Gravel roads deterioration with absence of maintenance is one of the serious issues and common problems in the world. It’s majorly affected by deterioration which manifests as removing from gravel road materials with the major factors such as traffic volume and environmental conditions. Jimma zone might have been a standout amongst those ranges influenced toward the issue for gravel way absence of maintenance. In order to achieve the objectives of the study, the researcher was used questioner survey. To achieve this, first identified the road sections those having lack of maintenance on time existed in the study area. Then the representative road (Sarbo-Busa, Saka-Ushane and Buxure-Sanxama) and questioner surveys samples have been selected by non-probabilistic purposive and systematic sampling respectively. The questioner’s survey was focused on identifying the causes of absence of maintenance and pre-conditions considered. Questioner survey was analyzed by RII. The absence of maintenance was occurred due to lack of budget fund, poor management, lack of skilled manpower, lack of good material quality, lack of regular inspections, poor working environments. The pre-conditions considered while maintaining the gravel roads are: Cost of maintenance, class as the road, maintenance schedule, skilled manpower, topography, number of road users, traffic volume, and economic standards of the society and location of the road from the center. In Jimma zone the deteriorations of gravel roads has been increasing with the absence of maintenance time.

Keyword: Gravel Road, Deterioration, Maintenance Delays, Surface Materials

1. Introduction

Roads are a critical asset and should be properly maintained no matter their magnificence or function to decorate their sustainability and overall performance. Globally, gravel road comprises the more proportion of the period of public roads in rural areas in developing areas. It accounts for nearly sixty percent of the principal road network. Gravel road would vital parts furthermore incredulous of the way transportation. For huge numbers creating universal locations, additional over seventy-five percent of those way system comprises of gravel what's more world road Rajkamal et al. [2].

The total road network in the Ethiopia, gravel road shares 82% all road networks [3]. The total length of the road in Ethiopia has 56,100 kilometers of both gravel and asphalt road asset, ERA had 24,550 kilometers and the regional road authorities had 31,550 kilometers [3]. It accounts for nearly sixty percent of the principal road network. Gravel road would vital parts furthermore incredulous of the way transportation. For huge numbers creating universal locations, additional over seventy-five percent of those way system comprises of gravel what's more world road Rajkamal et al. [2].

Gravel is utilized for surfacing provincial road what's more settled on from regular aggregates [5]. It became no longer best carry traffic’s masses but also be proof against shear deformation and wear i.e. they have got enough class and sturdiness. The road deterioration manner begins immediately after starting to traffic. Because of the motion of site traffics and climatic adjustments over a period of time, the problems with gravel are numerous like gravel loss, safety chance, soreness and nuisance, air pollutants, and inaccessibility of roads at some point of rainy season [6].

Traffic volumes for diverse ecological part needed the elementary variables on upgrade gravel misfortune accuse.

Gravel passing rates from claiming roughly 25-30mm thickness a quite a while as stated by one hundred motors steady with day will be predicted, relying on precipitation and materials properties (mainly plasticity [7]. This procedure begins off advanced exceptionally gradually in place that it has the capacity with presently not a chance to be important, and about whether it quickens at snappier costs as postpone maintenance has been proceeded. Those assessment from claiming distresses thru this approach, contending that the impacts accepted didn’t outfitted with an exact estimation of the states of the whole way surface Rivera et al [8].

2. Materials and Methods

2.1 Study area

The study was conducted at Jimma zone, southwestern Ethiopia. Which is located 335km by road southwest of Addis Ababa. Its geographical coordinates are between 7° 13'- 8° 56N latitude and 35°49'-38°38'E longitude. The topographic features elevations vary from 1000m to 3360 above sea level. The town is found in an area of average altitude, of about 5400 ft. (1780 m) above sea level. It lies in the climatic zone locally known as woyinadega.[9]

The study was conducted on the three selected gravel roads (Sarbo-Busa, Saka-Ushane and Buxure-Sanxama) found in Jimma zone wereda. The general characteristics of those three selected road were discussed in the
For this study, questioner survey was the main method of
collecting data. The studies questionnaire contained twenty-three
questions related to gravel road maintenance conditions in Jimma
zone were provided for the respondents.

2.2 Sample size and selections
The objective of sampling turned into to provide a
practical approach of permitting the facts collection and
processing components of studies to be executed whilst
ensuring that the pattern affords a very good illustration of
the population this is the sample turned into representative
[11]. Due to the fact that whole facts approximately the
populace, sampling strategies has been used for this
research turned into non-probability purposive sampling &
systematic sampling. Non-probability purposive sampling has been used to select population of gravel road

2.3 Data collections
For this study, questioner survey was the main method of
data collection. The studies questionnaire contained
twenty-four questions related with the reasons and
absence of maintenance had been identified thru literature
review and dialogue with some events worried in Jimma
zone road authority. The questionnaire turned into
developed in order to compare the cause’s absence of
maintenance on the gravel road deteriorations

2.3.1 Sampling Procedures and Analysis
The researcher targeted on the road geometric standard
DC2 (collectors and feeder). In Ethiopia, the majority of
the road network is gravel road and in the targeted area.
According to Jimma zone road authority, the majority of
gravel road population was DC2. In this study, the gravel
road samples were taken from the road networks of
interest were identified by first gathering information’s
from zonal road authority and to identify best road
project. The gravel road samples were taken those
maintenance times already absented for one-year, two
years, & three years were selected.

2.4 Questioner surveys procedures
The sample required for questioner survey were fixed by
using systematic sampling. The most common form of
systematic sampling is an equal probability method where
every Kth case in the population frame is selected for
inclusion in the sample. Once the population frame is
randomized, the next step is to decide on the sampling
interval. The confidence level set in determining the
sample size is 95% confidence level of the target
population while the response is taken to be within
positive or negative 5% (+ or -5%) of the population. The
sample size for the population was calculated using the
formula below [12].

\[
\frac{\sigma^2}{n} = \frac{\chi^2}{(N-1) \times \sigma^2 \times p(1-p)}
\]

Where;
N – Size of the population
P – Sample proportion
n – Size of the sample
q – 1-P
\(e\) – Accepted error (\(e=0.05\), this is because estimate
should be within 5% of the true value)
\(Z\) – The value of the standard deviation at a given
confidence level.

2.5 Questioner survey analysis.
The questioner categorized into two main components.
The first one is the questions related to the pre-
considerations while maintaining the gravel roads
thirteen’s questions and the second one where focused on
the causes of absence of maintenance contains ten
questions. Totally twenty-three questions related to gravel
road maintenance conditions in Jimma zone were

Not Significant (N.S.) 0% absence contributing factors;
Slightly Significant (S.S.) <35% absence contributing factors;
Moderately Significant (M.S.) 35-60% absence contributing factors;
Very Significant (V.S.) 60-75% absence contributing factors;
Extremely Significant (E.S.)>75% absence contributing factors.
The collected data were analyzed through the statistical techniques and
indices. Following formula is used for calculating the RII
used to analyze the issue of the causes gravel road
absence of maintenance in study area.

Relative Importance Index (RII)

\[
\frac{\sum W}{A-N}
\]

\(W\) = Weighting given to each cause by respondent ranges
from 1 to 5 where ‘1’ is N.S. and ‘5’ is E.S., \(A\) = Highest
weight i.e. ‘5’ in this case, \(N\) = Total number of
respondents identified causes are classified into five
groups depending upon their RII. It is very difficult to
suggest the possible measures to each and every absence because lies in the questionnaire, so attempts are made to suggest the possible measures to those causes, which are E.S. and pertains maximum contribution as an absence maintenance factors.

3. Results and Discussions

3.1 Response Rate

Table 1: Questionnaires distributed and response rate.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Questionnaires Distributed</th>
<th>Questionnaires Returned</th>
<th>Response rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Percent (%)</td>
<td>Number</td>
<td>Percent (%)</td>
</tr>
<tr>
<td>1. Clients</td>
<td>21</td>
<td>18</td>
<td>54.54</td>
</tr>
<tr>
<td>2. Consultants</td>
<td>12</td>
<td>11</td>
<td>33.33</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>29</td>
<td>87.87</td>
</tr>
</tbody>
</table>

Fig 2: pre-conditions considerations whilst maintenance absence client prospective.

3.2 Pre-Conditions considerations whilst maintenance absence client prospective.

The respondent evaluations approximately the pre-attention for the duration of gravel avenue preservation have been explained & mentioned based totally at the Figure 2 have been available in the following paragraphs. In line with the results obtained from evaluation based RII, 75.6% of the respondents feel that the fee of gravel road may be determined as pre-conditions concerns whilst keeping the gravel avenue.73.3 % of the respondent feel that the quantity of road users can be apprehend because the pre-conditions even as preserving. 70% of respondent feel that financial widespread of the society can be determine as pre-situations preservation. 68.9% of respondents feel that selected materials used for any gravel road can be recognize the pre-situations maintenance.

3.3 Causes of the gravel road deteriorations with maintenance absence client prospective.

The effects of the respondents’ evaluations based at the questioner end result of the reasons of absence of maintenances at the gravel road deteriorations have been defined & discussed inside the Figure 3, the result suggests, 77.8% of the respondent feel that bad road maintenance control machine may be understood because the first and main causes of gravel avenue loss of maintenance. 76.7% of respondent feels that loss of price range fund needed for gravel avenue preservation may be discerned as the second one causes of gravel avenue loss of maintenance. 72.2% respondent feel that absence of skilled/professional manpower can be understood the reasons of gravel road loss of maintenances. 57.6% respondent feels that poor regular inspection may additionally determine because the reasons of gravel road absence of maintenance. 54.4 % of respondent’s experience that awful climatic situations may be understood as the reasons of gravel road absence of maintenance. 53.3% respondent experience that respondent feel that poor working environment in the organizations may understand as the causes of gravel road having absence of maintenance.

Fig 3: Causes of maintenance absence client prospective.

3.4 Pre-condition considerations whilst maintenance absence client prospective (Consultant prospective).

Respondent opinion on the pre-conditions consideration while maintaining the gravel road were explained in the following paragraph. According to that 89.1% respondent feels that class of the road may be discerned as the first pre-condition consideration during gravel road maintenance. 81.8% respondents feel that the cost of maintenances may understand as the second pre-condition consideration during gravel road maintenance. 80% respondents feel maintenance schedule may discern as the pre-condition consideration while gravel road maintenance. 74.5% respondent feel that selected materials haul distance may be understood as the pre-condition
consideration during gravel road maintenance. 72.7% of respondents feel that absence of skilled manpower may discern as the pre-condition consideration during gravel road maintenance.

Fig 4: Shows the pre-condition consideration while maintains consultant prospective.

3.5 Causes of absence of maintenance consultant prospective

Respondent’s opinion on the causes of absence of maintenance on the gravel road deteriorations were explained in the following paragraph. According to that 92.7% of respondents feel that absence of budget fund for gravel road maintenance system may be understood as the first & causes of gravel road absence of maintenance. 79.8% of respondent feel that poor management may discern as the causes of gravel road absence of maintenance. 78.2% of respondents feel that poor regular inspections may be understood as the causes of absence of maintenance. 76.1% respondents feel that poor sub-grade materials may be discerned as the causes of gravel road absence of maintenance. 69.1% respondents feel that poor regular inspections activity may be discerned as the causes of gravel road absence of maintenance. 65.5% respondents feel that absence of maintenance standard manuals may discern as the causes of gravel road absence of maintenance.

Table 2: Ranking causes of absence and gravel road maintenance pre-considerations. (Client & consultants prospective)

<table>
<thead>
<tr>
<th>No</th>
<th>Pre-conditions considerations while maintaining gravel road</th>
<th>Number of responded out of 11 consultants(RII value)</th>
<th>RANK</th>
<th>Average RII</th>
<th>RANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>lack of budget fund</td>
<td>0.838</td>
<td>3</td>
<td>0.784</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>budget management</td>
<td>0.730</td>
<td>6</td>
<td>0.818</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>maintenance manuals</td>
<td>0.751</td>
<td>5</td>
<td>0.916</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>absence of skilled manpower</td>
<td>0.749</td>
<td>4</td>
<td>0.756</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>lack of equipment</td>
<td>0.664</td>
<td>9</td>
<td>0.664</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>topography</td>
<td>0.658</td>
<td>7</td>
<td>0.646</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>poor working environment</td>
<td>0.636</td>
<td>10</td>
<td>0.563</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>poor regular inspections</td>
<td>0.622</td>
<td>12</td>
<td>0.636</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>poor awareness</td>
<td>0.585</td>
<td>13</td>
<td>0.585</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>economic standard of the society</td>
<td>0.589</td>
<td>5</td>
<td>0.589</td>
<td>10</td>
</tr>
</tbody>
</table>

3.6 Causes of absence of maintenance

The following discussions are based on the results obtained from the average RII. The respondent’s opinion on the causes of absence of maintenance in gravel road deteriorations was explained in the following paragraph. According to that 84.7% of respondent feel that lack of budget fund required for maintenance of gravel roads may discern as the first causes of gravel road absence of maintenance. 79.8% of respondent feel that poor management system in the organizations administered the road may discern as the second causes of gravel road absence of maintenance. 76.1% respondent feel that absence of skilled manpower the causes of gravel road maintenance. 72.2% of respondent feel that lack poor material quality may discern as the causes of gravel road absence of maintenance.
The clients and consultant opinion on the contribution towards the pre-conditions consideration while maintenance gravel based on the average RII values were detailed in the following paragraph. According to that, 78.7% of all respondents feel that cost of gravel road maintenance may discern as the first pre-conditions consideration. 78.4% of respondent feel that class of the gravel road standards may understand as the pre-conditions consideration. 75.6% of respondent feel that maintenance schedule may discern as the pre-conditions consideration while prioritizing gravel road maintenance. The final one was forty-eight point nine percent of the respondent feel that location of the road existed may discern as the pre-conditions consideration. Graphically both clients and consultants perspective were shown in Fig 7.

4. Conclusions

The major causes of gravel road with absence of maintenances has obtained from questioner responses, estimated from the average relative important index (RII) of respondents (clients and consultants) opinions, globally rural roads may make up over eighty percent of the road network length but are given lower priority in the allocation of funding because they carry much lower volumes of motorized traffic. Similarly, in this study area, eighty-four point seven percent of the respondent feel that absence of gravel road maintenance budget fund may be identified as the primary causes of the gravel road absence of maintenance’s.

For most developing and emerging economies, the road maintenance challenge is dominated by the poor road maintenance management system. Similarly, in Jimma zone poor management system was the main causes of gravel road absence of maintenance. Seventy-nine point eight percent of the respondent’s feel that poor management in the organizations may understand as the causes of absence of maintenance. Seventy-six point one percent of the respondent may understand that poor climatic conditions of the road required maintenances may make up over eighty percent of the road network length but are given lower priority in the allocation of funding because they carry much lower volumes of motorized traffic. Similarly, in this study area, eighty-four point seven percent of the respondent feel that absence of gravel road maintenance budget fund may be identified as the primary causes of the gravel road absence of maintenance’s.

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of the total respondent’s opinion, absence of government commitments towards gravel road maintenances may be discern as the causes of gravel road maintenances absences.

5. Acknowledgements
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References


