes our personal travel or cargo expensive but also increases the financial budget of things like cement, clothes, electronic accessories, etc. For instance if a buyer has to buy cement from Delhi, along with its worth he has to pay the transportation charges for from wherever it must have had come. And increase in fuel price makes it even worse. This paper is about although the fuel price is increasing every often, there are measures that we can take to reduce the transportation charges.

Keywords: Drag: It is a resistance caused by any fluid (air in our case) against the forward motion of any object (automobile in our case).

Case 1

Figure 9 the air strikes perpendicular to the surface and drag opposite to the direction of movement of automobile is maximum

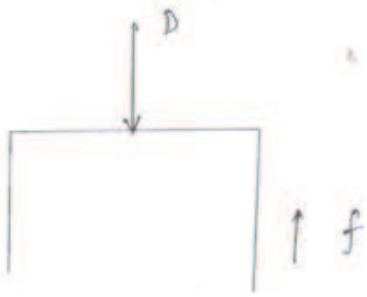

Figure 10

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Considering the initial flat surface

Here **f** is the forward force in which the automobile is moving.
And **D** is the Drag or the air resistance offered in opposite direction.
So here the final force is **F** with which it is moving, after resolving we get:

$$\boldsymbol{F = f - D}$$

Note:

This force $\boldsymbol{F = f - D}$ is the force which is exerted by all the trucks, heavy vehicles and few cars that run on Indian roads.

And all the trains that run on Indian rail tracks

Impacts:

1. Loss of efficiency, specific fuel consumption directly depends on the air resistance produced, more the air resistance (or drag) more will the fuel consumption, and less will be the mileage and transportation charge increases automatically beyond hikes in fuel price.

2. In case of trains, the trains that run on diesel engine will have same impact, and the trains that run electrically will have impact on endurance, the less the air resistance the more will the endurance. And the time consumed will be less, means the frequency of transportation can be increased

Case 2

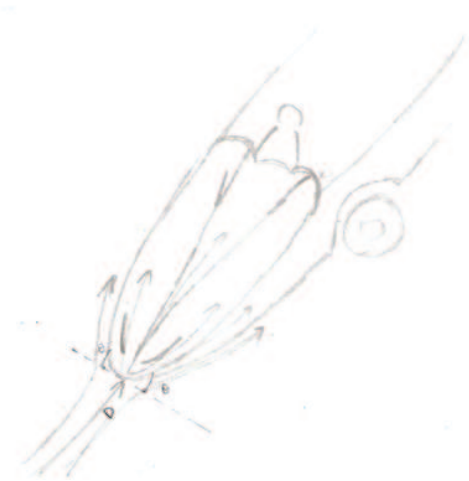

Figure 11

Now in this case if we consider the air and the initial inclined surface where the air strikes

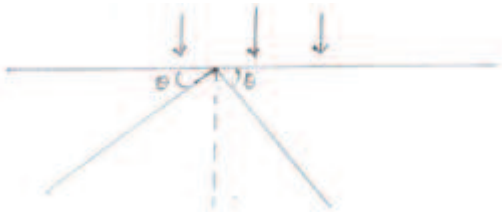

Figure 12

Here the surface is modified by tilting with an angle θ backward with respect to the original horizontal axis.

The drag is produced by the air striking perpendicular to the surface.

$$\therefore we\ know, \boldsymbol{Drag}\ (\boldsymbol{D}) = \frac{\mathbf{1}}{\mathbf{2}}\boldsymbol{\rho v^2} \ldots\ldots\ldots\ldots\ldots (1)$$

$(By\ drag\ equation)$
$Where,$
$\rho\ is\ density$
$v\ is\ velocity$
$S\ is\ surface\ area\ of\ perpendicular\ air\ strike$
$C_D\ is\ Drag\ coefficient$

Here the surface of contact to perpendicular air is Scosθ

$$So,$$
$$D' = \frac{1}{2}\rho v^2 S cos\theta C_D$$
$$D' = \frac{1}{2}(\rho v^2 S C_D) cos\theta$$

$$\boldsymbol{D' = Dcos\theta}$$

Hence, here the final force will be

$$\boldsymbol{F = f - Dcos\theta}$$

Alternatively

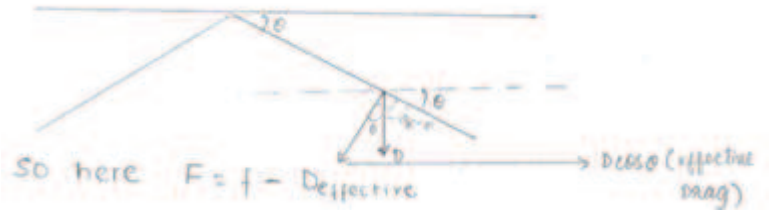

Figure 13

So here,

$$F = f - D_{effective}$$
$$\boldsymbol{i.e.F = f - Dcos\theta}$$

Comparison

In the initial case we get

$$Final\ Force = f - D \ldots\ldots\ldots (1)$$

By taking a tilted or V-shaped design

$$Final\ Force = f - Dcos\theta \ldots\ldots\ldots (2)$$

$$(2) - (1)$$

$$= f - Dcos\theta - f + D$$
$$= D(1 - cos\theta)$$

Hence, the final force is **D (1-cos$\boldsymbol{\theta}$)** units more than the initial case resulting in a decrease in drag or air resistance by bringing an automobile design modification.

CONCLUSION

Hence, by bringing this modification in the trucks, heavy vehicles, transport vehicles, trains and etc, we can bring change up-to some considerable level.

In the fast developing India, in the coming near future, this modification can support ease India's pain. Help Indians grow faster.

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[1]*Neeraj Jasher, Nirav Patel & Blesson Prakash*
Indian Institute of Aeronautical Engineering
Dehradun, India.
kindnwisdom@gmail.com