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CVE 506
Highway Assignment

1 The following non-linear speed-density relationship is assumed for a highway link:-
$u = 0.001(k-250)^2 - 1.4$
- Where u has units of km/h and k has unit of vehicles per km
Estimate the free-flow speed, the jam density, the speed and density at maximum flow and the lane capacity of the link in question

~~free-flow speed = 87~~ Solution
free flow speed = zero density
$K = 0$
$\therefore u = 0$
Solving the equation
$K = 287$ or 212 veh/km
At max q,
Solving the quadratic equation
Chosen 80.58 veh/km
If $K = 80.58$ veh/km

2 The following flow-density relationship is assumed for a highway link: $q + u) = 250u$
Estimate the free-flow speed, the speed at maximum flow, the maximum f... on the link in question and the density at maximum flow

3

Solution

ⓐ $t = 30s$

$P(0) = \frac{15}{100} = 0.15$

$P(n) = \frac{(qt)^n e^{-qt}}{n!}$

$P(0) = \frac{(qt)^0 e^{-qt}}{0!} = 0.15$

Therefore

$e^{-qt} = 0.15$

$-qt = \ln(0.15) = -1.89712$

$q = 1.89712 \div 30 = 0.0632$

Therefore

$P(3) = \frac{(0.0632 \times 30)^3 e^{-(0.0632 \times 30)}}{3!}$

$= \frac{(1.897)^3 e^{(-1.897)}}{6} = 0.171$

There is thus a 17.1% chance that 3 vehicle will arrive within any one interval

b $P(\text{headway} > 6) = e^{-6.0}$

$= 0.684$ or 68.4% of the time

c $P(\text{headway} \geq 4) = e^{(-0.0632 \cdot 4)} = 0.777$ or 77.7% of time

Therefore $P(\text{headway} \geq 4) = 1 - P(\text{headway} \geq 4)$

$= 1 - 0.777$

$= 0.223$ or 23.3% of the time