Speed limit presentation draft

Our proposed speed limit is 30mph in consideration of three factors: human, nature and engineering.

### Human

The first one is human factor, which consists of human ability and human safety.

As speed increases, the magnitude of the information that the brain needs to process increases. This means that the field of vision decreases as speed increases. Human ability also includes the human reaction time, which is 2.3s according to a controlled study.

There are two factors we need to consider when regarding human safety. First is to ensure that the car maintains contact with the ground. The largest possible speed under such circumstances is when the centrifugal force equals gravity

Applying the formula…, we get…

We see the bridge as a sector, since the angle is 5, as this is an isosceles triangle, this angle is 10, so the radius can be calculated by…, because the total length of the bridge is about 48m as we measured.

Then we get the radius.

Then we plug in… and get v should be less than 52m per second.

The second thing about human safety is to ensure that the car will not hit the obstacle.

The total stopping distance needs to be less than the shortest sightline distance. To do so, we see the bridge as the graph of a quadratic function.

(draw the bridge) so this is the bridge, the distance is the shortest when the person and the car are equally far from the top of the bridge. we can draw another quadratic function here and that represents every possible position of the driver and the obstacle.

Then we can draw a tangent line to the first function, when the line is horizontal, the distance is smallest.

(draw triangle)

Because the slope is 5 degrees as we measured, and the height is 1.5, we can calculate the distance using trigonometry, and the result is 34, so the total stopping distance should be no longer than 34m.

### Nature

The second factor is nature.

And that is composed of weather, location and visibility.

Weather has an impact on thekinetic coefficient of friction of the road, and in the worst scenario, the coefficient is 0.45.

Also location. The bridge is near a school, and the speed limit near a school is usually 30km per hour.

For visibility, even when it is raining or fogging, the visibility should be normally greater than 34m.

### Engineering

The third and last one is engineering.

That is made up of factors like traffic flow, road material and shoulder space.

These factors will not influence our final calculation, as we will be considering the extreme condition, in which a single car is driving at the highest possible speed.

### Calculation

Now since we’ve considered most of the factors, we may start the calculation.

Suppose the initial speed of car is u m/s, the reaction stopping distance is 3u.

There are three possibilities.

First, when 2.3u < 17, then the speed is less than 7.4m/s.

Second, the speed equals to 7.4m/s.

Third, the speed is greater than 7.4m/s.

We can first look at the second possibility, u = 7.4.

We can use the formula v^2 = u^2 + 2as

Plug it in and we will get…

Then we solve for s, we get s = 7.7m.

So the speed should be greater than 7.4m/s

Then we get…

So the final result is v = 9m/s, which is about 32km/h.

In conclusion, take all of these factors into consideration, we would like to use 30km/h as our final proposed speed.