International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 1103-1108 www.ijaem.net ISSN: 2395-5252

Intelligent Speed Adaptation on Highway Curves: Its Limitations and Proposals

Patan Azmatullah Khan
Assistant Professor RGM CET, SCE ,Nerwada X roads ,Nandyal ,

Submitted: 01-08-2021 Revised: 14-08-2021 Accepted: 17-08-2021

ABSTRACT:
Intelligent Speed adaptation system is widely used in foreign countries to reduce the speed of the vehicle even without the consent of the driver of the vehicle just to safely maneuver the journey on highways especially on the curves .speeding is the biggest factor for fatal accidents on highways and it becomes more dangerous on curves with high speeds because the effect of centrifugal force is more on the curves. The only two saviors for the vehicle not to overturn or skid on highway curves is the friction factor of 0.15 and the super elevation provided according to the requirement. when we are continuously requesting the driver of the vehicle not to speed more than the restricted speed which are provided as sign boards just before the start of the curves , the dynamic young drivers often overlook the speed limit signboards leading to the fatal accidents on highways and expressways .Intelligent speed adaptation is a system wherein we use the GPS and posted speed limit sign board information to know the exact location of the vehicle and to get the information of the speed limits and thereby reducing the speed according to the requirements .In this paper an exercise has been done to overcome the drawbacks of ISA ie when the vehicle negotiates a curve inside a tunnel , the entire system of ISA does not respond because of poor GPS signals inside the tunnels .Though beacons have been used to improve the signal strength but they were of not of so much significance .Here a system is proposed where almost both the tools of ISA are not required .Before starting the journey if we can clearly know at what chainage the sharp curves are coming and their radii are known before hand then we can easily calculate the restricted speed with which the curve has to be negotiated then we can easily slow down the vehicles using sensors installed in odometer of the vehicle i.e. when a vehicle approaches a particular chainage say 78.30 kms starting from 0.00 kms then at that chainage using sensors installed in odometer of the vehicle will initiates ISA system there by slowing down the vehicle to a safe restricted speed and driver can override the system wheneverrequired.

I. INTRODUCTION:

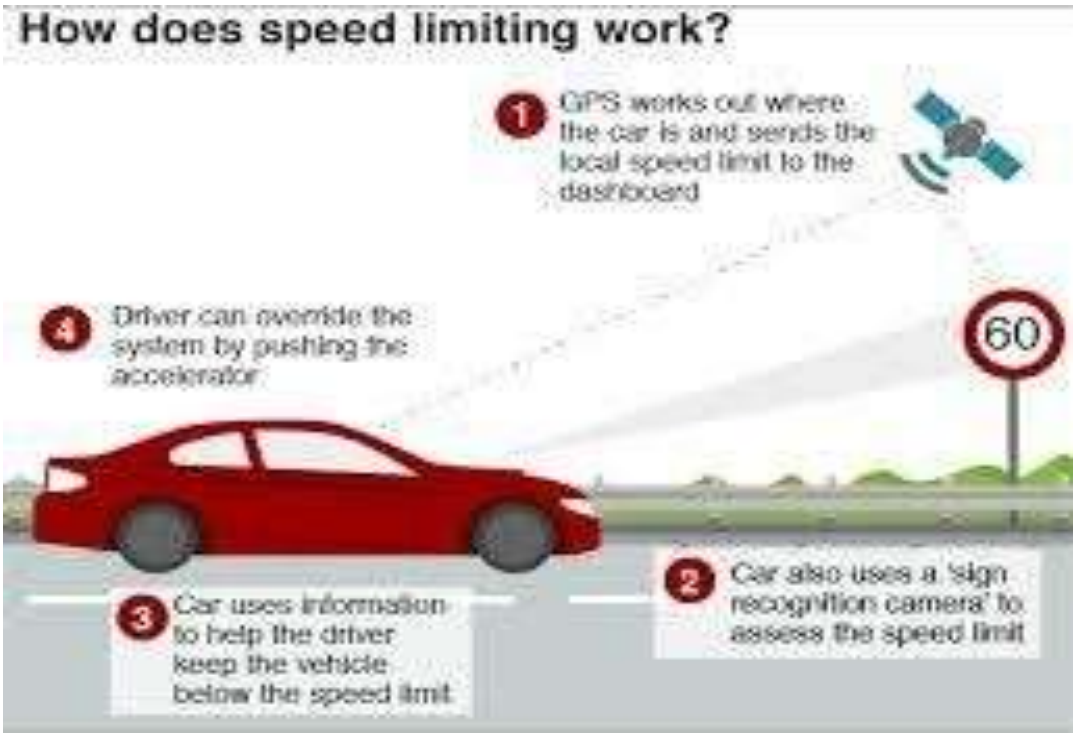
By adapting the ISA system the result is an estimated reduction in road casualties of 25 to 30 %. et al 1.Many developing countries are investing crores of rupees to reduce the road accidents and that too mainly caused by over speeding .Intelligent speed adaptation system has been successfully introduced in countries like Netherlands, France ,Belgium and many other developing countries . Recent statistics reveal that 311,714 accidents do happen in the entire world as road accidents are causes of deaths for 50-69 years old in the entire world in the year 2017.Basic requirement starts from the fact that so and so many road accidents are occurring worldwide every year and many countries are taking lot of measures to reduce these fatalities . Intelligent speed adaptation is one such measure when the young drivers pose a question : who are u to control the speed of my vehicle?.Inspite of many alarming systems and measures to control the speed of the vehicle to reduce fatal accidents and the drivers are continuously neglecting the speed factor , then there arises the need to control the vehicle instead of humans.Here in intelligent speed adaptation system the speed of the vehicle is reduced either by jamming the accelerator or by reducing the fuel supply of the vehicle and hence automatically the speed of the vehicle is reduced .Not only in highways this speed reduction can be successfully adapted in school zones , traffic zones of low speed , central business district (CBD) and much more.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 1103-1108 www.ijaem.net ISSN: 2395-5252

II. ACTIVE & PASSIVE MODES OF INTELLIGENT SPEED ADAPTATIONSYSTEM.

As of now there are two systems of ISA prevalent ie1.Active ISA system and 2.passive ISA system. In passive ISA system , whenever the vehicle exceeds the required speed limit the driver of the vehicle is warned by a beep sound or an alarming system and the driver becomes alert and reduces his speed of the vehicle by applying brakes or decelerating gradually and the other system is passive ISA system where even if the driver overlooks the alarm sounds and beeps then the ISA system itself intervenes into the speed control system and reduces the speed of the vehicle either by jamming the accelerator or by reducing fuel supply as a result of which the speed of the vehicle is reduced gradually. In four stroke internal combustion engines if we can reduce the enriched mixture of air and fuel into the cylinder where the fuel is compressed and power stroke is generated , automatically lesser the fuel ,lesser the energy produced and ultimately lesser will be the work done ie less speed of thevehicle.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 1103-1108 www.ijaem.net ISSN: 2395-5252



III. REQUIREMENTS OF INTELLIGENT SPEED ADAPTATIONSYSTEM.

The two basic requirements of ISA are the GPS (Global positioning system) and the PSL (posted speed limits) of the concerned area so that the exact location of the vehicle can be tracked by GPS to an accuracy of 2-5 cms using highly sophisticated GPS instruments and a better knowledge of local speed limits which are posted as restricted speed limits on sign boards and yet these restricted speed sign boards are frequently neglected by the young drivers on highway curves unaware of the fact : ``speed thrills but it kills ``and are becoming prey to fatalities. Over speeding is one of the major cause for all the highway fatalities. When we are requesting the human factor to reduce the speed of the vehicle and when the driver overlooks this concern , then the only option left over is to control the mechanical system of the vehicle ie to control the speed either by jamming the accelerator or by reducing the fuel supply even without the concern of the driverhimself.

Previous investigations and results reveal that raised pedestrian islands, speed humps and traffic islands kept in staggered manner have proven to be some of the best traffic calming measures deployed especially in urban environment of the central business district (CBD) areas. Some of the images are uploaded for reference as follows.

On rural road limits ,especially in school zones, speed limit road markings, chevron road markings which are attached to the road as rumble strips and restricted speed limit sign boards will serve the purpose of reducing the speed of the vehicle to some extent but it will not cater the needs to the fullest. The main idea of rumble strips is to alert the sleepy long haul truck drivers by

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 1103-1108 www.ijaem.net ISSN: 2395-5252

vibration sound of tires ofvehicle.

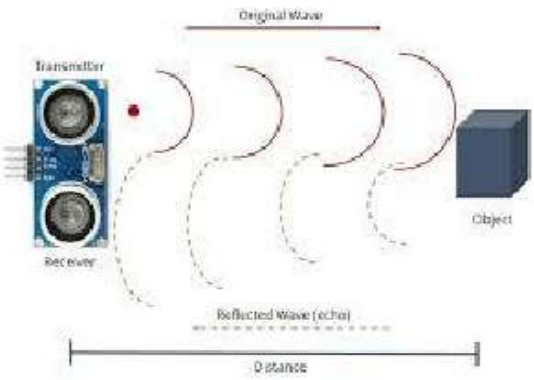
IV. DRAWBACKS OF INTELLIGENT SPEED ADAPTATION.

Terrain is defined as the cross slope of the country and the various values ranging from 0-65 %Classified as plain, rolling ,mountainous and steep terrain and where tunnels are mandatory to be driven to provide a passage in mountains , this ISA system cannot work in tunnels as it lacks signals from the GPS servers and if there is a curve in a tunnel then the problem increases manifolds . Yassine[2] et al states that Curve detection is of vital importance since the crash rate is at least 1.5-times higher than in tangent (straight) segments.

V. AUTHOR CONTRIBUTIONS.

As a suggestive measure I am proposing a theory as follows :

If we can measure the radius of the curve/s well before hand either by Total station or by plane table survey and we have the knowledge of the radii of the road well before the start of the journey and if we can embed some sensors in the digital odometer of the vehicle and if we can measure distance of the start of the various radii say at x , y , z chainages these two componentsie odometer and the knowledge of radii of the road will easily interchange with GPS and posted speed limits of the road. We start at 0.00 km and a sensor will be embedded into the odometer of the vehicle which will automatically initiate or triggers the intelligent speed adaptation system once it reaches the chainage i.e. the start of the curve and we can calculate the restricted speed limit of that particular local road stretch using the super elevation formula we can reduce the high speed of the vehicle to a safe restricted speed and thus after negotiating the curve safely on the curves using sensors ,restricted speed and intelligent speed adaptation the driver can over ride the system by hardly pressing the pedal of the accelerator. And another proposal is the sensors are installed in the speed limit sign boards indicating the restricted speed limits as explained that every sign board will have a sensor which will transmit signals and every vehicle will be attached with a receiver and when the vehicle comes in the proximity of the sign board it will trigger the intelligent speed adaptation system thus slowing down the vehicle to a safe speed.



International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 1103-1108 www.ijaem.net ISSN: 2395-5252

VI. MATH FORMULAE :

$E + f = V^2 / 127 R$

E is the rate of super elevation and the maximum value is 0.07 ie 7% F is the coefficient of lateral friction and its maximum value is 0.15 V is the restricted speed of vehicle and to be calculated based on radii

R is the radius of curve to be negotiated, which is known before hand and after simplifications,

$$V=5.285*\sqrt{R}$$

1. TABLES AND CALCULATIONS:

VALUE OF `e`	VALUE OF `f`	RADIUS OF CURVES, MTS	RESTRICTED SPEED, KMPH	ROUNDOFF SPEED LIMIT
0.07	0.15	100	52.85	55
0.07	0.15	200	74.75	75
0.07	0.15	300	91.53	90
0.07	0.15	400	105.7	110
0.07	0.15	500	118.16	120

VII. CASE STUDY:

A study area of N H 44 was considered for evaluation from RGM CET (Autonomous)Nandyal to Kurnool a 80 km stretch and three locations were considered for study ., orvakal, Somayajulapalli and Panyam market yard and at all the three stretches the radii of the curves were found to be more than 400 mts thereby concluding that we can travel safely with a speed of 100 KMPH and more . If the radius of the curve is more than 400 mts the vehicle can safely negotiate the curve with a speed limit of 110 KMPH and if the radius of the curve is 500 mts then we can easily traverse that curve with higher speed limit ie with 100 KMPH.

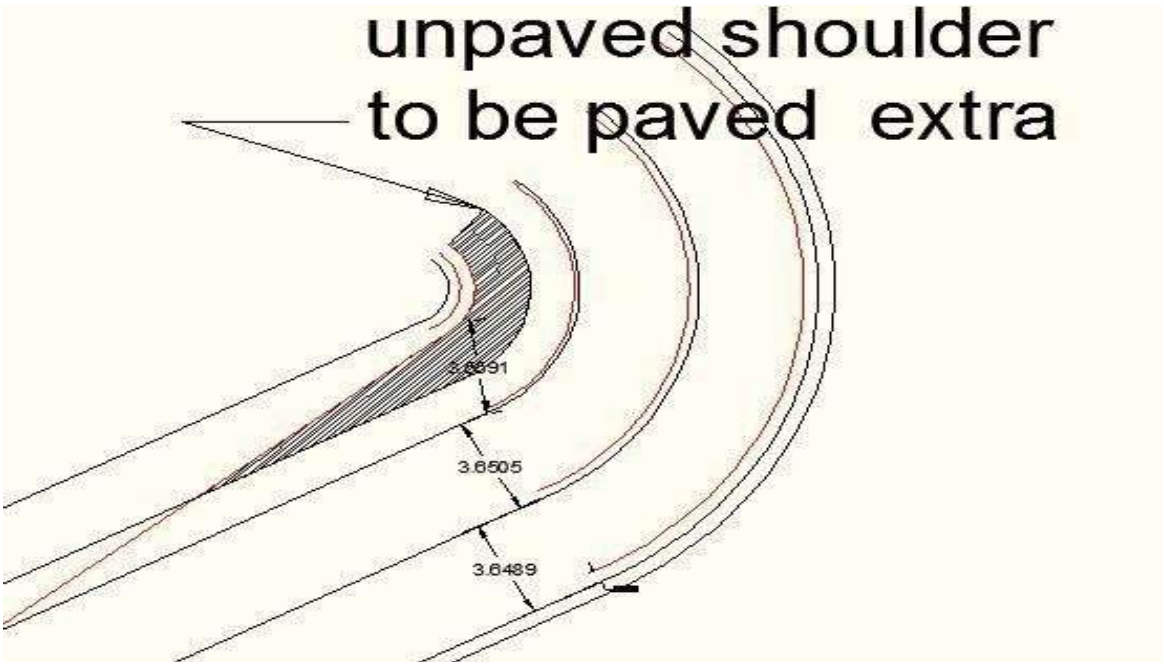
VIII. CONCLUSIONS :

The two drawbacks of Intelligent Speed adaptation system ie the requirement of GPS signals and Posted speed limit data has been successfully replaced by the introduction of a sensor in the odometer and calculation of the restricted speed with the simplified form of super elevation equation. Thus the weak signals issue of GPS in tunnels and other areas can be fulfilled with the introduction of these sensors. The original ISA system has been proposed in the year 2001 and since last 20 years a lot of innovative measures have been taken and in this paper presentation a sensitive issue of drawback of ISA has been addressed and some proposals suggested .

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 1103-1108 www.ijaem.net ISSN: 2395-5252

LIMITATIONS OF THE PROPOSED SYSTEMS AND ITS REMEDIALMEASURES.

The only drawback of the above said proposal is that too many vehicles slow down at curves and instead of reducing traffic accidents you are posing a threat of bottle neck situation at curves and that it can be solved by providing extra lanes taking the right of way from unpaved , paved and median to increase the number of lanes from two to three. Similar to a roundabout the vehicles from different directions merge and then diverge to their respective directions , they slow down but will not to come to stand still condition. Now that the vehicles are safe to move with reduced speed at curves and then they can increase the speed in straight stretches .



REFERENCES.

1. Intelligent speed adaptation and road safety by HL OEI and PHPOLAK
2. Dynamic Speed Adaptation for Path Tracking Based on Curvature Information and Speed Limits byCitlalli Gámez Serna*‡ andYassineRuichek