Highway Risk Index (HRI)

Traffic volume serves as an indicator in understanding road safety dynamics. It represents the volume of vehicles traversing a specific stretch of road within a designated time frame. Concurrently, road fatalities denote the tragic outcome of traffic crashes.

The correlation between traffic volume and fatalities is significant. As traffic volume increases, the likelihood of crashes increases proportionally. This correlation underscores the necessity for comprehensive strategies aimed at improving road safety across any highway.

The correlation between the traffic volume and the fatalities can be effectively assessed using indices like the Highway Risk Index.

Highway Risk Index (HRI)= $Fatalities \times Safety\ Measure \times \left(\frac{1}{\left(\frac{Traffic\ Volume}{Highway\ Capacity}\right)}\right)$

- **Fatalities**: This represents the total number of fatalities that have occurred within the district over 1 year.
- **Traffic Volume**: Refers to the total volume of traffic on the roads, usually measured as the number of vehicles passing through a specific point of the road in a given timeframe (**PCU/hr**).
- **Capacity**[1]: Capacity of road (**PCU/hr)**
- **Safety Measures:** A qualitative measure representing the effectiveness of road safety initiatives, enforcement efforts, infrastructure improvements, public awareness campaigns, etc., implemented by the district administration. This can be assessed on a scale (e.g., from 0 to 1, where 1 indicates highly effective measures).

The HRI thus obtained provides a measure of how effectively the road-owning agencies are ensuring the safety of the specific highway.

Interpretation:

- A higher HRI value indicates that travelling on a specific road is associated with higher risk despite recording the same number of fatalities as that of another similar highway.

[1] CSIR - Central Road Research Institute. (2017). Indian Highway Capacity Manual (Indo - HCM). https://crridom.gov.in/sites/default/files/files/Indo-HCM%20Snippets.pdf

- The district administration can work towards reducing the HRI so that commuters can travel safely.
- The district administration can compare the HRI's of the specific highway between different years to assess the changes in road safety standards.

Overall, by using this formula, the district administration/road-owning agencies can quantitatively assess its performance in road safety and identify areas for improvement, ultimately aiming to reduce the number of fatalities despite increasing traffic volume.

The sample working sheet explaining the dynamics of the HRI is presented in the Annexure.

Annexure

The sample combinations for the interpretation are presented below:

Fatalities	Traffic Volume, PCU/hr	Design Capacity, PCU/hr	Safety Measures
100	1500	1500	0.25
200	2500	2500	0.75
300	3500	3500	1

The resulting HRI for different combinations are presented below:

Year	Road	Fatalities	Traffic Volume, PCU/hr	Design Capacity, PCU/hr	Safety Measures	Risk Index
2018	1	100	3500	2500	0.75	53.57
2018	2	100	2500	1500	0.25	15.00
2018	2	100	2500	1500	0.75	45.00
2018	2	100	3500	1500	0.25	10.71
2018	3	100	1500	1500	0.75	75.00
2018	4	100	2500	2500	1	100.00
2018	5	100	3500	2500	1	71.43
2019	1	100	2500	2500	0.25	25.00
2019	2	100	3500	3500	1	100.00
2019	4	100	3500	3500	0.25	25.00
2019	5	100	3500	3500	0.75	75.00
2019	5	100	1500	3500	0.25	58.33
2020	3	100	1500	3500	0.75	175.00
2020	4	100	1500	1500	0.25	25.00
2020	4	100	2500	3500	0.25	35.00
2020	5	100	2500	2500	0.75	75.00

Year	Road	Fatalities	Traffic Volume, PCU/hr	Design Capacity, PCU/hr	Safety Measures	Risk Index
2021	1	100	1500	1500	1	100.00
2021	1	100	2500	3500	1	140.00
2021	2	100	1500	2500	0.25	41.67
2021	2	100	2500	3500	0.75	105.00
2022	2	100	3500	1500	0.75	32.14
2023	3	100	3500	2500	0.25	17.86
2023	4	100	3500	1500	1	42.86
2024	2	100	1500	2500	0.75	125.00
2024	3	100	1500	2500	1	166.67
2024	3	100	1500	3500	1	233.33
2024	5	100	2500	1500	1	60.00
2018	2	200	1500	1500	0.25	50.00
2018	3	200	3500	2500	0.25	35.71
2018	4	200	3500	3500	1	200.00
2018	5	200	1500	2500	0.25	83.33
2019	1	200	2500	2500	0.75	150.00
2019	2	200	1500	1500	1	200.00
2020	1	200	1500	3500	0.75	350.00
2020	2	200	2500	1500	0.25	30.00
2020	2	200	3500	2500	0.75	107.14
2022	2	200	3500	2500	1	142.86
2022	3	200	2500	3500	0.75	210.00
2022	5	200	3500	1500	1	85.71
2023	1	200	3500	3500	0.25	50.00
2023	1	200	1500	3500	0.25	116.67
2023	2	200	2500	2500	0.25	50.00
2023	3	200	1500	3500	1	466.67

Year	Road	Fatalities	Traffic Volume, PCU/hr	Design Capacity, PCU/hr	Safety Measures	Risk Index
2023	3	200	1500	2500	1	333.33
2023	3	200	3500	1500	0.25	21.43
2023	4	200	2500	1500	0.75	90.00
2023	5	200	1500	1500	0.75	150.00
2024	1	200	3500	3500	0.75	150.00
2024	1	200	2500	3500	1	280.00
2024	3	200	3500	1500	0.75	64.29
2024	3	200	1500	2500	0.75	250.00
2024	3	200	2500	1500	1	120.00
2024	4	200	2500	2500	1	200.00
2024	5	200	2500	3500	0.25	70.00
2018	2	300	2500	3500	0.75	315.00
2018	4	300	3500	3500	0.25	75.00
2018	5	300	3500	3500	0.75	225.00
2019	5	300	2500	3500	0.25	105.00
2020	1	300	2500	3500	1	420.00
2020	1	300	1500	2500	0.75	375.00
2020	2	300	3500	2500	0.25	53.57
2020	3	300	2500	2500	0.25	75.00
2020	4	300	1500	1500	0.25	75.00
2020	4	300	2500	2500	0.75	225.00
2021	1	300	1500	1500	0.75	225.00
2021	1	300	2500	1500	1	180.00
2021	2	300	2500	2500	1	300.00
2021	2	300	3500	1500	1	128.57
2021	3	300	3500	1500	0.75	96.43
2021	4	300	2500	1500	0.25	45.00

Year	Road	Fatalities	Traffic Volume, PCU/hr	Design Capacity, PCU/hr	Safety Measures	Risk Index
2021	5	300	1500	3500	0.75	525.00
2022	3	300	1500	2500	1	500.00
2022	3	300	3500	1500	0.25	32.14
2022	3	300	1500	2500	0.25	125.00
2022	4	300	1500	3500	1	700.00
2022	4	300	3500	3500	1	300.00
2024	2	300	3500	2500	1	214.29
2024	3	300	1500	3500	0.25	175.00
2024	5	300	2500	1500	0.75	135.00
2024	5	300	3500	2500	0.75	160.71
2024	5	300	1500	1500	1	300.00