International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 7 (2018) pp. 166-168

Pavement Shoulder Maintenance: Case Study

Thilak Gowda N*
PG Scholar, School of Civil Engineering,
REVA University, Bengaluru, Karnataka, India.

Dr. P Shivananda
Professor, School of Civil Engineering,
REVA University, Yelankha, Bengaluru, Karnataka, India.

Abstract
This paper presents a case study on maintenance and importance of road shoulder. Transportation plays a vital role in the development of any country. To provide rapid movement of vehicle the highway construction and its maintenance should be perfect. Shoulder is a very essential requirement of any roads. It gives a service for emergency space for stopping vehicle, damaged automobile and support for pavement structure, drainage and many more. Maintenance usually involves rebuilding of lost material with compacting it. Hence a periodic development in maintenance of shoulder is essential.

Keywords: Maintenance, Shoulder, Highway system, Emergency stops, Compaion.

Introduction

Shoulder is an ideal roadway part. It provides feature for vehicles.when emergency and a recovery land when vehicles depart the driving lane. Shoulder of granular material implementation is low cost and hence it is widely used. Still they result in a failure named as shoulder edge drop off. Properties of shoulders consists of clear lane marking between traffic lanes and shoulders, required camber for proper drainage, more width for emergency purpose and also guard rail adopting, stability of structure, less total and construction costs.

General Failures in Shoulder
The various failures we can generally observed in the shoulder are,
1. Edge break 2.Edge drop off 3. Pothole 4.Cracks 5. Rutting 6. Stability Failure of stability 7. Settlement 8. Blow out 9. Sink hole 10. Stripping off.

Fig-1: Shoulder failures on pavement

Materials and Methodology

Materials
There various types of shoulders and each type of shoulder has its own usage of materials and corresponding construction method. The various types of shoulders are mainly classified as paved unpaved shoulders. The various types of shoulders are, 1) Earthen shoulder 2) Granular shoulder 3) BC paved shoulder 4) CC paved shoulder 5) Geo-cell shoulder 6) Geo-grid shoulder 7) Fly ash stabilized shoulder. etc.

The various materials used for the construction of shoulders are, Granular soil, Aggregate, Bituminous concrete, Cement concrete, geo grids, Geo cells, granular base material, cement-fly ash, lime for stabilization, Recycled asphalt, etc.

Methodology
The case study is done by taking consideration of flexible pavement and its failures. The causes of failure are,

1. Use of substandard material.
2. Low bearing capacity.
3. Improper drainage system.
4. compaction
5. Improper supervision
6. Making profit by contractor by poor construction.
7. Improper workmanship.

To overcome the failures, above mentioned causes as to be corrected and a proper methodology should be adopted.

1. **Materials:** If the materials employed in the construction of flexible pavement should have standard requirements, the structural behaviour of the pavement is affected.
2. **Bearing capacity of sub strata:** Inadequate strength, Loss of lateral confinement, inadequate wearing course, Loss of binding action, these leads to failure of shoulder.

Therefore, the methods involved in this should be accurate.

3. **Drainage system:** The water should be prevented from reaching the sub layers of structure wherever possible or attempt should be made to remove it quickly from the shoulder and a well-designed drainage system should be provided beside it.
4. **Compaction:** It is a main factor because higher the compaction then bearing capacity will be increased. Since the load transformation in the shoulder region is static load, the compaction rate should be equal to sub grade strength i.e. 97% and dry density of 1.75 gram/cc.
5. **Site Supervision:** Proper supervised shoulders will increase the load carrying intensity and frequency of failures.
6. **Workmanship:** Using skilled labours will make good and proper use of materials and reduces faulty & wrong methods of construction.
7. **Profit of contractor:** Use of low quality material is done in constructing the shoulders, because the contractors will not give much importance to the shoulder since they want to make money they neglect the importance of shoulder.

   The construction methods of pavement should be perfect give giving equal importance to the shoulder also.

Case study

The study was conducted in NH-44 (BENGALURE-HYDERABHAD) at Bagalur cross service road to know the existing conditions of a shoulder and it is compared with conventional shoulder. According to study did, the shoulder provided is of about 2m and it's completely grown by grass. The shoulder also got settled due to inadequate compaction and improper drainage system. When the heavy vehicles parked at shoulder region, due to more static load the top layers of shoulder under gone failure. This failure is because of inadequate compaction and improper maintenance of shoulder. The problem facing in this location is heavy commercial vehicles are parked for a while. This is leading for transferring heavy static load on the shoulder. But the serious issue is when the vehicle attains lower speed while parking and while taking vehicle out, the wheel loads making pavement edges more stress and failure of edge as being taking place. Since shoulder also acts as drainage path along the roadside, the slope of shoulder is not maintained due to that the water get stacked when rain comes, this results in losing of strength of shoulder. When water stacked at a same region it may enter to road pavement structure by base or sub base layers. This leads to make layers permeable and decreases stability of base, sub base and also sub-grade. Correspondingly when an vehicle moves on road, due to weak layers the road get settled and causes failure of structure like: potholes, rutting, cracking, stripping off etc. Also the edge failure of pavement occurred in higher value.

Fig-2: Unpaved and paved shoulder

Fig-3: Typical diagram of flexible pavement with earthen shoulder

Fig-4: various shoulder failures and causes at Bagaluru Cross

Conclusion

According to study did in a location chosen, the problem facing is heavy static load, improper drainage system, and mainly lack of maintenance of shoulder. To avoid the failure of shoulder the drainage system as to be cleared and a waste weed which is penetrating their roots to pavement structure as to be removed. If in case the soil is weaken then geo reinforcement or stabilization has to be done. Since it's a service road major highway and important highway where it is connecting airport, maintenance is essential and the earthen shoulders are unsuitable. So the paved or paving blocks may be used to provide a shoulder of higher efficiency.

References

[1]. Effective Shoulder Design and Maintenance: David J. White Associate Professor, Civil, Construction, and Environmental Engineering Iowa State University
[2]. MnROAD. Version 1 - June 2009:shoulder safety and maintenance
[3]. Highway Shoulder Maintenance and Gravelling: ministry of transport and infrastructure. British Columbia
[4]. Reasons for Highway Shoulders: Prepared by Michael Ronkin, Bicycle and Pedestrian Program Manager & Members of the Preliminary Design Unit Oregon Department of Transportation.
[5]. Study of causes of failures and remedies on road: North Maharashtra University