**Bridge Building Teacher Sheet**

**Exemplar Calculation**

**Number of cars per year for each lane:**

The number of cars per second can be given by:

$$\frac{Speed of vehicles}{Distance between each vehicle}= \frac{0.1}{0.3}=0.33 per second$$

That one car every three seconds or 20 per minute, 1200/hr, 28, 800 /day or 10.5 million per year. This equation is analogous to wave frequency, speed and wavelength.

**Income per year:**

Each car pays 10p, so for each lane the income per year is £1.05 million

$$10.5 million cars × £0.01= £1.05 million$$

**Build cost:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Unit cost / £** | **No. Units** | **Cost /£** |
| Paper | 750, 000 | 20 | 15m |
| Nuts and bolts | 500, 000 | 10 | 5m |
| Tape | 2.5m | 1 | 2.5m |
| **GRAND TOTAL** | **22.5m** |

**Payback time and profit:**

The proposed bridge has two lanes (minimum 8 cm road width), so can carry 21 million cars per year and generate an annual income of £2.1m. With a build cost of £22.5m, the payback time is:

$$payback time= \frac{22.5}{2.1}=10.7 years$$

After taking into account initial costs and the income generated over the 100 year lifespan of the bridge (but ignoring maintenance) the bridge will yield a profit of £187.5 m.

**Weight requirement:**

For a two lane bridge and with a 0.3m safety margin, 6 vehicles will be on the bridge at any one time. Each has a mass of 67g, so with a combined mass of 400 g. Add to this the safety margin of 50%, the bridge must support a minimum of 600 g.