Traffic Study and Analysis of Highway (NH5) from Balongi to Kharar

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Abstract: Evaluation of in service pavements is very vital for keeping them in good serviceable condition because pavements deteriorate with age and traffic loading. To get a complete idea of the existing condition of any pavement both structural and functional evaluation are necessary. This study aims to investigate the accidental spots, traffic volume, and pavement condition. For this survey, the location of Kharar was chosen i.e. Balongi to Kharar Bus-Stand of 7 km stretch. The road initiates with intersection near Kharar bus stand and passes through many in between intersections near Sunny Enclave, VR Punjab Mall which are prime locations in that area. This road also connects with T junction and connects to NH5 / NH7 via Airport road. The data collected was processed, categorized and analyzed to generate reports for vehicle classification, hourly traffic variation, accidental black spots, pavement condition and origin & destination of trips.

KEYWORDS: traffic analysis; traffic; traffic volume; pavement; pavement management; accident spots

1. Introduction

The behavior of the pavement design depends on the various characteristics such as materials and thickness of each pavement layer, the quality of its construction, [1–3] the climatic conditions and the sub grade quality such as its bearing capacity and presence of water. Pavements deteriorate with age and traffic loading [4–6]. Evaluation of in service pavements is very vital for keeping them in good serviceable condition. To get a complete idea of the existing condition [7–9] of any pavement both structural and functional evaluation are necessary.

In the flexible asphalts, the dissemination example of burden changes starting with one asphalt layer then onto the next, in light of the fact that the quality of every asphalt layer is unique. The topmost layer consist of least adaptable material and the lowermost layer consist of the most adaptable and fragile material. As the wheel load imposes high level of stress [10–12] at the surface and comparatively much lower stress level is there as we go down, therefore the utilization of less quality or fragile materials can
be there. The various factors of traffic analysis and pavement evaluation\[13–15\] are traffic growth rate, traffic volume, lane distribution, and daily traffic volume and vehicle damage factor \[16–18\]. This study aims to investigate the hourly traffic variation, accidental spots, O-D studies and pavement condition. The practical application of this study is that it helps in checking the growth of traffic, traffic volume, and the characteristics of pavement materials. It also helps in detecting the accidental spots, black spots, pavement surface condition checking and maintenance requirements of pavement which is very useful in traffic planning and control.

2. Methodology

Traffic Analysis and Pavement Management is the process to analyze and evaluate the traffic and pavement simultaneously. It helps in planning the maintenance and repair of pavement according to the traffic flow in particular zone. For this study, location of Kharar in Punjab, India was chosen i.e. Balongi to Kharar Bus-Stand (km 0 to km 7.0) as shown in figure 1 where construction of fly over is also going on. The road initiates with intersection near Kharar bus stand and passes through many in between intersections near Sunny Enclave, VR Punjab Mall which are prime locations in that area. This road also connects with T junction and connects to NH5 / NH7 via Airport road. In this concentrated area, traffic volume count was measured according to the class of vehicles and pavement condition was checked accordingly. In Pavement Condition Survey, Pavement condition, assessment and analysis could be done to evaluate various points at different intersections.

![Figure 1. Survey location (Balongi to Kharar) (Google map)](image)

3. RESULTS AND DISCUSSION

3.1 Detection of accidental spots

The accident data includes the various aspects such as location, involvement of vehicles or pedestrian and type of accident. According to the nature of injury accidents are classified into fatal, grievous, minor and non injury accidents respectively. The road has various spots where accidents can occur due to blind spots or blind intersections. Observations were taken at every
250 m; each 250 m section was further divided into 10 parts of 25 m each to observe points of accidents as shown in table 1, where PA indicates point of accident and SP indicates safe point. Various spots were observed responsible for accidents such as small roads meeting main highway, place of worship, absence of curve indicators, various blind junctions, off road driving by the drivers, no warning sign boards as shown in figure 2.

![Figure 2. Points of Accidents noted at 250 m intervals](image)

| Distance | Points of accidents and Safe Points |
|----------|------------------------------------|
| 250m     | PA PA SP PA SP PA PA SP SP PA    |
| 500m     | SP PA SP SP PA SP PA PA SP SP    |
| 750m     | SP SP PA PA PA PA SP SP PA SP    |
| 1km      | SP PA SP PA PA SP PA SP PA PA    |
| 1.25km   | PA SP PA PA SP PA SP PA SP SP    |
| 1.5km    | PA PA PA SP SP PA SP PA PA SP    |
| 1.75km   | PA SP PA SP PA SP PA SP PA PA    |
| 2km      | SP SP PA PA SP PA SP PA PA SP    |
| 2.25km   | SP PA SP SP PA SP PA SP PA PA    |
| 2.5km    | PA PA PA SP SP PA SP PA SP PA    |
| 2.75km   | SP PA SP PA SP PA SP PA SP PA    |
| 3km      | PA PA SP PA PA SP SP PA PA PA    |
| 3.25km   | PA SP PA PA PA SP PA PA PA PA    |
| 3.5km    | SP SP PA PA SP PA SP PA SP PA    |
| 3.75km   | PA PA SP PA SP PA SP PA SP PA    |
| 4km      | PA SP PA PA SP SP PA PA PA SP    |
| 4.25km   | SP PA SP PA SP PA SP PA SP SP    |
3.2. Vehicle Class Count and Hourly Variation

With the advances in innovation, checking traffic through picture preparing procedures yield a wide scope of traffic parameters, for example, number of vehicles, speed of vehicles, classification of vehicles [19,20], traffic flow, density of vehicles and so forth. The method used for vehicle tracking and vehicle classification in this study consisted of 7 steps i.e. converting a video stream to a sequence of single frames, detecting a stable image from a dynamically changing background image, calibration of the camera, identification of vehicles, tracking moving vehicles in each lane, counting vehicles and then classifying the vehicles. Vehicles were classified into large, medium and small, further are tracked to find the route they adopted in selected area. The PCU factors are shown in table 2.

| Type of Vehicle | PCU factor |
|-----------------|------------|
| Two wheeler/Cycle | 0.5        |
| Auto Rickshaw/Goods Auto | 0.75       |
| Car/Taxi/Pick Up | 1          |
| Private Bus/Government Bus/Truck | 3          |

The readings for vehicle count and classification were taken at T Junction near VR Punjab Mall. The interval of 1 hour was kept between two successive readings which were then noted down from the video recording done for 1 minute every time. The observations were taken both ways i.e. vehicles moving towards Kharar and towards Balongi. The results of the same are listed in table 3 and table 4 respectively.

| Table 3. Hourly Variation of Traffic at T Junction near VR Punjab Mall for traffic moving Balongi to Kharar |
| Type of Vehicle | Balongi to Kharar | Kharar to Balongi |
|-----------------|------------------|------------------|
|                 | Two wheeler / Cycle | Auto Rickshaw/Goods Auto | Car/Taxi/Pick Up | Private Bus/Government Bus/ Truck |
| 1st reading     | 20                | 4.5              | 41              | 21              |
| 2nd reading     | 15                | 13.5             | 45              | 18              |
| 3rd reading     | 21                | 6                | 38              | 27              |
| 4th reading     | 25.5              | 9                | 39              | 24              |
| 5th reading     | 16.5              | 6.75             | 35              | 18              |
| 6th reading     | 18                | 6                | 42              | 21              |
| 7th reading     | 20                | 9.75             | 34              | 21              |
| 8th reading     | 16                | 6                | 31              | 24              |
| 9th reading     | 21                | 7.5              | 44              | 18              |
| 10th reading    | 20.5              | 8.25             | 35              | 30              |
| 11th reading    | 19                | 5.25             | 38              | 21              |
| 12th reading    | 20                | 9                | 40              | 24              |
| 13th reading    | 17.5              | 6                | 31              | 18              |
| 14th reading    | 18.5              | 7                | 44              | 21              |
| 15th reading    | 21                | 9                | 30              | 24              |

Table 4. Hourly Variation of Traffic at T Junction near VR Punjab Mall for traffic moving Kharar to Balongi.
3.3. Pavement Condition Survey

In pavement condition survey, the maintenance and management is also considered on the basis of the present condition of the road or pavement. During the survey [21,22], the various types of pavement deformations were found as shown in figure 3.

|        | 14th reading | 15th reading |
|--------|--------------|--------------|
|        | 25.5         | 12           |
|        | 18           | 21           |

Figure 3. Distress pavement, deterioration in pavement due to improper drainage and potholes in pavement

3.4. Origin and Destination Survey

This survey consisted of the 2 points, first is the start point known as origin and second is the last point known as destination. The survey was taken at T Junction near VR Punjab Mall twice a day (2 shifts in peak hours (8:00 am – 10:00 am in the morning and 4:00 pm to 7:00 pm in the evening) for 26 days [22–24]. During the survey, questions were asked to the driver on the basis of the questionnaire survey such as origin and destination of the trip, time of travel, delay time, condition of road etc. The data was collected was analyzed as shown in table 5.
Table 5. Destinations from T Junction near VR Punjab Mall during Origin and Destination survey

| Shift No. | Airport | Work | Shopping Mall | School & College | Trip | Other |
|-----------|---------|------|---------------|-----------------|------|-------|
| 1         | 8       | 17   | 3             | 0               | 16   | 15    |
| 2         | 10      | 10   | 5             | 30              | 10   | 12    |
| 3         | 0       | 1    | 5             | 10              | 2    | 10    |
| 4         | 5       | 10   | 10            | 10              | 8    | 4     |
| 5         | 2       | 5    | 15            | 0               | 5    | 12    |
| 6         | 8       | 10   | 20            | 0               | 3    | 10    |
| 7         | 10      | 15   | 2             | 0               | 5    | 7     |
| 8         | 7       | 2    | 10            | 0               | 2    | 9     |
| 9         | 4       | 0    | 8             | 0               | 4    | 4     |
| 10        | 6       | 3    | 5             | 0               | 5    | 6     |
| 11        | 10      | 15   | 10            | 0               | 0    | 7     |
| 12        | 8       | 5    | 6             | 0               | 4    | 9     |
| 13        | 4       | 6    | 5             | 15              | 0    | 11    |
| 14        | 3       | 1    | 3             | 12              | 7    | 4     |
| 15        | 0       | 0    | 5             | 13              | 4    | 6     |
| 16        | 9       | 0    | 1             | 0               | 0    | 7     |
| 17        | 4       | 0    | 4             | 1               | 1    | 3     |
| 18        | 5       | 5    | 6             | 0               | 0    | 12    |
| 19        | 4       | 6    | 7             | 0               | 1    | 5     |
| 20        | 7       | 6    | 9             | 0               | 6    | 7     |
| 21        | 3       | 5    | 4             | 0               | 4    | 10    |
| 22        | 0       | 1    | 6             | 0               | 1    | 13    |
| 23        | 0       | 7    | 1             | 0               | 2    | 6     |
| 24        | 0       | 4    | 8             | 15              | 1    | 7     |
| 25        | 1       | 6    | 5             | 14              | 6    | 1     |
| 26        | 2       | 3    | 3             | 0               | 2    | 4     |
4. Conclusion and Future Scope
In this study, the results are evaluated and has been seen that the concentrated area suffered a lot from the pavement deterioration and many other factors including accidental spots. The pavement thickness of bitumen layer was found to be non satisfactory considering the axle load of heavy vehicles and the traffic volume was very high in the area. Excess of cracks and pot holes were seen on the pavement due to which the delay time also increases and the maintenance cost of the vehicle too increases. The lack of signal was seen at the intersections and the crossings on roads. The width of pavement is less as the traffic is more and lane capacity is less. Many accidental spots have been spotted and could be dangerous. They require the markings or any ideal signal for the driver to be aware of them.

In this study, pavement analysis has been done, however there is a scope of designing of pavement for the same stretch of road. The pavement management system can also be used for the analysis of pavement in future studies. Also, the functional and structural evaluation of a pavement is recommended for futures studies.

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