

DEVELOPMENT OF LOW COST ROAD BY USING ROUGHNESS MEASURING DEVICE AND AUTO LEVEL

N. KUMAR SWAMY
M.Tech
Dept of Civil Engineering
Avn Institute Of
Engineering And
Technology

**Mr. JAVEDALI M
JALEGAR**
M TECH Asst. Prof.
Dept of Civil Engineering
Avn Institute Of
Engineering And
Technology
jmjjaved@gmail.com

Dr. Md Subhan
HOD Dept of Civil
Engineering
AVN INSTITUTE OF
ENGINEERING AND
TECHNOLOGY

ABSTRACT

A standout amongst the most imperative measures of street condition is unpleasantness of street surface. For the most part there are two distinct sorts of instruments utilized for the estimation of street harshness in this report. Initial one is the Merlin. It is a machine which evaluates unpleasantness utilizing minimal effort instrumentation, used either for prompt estimation or for changing response sort instruments. Furthermore is the Auto-Level which is a robotized leveling optical instrument. Amid development site reviews for gathering, exchanging or setting flat levels and grade applications is ordinarily utilized. The estimation of harsh separation amongst instrument and grade staff is finished by the stadia reticle introduce in auto level. In this examination a minimal effort gadget has been indigenously created/created to quantify the unpleasantness of a street's surface. At long last, investigates ten street extends have been led utilizing three techniques including the created gadget. It has been watched that the general harshness parameters as far as International Roughness Index (IRI) in every one of the strategies are practically same.

The unpleasantness of a street's surface is an essential measure of street condition and a key factor in deciding vehicle working expenses on low quality surfaces. This report portrays a basic harshness measuring machine which has been composed particularly for use in creating nations. It is called MERLIN - a Machine for Evaluating Roughness utilizing minimal effort instrumentation. The gadget can be utilized either for coordinate estimation or for adjusting reaction sort instruments, for example, the vehicle-mounted knock integrator. It comprises of metal edge 1.8 meters in length with a wheel at the front, a foot at the back and a test mid-path between them which lays out and about surface. The test is joined to a moving arm, at the flip side of which is a pointer which moves over an outline. The machine is wheeled along the street and at normal interims the position of the pointer is recorded on the graph to develop a histogram. The width of this histogram

can be utilized to give a decent gauge of harshness as far as the International Roughness Index. Alignment of the gadget was completed utilizing PC reproductions of its operation on street profiles measured in the 1982 International Road Roughness Experiment. Merlins are being used in various creating nations.

Keywords: Roughness, Merlin, Auto- level, International Roughness Index (IRI), Pavement Car Index (PCI)

Chapter-1 Introduction

1.1 General-Unpleasantness is portrayed as the longitudinal unevenness of street surface. It is an awesome factor which measures street condition, vehicle working expense and ride quality. Presently a day there is a significance of concentrate on the impact on vehicle working expense. Number of investigations and studies have demonstrated that harshness has more prominent impact on vehicle profitability, running velocity, upkeep and tire harm and consequently vehicle efficiency.

1.2 OBJECTIVES OF THE EXAMINATION-The fundamental goal of this exploration venture is to survey and assess the precision, repeatability, reproducibility, cost and convenience of various instruments for building up the reference unpleasantness on chose adjustment locales. The merlin is the new instrument which has been produced is a variety of the static profile measuring gadget. It is a physically worked instrument which is wheeled along the

street and measures surface undulations at general interims. Readings are effectively taken and there is a graphical methodology for information investigation so street unpleasantness can be measured on a standard harshness scale without the requirement for complex figuring. An assortment of instruments will be chosen for undertaking the adjustment level reviews, each with shifting levels of exactness, accuracy and cost.

✚ Looking at the ascertained unpleasantness from each, to the acknowledged standard reference harshness instrument, will permit examination against a typical benchmark.

✚ Create ideas and particulars for a new minimal effort gadget and Design and develop the new item.

✚ At one chose site various runs will be embraced with each instrument by two separate administrators.

✚ The aftereffects of which, will be investigated to ascertain the mean, standard deviation and standard mistake.

✚ The examination will demonstrate which instruments indicate administrator reliance. Instruments that are more hard to utilize can progress toward becoming administrator dependant, bringing about between administrator comes about ending up less reproducible

✚ Concentrate the merlin street unpleasantness test and direct the merlin street harshness to get the outcome.

✚ The present test work is done to the research the advancement of ease street by utilizing the merlin cycle, auto level and new gadget of unpleasantness file (suggested)

✚ The period of time to study each site will be recorded, alongside any challenges in utilizing the instrument. The buy or development cost for each instrument will likewise be looked at.

✚ After the test set up was led at the intersection zones to know the street harshness esteems in IRI scale by utilizing two diverse sort of instruments. The

instruments are as per the following beneath.

- MERLIN CYCLE
- AUTO LEVEL

Chapter-2

Literature Review

Pooja.M (2015) Today street and transport experts around the world collectively spend substantial wholes of cash every year improving and keeping up their street systems. Street clients in the lion's share of nations around the globe keep on desiring better and smoother streets, in spite of weight on street specialists to additionally diminish consumption. This weight is achieved, in light of the fact that subsidizing for street foundation is just a single of the numerous needs going after Government reserves. Asphalts can't be figured out how to the degree wanted by chiefs, unless point by point precise data and investigation bolsters the framework. Street unpleasantness information is viewed as a standout amongst the most critical parts of street condition data utilized as a part of training in asphalt administration frameworks.

At display in the market, we have different unpleasantness measuring types of gear beginning from costliest hardware, for example, ARAN laser (which utilizes laser pillar to quantify the harshness) to tolerably exorbitant Bump integrator (which utilizes the knock checks made by the test wheel), to less expensive hardware, for example, MERLIN (which utilizes the incline estimation of the wheel to figure the harshness).

Stephen A. Arhin (2015) Various asphalt condition lists are gotten and used to lead asphalt administration evaluations two of which are the International Roughness Index (IRI) and Pavement Condition Index (PCI)). The IRI is normally acquired utilizing particular

gear which demonstrates the smoothness of the roadway section in view of built up PC calculations, while the PCI depends on subjective rating of the quantity of asphalts bothers. The writing recommends that a large portion of these asphalt lists are connected because of which a few wards have created models to foresee one record from the other. This examination utilized 2years of IRI-PCI informational collections to create models that foresee PCI by utilitarian order and by asphalt sort in the District of Columbia. The aftereffects of the enlightening insights, in view of the mean IRI and PCI esteems, recommend that parkways have a smoother ride than arterials, trailed by authorities and neighborhood streets. Thus, when the information was broke down by asphalt sort, the outcomes demonstrate that Composite Pavements were smoother than Asphalts Pavements took after by Concrete Pavement. The relapse demonstrate between the IRI and PCI by useful order and asphalt sort were resolved to be measurably noteworthy inside the wiggle room (5% level of hugeness), with R^2 esteems in the vicinity of 0.56 and 0.82. The consequences of the ANOVA tests additionally demonstrated measurably noteworthy F-insights ($p < 0.05$) notwithstanding factually critical relapse coefficients (from the t-tests, with $p < 0.05$). The remaining plots for every one of the models likewise demonstrated arbitrariness about the zero line demonstrating their reasonability, notwithstanding the typical likelihood plots indicating focuses almost a straight line.

Yuchuan Du, Chenglong Liu (2014) The IRI was produced in 1986 utilizing the aftereffects of the International Road Roughness Experiment performed in Brazil in 1982. Since the, IRI has turned into an all around perceived standard for the estimation of street harshness. The fundamental focal points of the IRI are

that it is steady after some time and transferable all through the world.

The IRI is a record characterized by applying the calculation proposed by Sayers to a deliberate acknowledgment of the longitudinal profile. The estimation of harshness is very troublesome and complex since it relies upon the vehicular attributes notwithstanding the genuine asphalt circumstance. Besides, the street harshness levels are promptly influenced by vehicle structures and driving velocity. Over the span of 50 years of advancement, specialists and researchers have developed a few strategies and techniques for measuring street harshness. The estimation gadgets can be partitioned into four general sorts' reaction sort street estimations, roundabout profile estimations, and subjective rating boards. Sort I gadget measure the asphalt unpleasantness by relating the RTRRMS estimations with the IRI figured from a profile, for instance, utilizing a knock integrator or NAASRA harshness meter. Sort II devices measures the street profile straightforwardly, which include measuring each wheel track independently, for instance, utilizing a 3-meter long bar or laser street surface analyzer (LRST). Sort III gadgets measure the longitudinal profiles over the wavelength scope of enthusiasm, for instance, utilizing a General Motors Research (GMR) profilometer. Sort IV gadgets assess the asphalt quality in view of appraisal direction and individual experience.

Thomas V Mathews (2001) The IRI was created in 1986 using the outcomes of the International Road Roughness Experiment performed in Brazil in 1982. Since the, IRI has transformed into an especially seen standard for the estimation of road repulsiveness. The guideline central purposes of the IRI are that it is enduring after some time and transferable all through the world.

The IRI is a rundown portrayed by

applying the figuring proposed by Sayers to a consider affirmation of the longitudinal profile. The estimation of repulsiveness is extremely troublesome and complex since it depends upon the vehicular traits despite the honest to goodness black-top situation. Additionally, the road disagreeableness levels are instantly impacted by vehicle structures and driving rate. Over the traverse of 50 years of headway, creators and analysts have made a couple of frameworks and systems for measuring road disagreeableness. The estimation contraptions can be confined into four general sorts' response sort road estimations, roundabout profile estimations, and subjective rating sheets. Sort I device measure the black-top brutality by partner the RTRRMS estimations with the IRI found out from a profile, for example, using a thump integrator or NAASRA obnoxiousness meter. Sort II contraptions measures the road profile particularly, which incorporate measuring each wheel track autonomously, for example, using a 3-meter long shaft or laser road surface analyzer (LRST). Sort III devices measure the longitudinal profiles over the wavelength extent of energy, for example, using a General Motors Research (GMR) profilometer. Sort IV devices survey the black-top quality in perspective of assessment heading and individual experience

Jia-Ruey Change (2009)In this paper, we test whether a self-sufficient robot can be utilized to quantify the International Roughness Index (IRI), a portrayal of asphalt ride quality as far as its longitudinal profile. An instant robot, the Pioneer P3-AT, was outfitted with odometers, a portable workstation phone, laser, and a SICK laser officer discoverer to independently play out the gathering of longitudinal profiles. ProVAL (Profile Viewing and AnaLysis) programming was utilized to register the IRI. The preparatory test was directed inside on an

amazingly smooth and uniform 50 m length of asphalt. The normal IRI (1.09 m/km) discovered utilizing the P3-AT is vigorously practically identical to that of the business ARRB strolling profilometer. This work is an underlying advance toward self-ruling automated asphalt examinations. We likewise talk about the future incorporation of inertial route frameworks and worldwide situating frameworks (INS and GPS) in conjunction with the P3-AT for useful asphalt investigations. Roger C.M. Dunn (2006) With the approach of key execution markers and execution determined support contracts (PSMC), both in New Zealand and abroad, the precision, repeatability and reproducibility of harshness information is going under expanded examination. Progression of the specialist co-op and their gear has demonstrated to help with getting repeatable outcomes. Be that as it may, in a few conditions an adjustment in the specialist co-op has prompt a critical change in the normal general system figures, which shows up to a great extent unconfirmed to the street controlling expert (RCA). Harshness is measured in arrange studies utilizing either profilometers or reaction sort street unpleasantness measuring frameworks (RTRRMS). Duty regarding adjustment of the hardware dwells with the specialist organization. Checks are frequently performed all through the length of the study to guarantee the vehicle remains inside acknowledged limits, particularly for RTRRMS. It is common to have the vehicle keep running over a similar segment of street to contrast the outcomes and those acquired from past runs. This gives the street controlling expert with some confirmation of information repeatability, yet does not give affirmation that the machine was effectively aligned regardless. For alignment it is important to acquire a reference unpleasantness.

Chapter-3 Methodology-MERLIN cycle

The gadget is called MERLIN-Machine for Evaluating Roughness using Low-cost Instrumentation. In the widespread way unpleasantness investigate this instrument was delineated on the commence of a workstation amusement of its operation on longitudinal way profile. The going with figure exhibits the Merlin instrument. For basic operation, there is a wheel as the front leg and back leg is comprised of firm metal shaft. Shorter settling leg is accessible at one side of back leg that associates in shielding the gadget from falling over all through taking scrutinizing. There are two handles expecting behind the essential back leg that gives the gadget look like a long and thin wheel cart. A pointer is added at the other side of the arm, which goes before forward the masterminded data graph. The arm is outfitted with mechanical upgrade of tens that causes age of advancement of the pointer of one centimeter when the test moves by one millimeter. The outline holds game plan of fragments, being 5 mm in width, and isolated into boxes. In case the traverse of the wheel is non-uniform, at that point it will provoke an assortment in the length of the front leg beginning with one estimation then onto the following and expediting error in the Merlin's outcomes. An engraving is given on the edge of the wheel to avoid this mistake and every one of the estimations are carried with the engraving at its nearest region with the road profile. Then the wheel is in its conventional position.



Figure 3.1 The MERLIN cycle.

3.2 Principle of Operation.

Merlin is a gadget with a test and two feet which lays at first glance with course of wheel track whose unpleasantness by this gadget is to be measured. This gadget is at 1.8 meters isolated and the test lies at the mid-way between two feet. At the contact of street surface and the two feet this instrument measures the vertical migration between the way surface and the point of convergence. The deliberate vertical movement is called as the mid-concordance deviation.

The position of the pointer on the outline consequently gives a precise sign of the position of the test as for nonexistent lines, which joins the base of the haggler foot. In the event that the position of the pointer is noted at various places along a street, at that point the rougher the street, the more noteworthy the spread of readings. It has been demonstrated that the spread connects well with street unpleasantness as measured on standard harshness scales. To choose this device

- ✚ Easy to operate
- ✚ Easy to calibrate the instrument
- ✚ Robusting
- ✚ Easily maintained and handling
- ✚ No complex for calculations
- ✚ Measure displacement less than a millimeters ($<1.0\text{ mm}$)

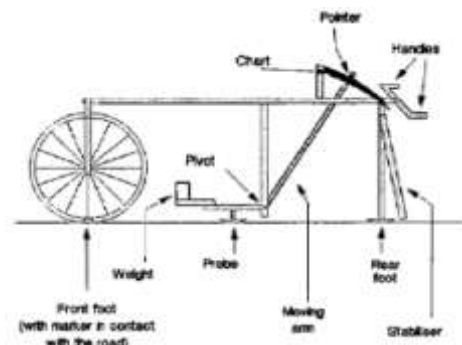


Figure 3.2 Described parts of MERLIN cycle

3.3 Methodology

For assurance of harshness of street surface profile, 200 estimations at steady between times is to taken. The machine is arranged with the wheels on its common area and the back foot stabilizer test in contact with the black-top surface at every one measuring point. By then the chronicle the position of the arm pointer on the diagram with a cross in reasonable area is done by the head. For keeping the record of total number of readings, cross in the check box of outline is given.

For the further arrangement of estimations the Merlin's handles are lifted up so quite recently the wheel keeps in contact with the way surface and the machine is come in forward heading at a similar strategy is reiterated. For whatever length of time that the wheel is in the run of the mill position the separating between the measuring centers does not have any kind of effect. By taking the estimations at standard intervals, will help in changing both extraordinary typical examples over the whole length of the zone and decline the peril of slant as a result of the penchant of manager to avoid horrendous ranges of the road.

The outline is expelled from the merlin after 200 perceptions. Mid way between the eleventh and the tenth checking from every one end of the outline underneath the segments as given in the specimen much of the time it might be essential to embed between portion limits. "D" is the separating between the two engravings is measured in millimeters and it's portrayed as the harshness on the merlin scale.

3.4 Practical Details

The essential leg, the central, the stabilizer, the moving arm and the handles are altogether made of steel tubing of square cross portion of 25 x 25 mm with 1.5 mm divider thickness for straightforward collecting strategy. The

stabilizer handles are settled by jars with the objective that they could be emptied for less complex transportation yet the joints are welded where possible. Additional struts are used for fortifying the joints between the standard column and legs. The wheel mounted in the combine of front forks may be any kind of bicycle haggler a tire having sensibly smooth tread plan.

The back foot and the test foot are 12 mm wide and balanced in the way of the wheel track to a length of 100 mm for diminishing the affectability way surface smaller scale creation. This altering associate for keeping the reason for contact of test with route surface with a similar vertical plane. To avoid setting up on unpalatable avenues the weight is ventured and the turn is made out of the bicycle wheel focus and the arm between the turns.

The layout holder is prepared from metal sheet and is twisted in such a course, to the point that the chart is addressed with the pointer over its keep running of improvement. An assistant is adjusted to the side of the rule bar holding the arm close to the column for guaranteeing the arm from undesirable sideways advancement. Right when the machine is raised by its handle one end of this associate exhibitions as a stop.

The association of the test with moving arm is done by a hung post going through a delayed hole that permits both parallel and vertical change. The position of the test which is vertical is arranged to the point that the pointer is close to the focal point of the framework when the histogram won't be central or the test dislodging is zero. At the point the machine is tilted side to side the pointer moves, if the above strategy isn't truly done. After right change of 15 readings the machine is hung to the other side with the goal that the stabilizer rests out on the town has little effect on the position of the

pointer. The upgrade of the arm should be checked by the help of a little arrangements bit of 6 mm thickness before using the machine.

The pointer should move by 60 mm after the inclusion of piece under the test. On the off chance that the pointer is moved by 57 mm, at that point the estimation of D demonstrated on the chart is extended by the segment of 60/57. A take a gander at is passed on earlier and after that a short time later every one arrangement of estimations for ensuring that there has been no undesirable improvement of fundamental parts like back foot. This is finished by outfitting a relative payback to an accurately portrayed position en route and checking that the pointer scrutinizing isn't changed. All through endeavor a disagreeable road, more than 10 readings are at limit of the histogram. The test should be emptied and associated with the given choice settling centers. The above illuminated one makes the point twice from the turn and decreases the mechanical heightening to 5. The scaling of diagram is completed by the earlier portrayed alteration system. The disappointments are to be exhibited are pretty much nothing and could be ignored for this circumstance in spite of the fact that the scattering between the test and the two feet of the gadget is not any more 0.9meters.

3.5 Calibration Equations

The IRI scale and the Merlin scales are related by the following equations for all types of pavements surfaces.

$$IRI = 0.593 + 0.047D$$

$$42 > D > 312 \quad (2.4 > IRI > 15.9)$$

Since

IRI= International Roughness Index

D= Roughness in Merlin scale Measured in mm

Here Graph values below showing the relationship between IRI and D, where as

IRI in terms of mm/km and D in terms of Merlin mm.

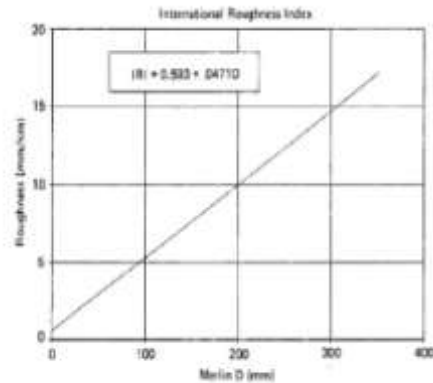


Figure 3.3 Graph showing Merlin Vs Roughness

Chapter-4-Methodology-Auto level

Principle of leveling

Tallness reference is given by the Auto level which is an optical instrument. "Tallness of Collimation" is characterized as this stature reference which through the hub of the telescope at the level plane. The stature of different stations can be found in the wake of knowing the tallness of collimation or instrument stature by measuring the plane with the assistance of a staff.

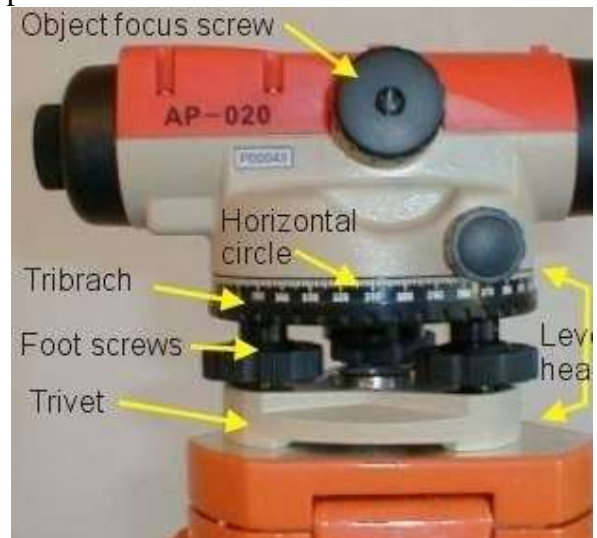


Figure 4.1 Auto level and their components

The tallness of collimation can be

acquired by taking the back sight to a staff set on a seat check and by adding the staff perusing to the seat stamp esteem.

here are three primary parts in leveling head: A Tribrach or best plate that conveys the soul level and the instrument out, screws and three leveling rivet or a foot plate that is connected with tripod head.

Attaching the instrument to the tripod:

The instrument can be centered by the tripod screw which is captive and rested on the movable bracket. To take tripod screw the device base plate or the trivet stage is threaded.

3. Longitudinal distance measured with tape or chain

Although rod and level equipment is familiar to most engineers, the requirements for acquiring a profile measure that is substantial for processing unpleasantness are very different than for laying out a street. You should take rise measures at close intervals of a foot or less. The individual height measures must be accurate to 0.5mm (0.02 in) or less. These prerequisites are substantially more stringent than is typical for reviewing. Be that as it may, the total stature of the instrument isn't of intrigue when measuring profile for roughness, even though it is normally a matter of great concern when utilizing pole and level for other applications

Altering the leveling head:

The air pocket tube ought to be aligned to the point that it will be parallel to two foot screws. The two foot tightens ought to be pivoted inverse heading with confronting the gadget, Either thumbs moving inwards or thumbs moving outwards toward left thumb the air pocket moves. The gadget is leveled on the pivot just when the air pocket is settled at the correct focus. The air pocket is lined up as for the third leveling screw by the revolution of the

telescope by 90°. When the air pocket is at focus the auto level is said to be level, checking should be possible through 90° of pivot. Releveling of two screws and rehashing the revolution should be possible for essential checking. The two arrangements of alterations before leveling of the gadget and the air pocket staying in the focal point of tube because of the revolution of the telescope may need to be done. Tripod's every leg can be effectively customizable with the length. By the assistance of lever clasp the legs are to be bolted (left) or screw (right). It is imperative to check the locking of lever or the screw is tight or not after the legs is set to the right length. The gadget is to be set up again and all perceptions are to be taken again if the instrument tallness is changed because of the development of legs amid utilize. The tripod is to be determined to the position and for inclining zone two legs are to be on downhill side. By the difference in length of every leg fine changes can be effectively achievable. Continuously there ought to be surety to have the clip or bolting screw to be tight after the review is done. To keep the instrument at a correct point over the study station the plumb pole is required.

4.3 Methodology

Itemized planning and activity control at test locales must be composed by the RSC. In any case, all movement control exercises at test destinations will be performed by work force from either the State or commonplace thruway organization. Design of the test site ought not be attempted until the point when all pertinent movement control gadgets are set up.

4.4 Equipment Requirements

The pole and level utilized as a part of routine looking over and street development will for the most part not have the determination required for asphalt profile estimations

International Roughness Index Range (m/Km)	Resolution (mm)
0 = IRI < 0.5	0.125
0.5 = IRI < 1.0	0.25
1.0 = IRI < 3.0	0.50
3.0 = IRI < 5.0	1.0
5.0 = IRI < 7.0	1.5
IRI = 7.0	2.0

Table 4.1 Resolution requirements for rod and level measurements.

Accuracy leveling instruments are required for asphalt profile estimations. Instruments utilized for profile estimation ought to fulfill determination paradigm given in underneath table, which was acquired from the ASTM Standard on Measuring Road Roughness by Static Level.

The pole utilized ought to be outfitted with an air pocket level so it can be precisely held vertically. A reasonable base might be chosen for the pole so as to diminish affectability to little varieties in pole situation. For smooth finished asphalts, any sort of base is appropriate. For finished surfaces, a roundabout cushion with a width of no less than 20 mm is recommended.(14) As just relative rises are required for processing harshness records, no rectification is required if a cushion is appended to the base of a pole.

4.5 Longitudinal Profile Measurements.

The principal perusing taken after the level is set up is alluded to as a backsight, while the last perusing taken at that setup before the level is moved is alluded to as a prescience. Different readings taken in the middle of a backsight and a prescience are alluded to as transitional sights. The technique to be taken after for measuring

longitudinal profile is as per the following:

Chapter 5-Study Area

5.1 General:

Experimental Setup: The trial setup was led at intersection zones. The setup was led at AP RESIDENTIAL GIRLS secondary school grounds on inner streets situated at Vijayawada hydetrabad national Highway of NH 65. By and large the grounds inward comprises of 3.2mts wide with two side trail and furthermore having a saucer seepage framework. We can watch that for each 0.500mts length of street, we can see an elastic mound for speed controlling and rash vehicle driving. The total college having all streets of adaptable streets.

For clear vision I was taken a few photos in grounds inward streets, a portion of the couple of streets taken consider to the Roughness Index Experiment by means of MERLIN Cycle.

1. Govt mortuary road (back line)
2. Auditorium road to Hostel (Front line)
3. Registrar office road
4. Over head tank road
5. Post office road



Figure 5.1 AP RESIDENTIAL girls high school road to GOVT MORTUARY road (photo Source: Google image)



Figure 5.2 AP RESIDENTIAL JUNIOR GIRLS HIGH SCHOOL Internal Roads
(Source: Google Image)



Figure 5.3 Girls SCHOOL road.

The above figure saying that the road having gradient of an average 0.001mm with having of side footpath, rubber bump for speed control and two sides of saucer drainage

Chapter 6 Data Collection and Analysis

6.1 General This report gives the street harshness esteem in IRI scale by utilizing two various types of instruments. The arrangements of instruments are as per the following underneath.

- MERLIN cycle
- Auto Level

By the utilization of merlin and auto level led 10 interior streets exploratory test at within AP RESIDENTIAL GIRLS grounds inner streets. Unpleasantness test on 5 streets for Merlin cycle and another 5

streets on Auto level were led for the examination between the instruments upon the premise of the harshness esteem as far as IRI

The arrangements of the streets amid tests are recorded underneath. Govt funeral home street (back line) Auditorium street to Hostel (Front line) Registrar office street Over head tank street Post office street

The Roughness of every street, was measured utilizing each of instruments. One of five unique site reviewed, three were lost because of support or recovery work over the span of research. the IRI acquired over the extents.

Examination of Roughness file of a Flexible asphalt utilizing Low cost instrument.

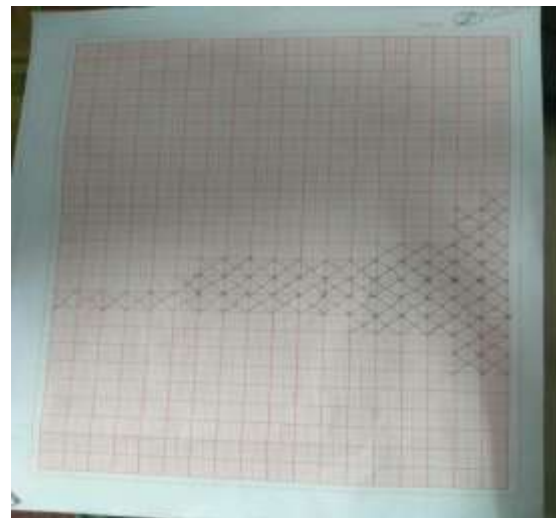


Figure 6.1 Graph 1
(govtmortuaryroad to girls Hostel)

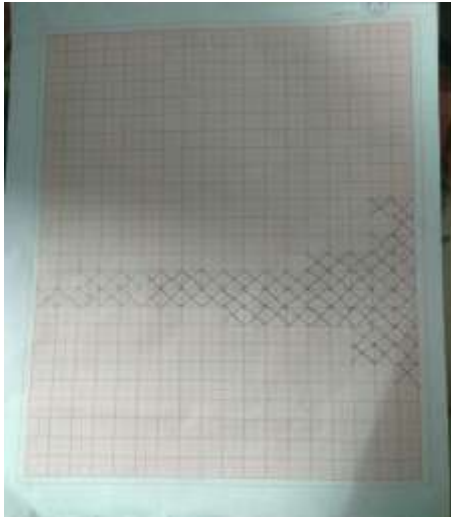


Figure 6.2 Graph 2 (registrar road to Girls Hostel)

6.2 Analysis

From the above graph we can understand the following calculation and analysis part

For Road No 5

The value of D = 16 Divisions
= 16x5mm
= 80mm

Where:

[D = Roughness on merlin scale]
[1 Division = 5mm]
[42 < D < 312]

Calculation of International Road Index (IRI)

$$\begin{aligned} \text{IRI} &= 0.593 + 0.0471D \\ &= 0.593 + 0.0471 \times 80 \\ &= 0.593 + 3.768 \\ &= \mathbf{4.361 \text{ m/Km}} \end{aligned}$$

[2.4 < IRI < 15.9]

For Road No 4

The value of D = 17 Divisions
= 17x5mm
= 85mm

Where:

[D = Roughness on merlin scale]
[1 Division = 5mm]

[42 < D < 312]

Calculation of International Road Index (IRI)

$$\begin{aligned} \text{IRI} &= 0.593 + 0.0471D \\ &= 0.593 + 0.0471 \times 85 \\ &= 0.593 + 3.995 \\ &= \mathbf{4.588 \text{ m/Km}} \end{aligned}$$

[2.4 < IRI < 15.9]

For Road No 3

The value of D = 19 Divisions
= 19x5mm
= 95mm

Where:

[D = Roughness on merlin scale]
[1 Division = 5mm]
[42 < D < 312]

Calculation of International Road Index (IRI)

$$\begin{aligned} \text{IRI} &= 0.593 + 0.0471D \\ &= 0.593 + 0.0471 \times 95 \\ &= 0.593 + 4.4745 \\ &= \mathbf{5.067 \text{ m/Km}} \end{aligned}$$

[2.4 < IRI < 15.9]

For Road No 2

The value of D = 15 Divisions
= 15x5mm
= 75mm

Where:

[D = Roughness on merlin scale]
[1 Division = 5mm]
[42 < D < 312]

Calculation of International Road Index (IRI)

$$\begin{aligned} \text{IRI} &= 0.593 + 0.0471D \\ &= 0.593 + 0.0471 \times 75 \\ &= 0.593 + 3.5325 \\ &= \mathbf{4.125 \text{ m/Km}} \end{aligned}$$

[2.4 < IRI < 15.9]

For Road No 1

The value of D = 16 Divisions
= 16x5mm
= 80mm

Where:

[D = Roughness on merlin scale]

[1 Division = 5mm]
[42 < D < 312]

Calculation of International Road Index (IRI)

$$\begin{aligned} \text{IRI} &= 0.593 + 0.0471D \\ &= 0.593 + 0.0471 \times 80 \\ &= 0.593 + 3.768 \\ &= \mathbf{4.361 \text{ m/Km}} \end{aligned}$$




[2.4 < IRI < 15.9]

Average IRI value for all experimental roads was = **4.502 m/Km**

The various comparative perusing was taken inside the interior streets of JNTU grounds. After the figuring of the unpleasantness of the diverse areas of streets by two distinct instruments the esteem if harshness as far as IRI was contrasted and the Merlin's unpleasantness perusing. After the examination with the merlin instrument the mistake % ascertained is less and in this way the instrument can be likewise utilized for the computation of streets surface unpleasantness. Merlin and auto level are the two instruments which are now accessible in the market. Be that as it may, new gadget is an indigenously created/created gadget which can be utilized for the estimation of streets surface unpleasantness.

Chapter 7 Results

7.1 General-This report gives the road roughness value in IRI scale by using three different kinds of instruments. The lists of instruments are as follows.






-  The MERLIN
-  Auto level
-  New Device (recommended)

By the use of Merlin and recommended new device 5 roads inside AP RESIDENTIAL GIRLS campus for both instruments were conducted for the

comparison between the instruments upon the basis of the roughness value in terms of IRI.

7.2 Results for Experimental Area

The list of roads used during experiments are listed below

-  Road No.1 Auditorium Road to Girls Hostel (Back Line Road)
-  Road No.2 Registrar Road to Girls Hostel Road (Front Line Road)
-  Road No. 3 govt mortuary Road to Mechanical Department Road
-  Road No.4 SBI Bank Road to registrar Road
-  Road No.5 girls Hostel Road to over-head tank Road

- The consequences of a couple of IRI esteems for asphalts which was taken default esteems
- Recently cleared surface regularly run from around 1.5-3.0 IRI m/Km
- More established cleared surfaces differs from ranges around 2.5 - 5.5 IRI m/Km
- Harmed Pavements are high as 11 IRI m/Km
- In the wake of directing test I got a normal IRI esteems was = 4.502 m/Km. All the asphalt surfaces are more established surfaces as chose that taken from standard esteems.

Chapter 8 Conclusion and Future Scope

8.1 Conclusion

Merlin and auto levels are regularly thought to be straightforward gadgets for estimation of street unpleasantness. An endeavor has been made in this investigation to plan and build up another gadget. Tests have been completed utilizing this gadget and in the meantime utilizing other two sorts of hardware's on a similar street extends. The aftereffects of the trials on street unpleasantness regarding IRI utilizing

these three gadgets have been thought about among the three techniques considered. It is watched that auto level has an error% of 3.95% when contrasted and the IRI esteems acquired from merlin. All the three instruments have its one of a kind significance in the count of the street roughness. The whole trial depends on use of ease hardware, for example, Merlin Cycle to discover the ideal outcomes for the harshness of the street. Thus after the got values normal IRI was 4.502 m/Km, and consequently it required bitumen coat for every single trial street and furthermore for different streets which was not canvassed in this postulation for JNTU grounds inside streets.

8.3 Future Scope

It is proposed that the following works using this new device can be taken up in future.

✚ A good number of experiments using these three experiments are to be conducted and the results to be statistically reviewed and compared.

✚ The same stretches should be tested for roughness by using other roughness measuring methods such as bump integrator and RTRRM in order to establish the validity of this new setup.

✚ The device is to be further modified to suit various roughness conditions.

Comparison of IRI and Auto level values

22.04.17	Surface of structure: Bitumen surface	High school roads	
Test No/ Road No	Road Section Type	IRI (m/Km)	
		Merlin	Auto Level
1	Auditorium Road	4.361	4.167
2	Auditorium Road to Girls Hostel	4.125	4.019
3	Administrative Block	5.067	4.800
4	Registrar road to girls hostel	4.596	4.380
5	Girls school road	4.361	4.240