Optimization of Pavement Profile Corrective Course Layer Volume: using MX Road Software

Abstract:

This paper describes the optimization process of profile corrective course layer (PCC) / regulating layer/ leveling layer volume with the help of MX Road software, for overlay and widening of road projects. It also proposes a rethink of the methodology of design standards with particular reference to vertical profile design, in the allowance for adjustment of cross-fall and of vertical alignment to better fit the purpose and to minimize the cost of this type of construction. The Computer-Aided Design and Drafting (CADD) and GIS methodology are the soft wares along with MX software.

Pavement quantity volumes are one of the major cost components in the delivery of a road project. An overlay-type project needs to optimize the profile corrective course volume with satisfying the structural strength capacity of pavement, road safety, and riding quality. The amount of money saved by optimization of PCC quantity can be invested in building more road lengths.

Keywords: Cross fall, Grade, K-Value, Longitudinal Section, Profile Corrective Course, Regulating Layer, Overlay Layer, Sight Distance, Super-elevation, Vertical Curve

Introduction:

The Ministry of Road Transport and Highways (MORTH) and other State Road Authorities in India have steadily increased their expenditure on the rehabilitation of their existing road assets to a point where this type of work commands a large portion of the total budget. Lion's share of these funds is spent on existing roads that are at the expiration of their useable life. Rehabilitation of these roads generally entails draping of the remaining surface with paving material and widening of the carriageway and shoulder.

This is a trend worldwide. Streamlining of the design process is required and simultaneously reviewing the design standards to provide economic strategy (as pavement volumes) and rehabilitation of the project cost.

Reuse of the existing road asset has a twofold benefit:

The reuse of old road materials reduces the construction cost to come across the present and future traffic necessities. It also conserves the naturally occurring road-making materials available on the earth and minimizes the upshot stress on the environment due to its extraction. Regulating/PCC layer is a variable thickness layer applied to the existing road surface to adjust the shape before the application of wearing course or any other bituminous surfacing or re-surfacing. The objective of the thesis is to minimize the overlay and profile corrective course material without compromising the strength of pavement and road safety requirements. **Figure 1** shows layers with PCC, overlay, etc. on cross-section drawings as well as on profile drawings.

Figure 1: Scheme of Road Overlay

The main design parameters which are taken into study for the optimization of profile corrective course are

- The minimum distance between two vertical intersection points (VIPs) in vertical profile design of alignment.
- Minimum length of Vertical curves satisfying the visibility requirements
- Applicable grades of the vertical alignment for the particular road project
- Cross fall flapping is used to vary the cross fall of the cross-section element of the road with conforming to the riding comfort.

All the different pavement models created to optimize profile corrective course considering different design parameters should conform to the basic requirements of visibility requirements and surface riding quality.

For this thesis study, MX Road (From Bentley) software is used which have the fine capability to model simple to complex road project for all type of road projects including New construction, Overlay and widening strengthening, and junction modeling. It has the best visibility module to verify the visibility requirements of all kinds of road projects. All the different road design models adopted for the study have been generated and analyzed with the MX Road Software.

Statement of the problem

Profile corrective course (PCC) layer over a road surface is of variable thickness useful to the existing road surface to adjust the shape before the application of wearing course or any other bituminous surfacing or re-surfacing. The objective of the thesis is to minimize the overlay and profile corrective course material without compromising the strength of pavement and road safety requirements.

From the engineering point of view, highway reconstruction is time and again well-thought-out to be the most difficult type of highway design to undertake. Instead of dealing with the pristine geometry of a new build, the designer is faced with integrating the design into the irregularities of existing conditions. Because of this, each roadway cross section often requires individual design, with careful attention to cross slopes, pavement irregularities, and many other potential conditions. Despite these challenges, the designer must generate an accurate account of the types and quantities of materials required.

The quantification of optimization of the profile corrective course with the use of departures from the standard requirements is without compromising the road user comfort and road user safety requirements.

Scope of the research

The major intention of this investigation is to conclude that the CADD and/or manual process for road overlay design is strenuous and at times give most uneconomical outcome as result. Pen out the best industry practice carried out for road rehabilitation projects and try the optimization to reduce the PCC layer.

- Profile Corrective Course layer volume optimization by application of relaxation or departure to the different design parameters which influences the PCC quantity, with conforms to the road safety and riding comfort.
- Use of MX Road software for the study of the PCC layer optimization

In this study, the road for the project considered is the Ministry of Road Transport & Highways (MoRT&H) intending to upgrade and rehabilitate the National Highways in the state of Odisha. Works Department, National Highway Division, Odisha has been entrusted with the preparation of DPR to M/s CADD Consulting Engineers Pvt. Ltd, Bhubaneswar for development of “Daringibadi Ghat portion from Km: 229+282 to Km: 254+575 of NH-59 in the State of Odisha”. The schematic plan for the project length is shown in **Figure 2**.

Table 1: ***Start and End point of Project Roads***

Name of the road	**From (Km)**	**To (Km)**	**Length (km)**
NH-59 (Daringbadi Ghat Portion)	Ex Km Post:229+282 Design CH:0.000	Ex Km Post:254+575 Design CH:28+941	28.941

LITERATURE REVIEW:

1.1 Design Parameters affecting PCC Layer Volume

There is extensive literature on the topic of Pavement Maintenance and Rehabilitation, however, regarding the optimization or aspects of the Profile Corrective Course (PCC) layer very less study is available on the subject. Widening and Overlaying projects are an increasingly large part of the workload of total road projects of any road department. The volume of profile corrective course for an overlay and widening project is an important cost component. PCC volume can be optimized by application of relaxation or departure to the different design parameters which influences the PCC quantity, conforming to road safety and riding comfort. The design parameters which were influencing the volume of the PCC layer for the pavement models are listed.

- The minimum distance between two vertical intersection points (VIPs) in vertical profile design of alignment.
- Minimum length of Vertical curves satisfying the visibility requirements
- Applicable grades of the vertical alignment for the particular road project
- Cross fall flapping is used to vary the cross fall of the cross-section element of the road with conforming to the riding comfort.

Description of these design parameter specifications from different standards and codes are listed and described in the next section. Relaxations and Departure to the design parameters are allowed in the British codes concerning the class of road and volume of traffic, which make a perfect economical project satisfying the safety requirements. This study will be compared how these applications of relaxations and departures to the Indian Roads Congress design parameters, affect the volume of PCC quantity for road projects.

For the study of the optimization of regulating layers in the pavement design models, the following code and standards of different countries are referenced, IRC: SP:73-2018, (Two laning of highways with paved shoulder) IRC; (Indian Roads Congress), for planning, design, construction maintenance, and operation with standards, safety, and sustainability of the environment. IRC:73-1980, Geometric Design Standards of roads and highways for Rural, IRC, countryside roads. IRC-SP-23-1983: Highway Vertical Curves design, IRC, India. TD 9/93, Design Manual for Roads and Bridges, existing carriageway, and freshly built highway link, UK, Policy on Geometric Design of roads/highways and Streets, and various intersections, and curves; AASHTO, USA

1.2 Road Design Software

From engineering considerations, highway overlay and reconstruction are often considered a herculean task for highway design. The pristine geometry of a new road structure at times put the designer to face intricacies during design accomplishments. Consequently, every cross-section of a roadway often requires individual design, with careful attention to cross slopes, and pavement irregularities. Road design software having the capability of performing the overlay and rehabilitation analysis and design for the road projects are listed below as shown in **Table 2.**

Table 2: Different Software used for Road Design

SL NO	SOFTWARE NAME	COMPANY
1	MX Road	Bentley
2	Autodesk Civil 3D	Autodesk
3	12D	12D solutions
4	HEADS	Techsoft Engineering Services
5	InRoads	Bentley
6	Geopark	Bentley
7	Open Road Designer	Bentley

For the current study, Bentley's MX Road software is used to model the road project. The preference for the MX Road software is given based on the availability of the software. The same road models can model in different software and outcomes can be compared to individual software outcomes. There may be a difference in the outcome with different software, as each software engine uses different algorithms for volume calculations.

Methodology

This research describes the step-by-step process and guidance for Overlaying and Widening road projects as per the Indian Roads Congress standards. Pavement rehabilitation is defined as a structural or functional enhancement of a pavement that produces a substantial extension in service life, by substantially improving pavement condition and ride quality. Pavement maintenance activities, on the other hand, are those treatments that preserve pavement condition, safety, and ride quality, and therefore aid a pavement in achieving its design life. The pavement overlaying and widening process is the combination of both the process of pavement maintenance and pavement rehabilitation. Procedures for the overlaying and widening of road projects with flow chart arrangement are shown in **Figure 3**.

1.3 Design Traffic In MSA

The design traffic in terms of Measure system analysis (MSA) has been estimated from a detailed traffic survey conducted at two locations. The cumulative numbers of standard axles arriving on the flexible pavement have been presented in **Table 3**.

Table 3: Design MSA for Pavement Design

Section	CVPD (A)	VDF (F)	Design Life (n)	LDF (D)	MSA Per Lane (N_{DES})
NH-59: Km 229+282 to Km 254+575	759	1.7	15	0.5	7.0
NOTE: Reference to the IRC-SP-73-2018 Cl No-5.4.1, the Minimum MSA per lane considered is 20MSA; VDF: variable data field; CVPD: commercial vehicles per day.LDF: lane distribution factor					

1.4 Pavement Condition Survey And Investigations

The following are the broad categories of survey, investigation, and data collection exercises carried out as a part of the study intending to capture the requisite data for the design of new pavement layers and rehabilitation of existing pavements. The following investigations have been carried out.

i. Historical Data collection regarding existing Pavement
ii. Geotechnical Investigations of OGL soil
iii. Existing pavement crust composition
iv. Geotechnical investigations of existing subgrade soil

v. Visual pavement condition survey
vi. Historical data about the pavement
vii. Condition survey of the pavement for identification of uniform sections having similar conditions
viii. Deflection measurements using falling weight Deflectometer
ix. Pavement layer thickness and composition and the subgrade characteristics

1.5 Existing Pavement Crust Composition

The existing pavement crust composition has been determined from the test pits at every 500m interval in a staggered manner. The existing pavement crust, as observed from the test pits, has been classified into a bituminous layer and a Granular layer. The existing pavement layer thickness is present in **Table 4.**

Table 4: Existing Pavement Layer Thickness

CHAINAGE In Km	**BITUMINOUS LAYER In mm**	**GRANULAR LAYER In mm**
229+282	100	450
230+000	100	450
230+500	100	450
231+000	110	450
231+500	110	450
232+000	110	400
232+500	100	400
233+000	100	400
233+000	100	400
233+500	100	400
234+000	100	400
234+500	100	400
235+000	100	400

The graphical representation of existing pavement layers along the project road has been provided in **Figure 4.**

Figure 4: Existing Pavement Layer Thickness

1.6 Pavement Condition Survey:

A pavement condition survey shall precede the actual deflection measurement and consist primarily of visual observations supplemented by measurements for estimation of cracking, rutting, and other distress in the pavement. It may be prudent to identify possible causes of distress using a condition survey and other investigations such as coring, test pits, and laboratory testing before conducting extensive deflection measurements using a falling weight Deflectometer. If the distresses are not related to the structural capacity of pavement layers, FWD measurement may not be of much help. Rutting in the bituminous mix, distress caused by stripping in the mix, etc are situations in which the structural condition of the pavement may not necessarily be explained adequately by FWD measurements.

The information collected in the condition survey should be relevant and adequate for identifying sections of uniform performance to determine the sample size for deflection measurements. Homogeneous sections for overlay design purposes will be identified based on deflection measurements and other relevant inputs such as traffic subgrade characteristics, deflection bowl parameters, etc

Table 5: Pavement Condition Classification

Classification	Pavement Condition
Good	Isolated cracks of less than 3.0mm width in less than 5% area of total paved surface and average rut depth less than 10mm
Fair	Isolated or interconnected cracks of less than 3.0mm width in 5 to 20% area of total paved surface AND/OR average rut depth between 10 to

	20mm
Poor	Wide interconnected cracking of more than 3.0mm width in 5 to 20% area (include the area of patching and raveling in this) of paved area OR cracking of any type in more than 20% area of paved surface AND/OR average rut depth of more than 20mm

Detailed evaluation of the existing pavement was carried out for the project section by walking along the road section with visual inspections. The condition of the existing pavement has been classified into Good, Fair, and Poor based on the criteria stipulated in Table 1 of IRC: 115-2014.

1.7 Pavement Evaluation By Falling Weight Deflectometer:

Evaluation of existing pavement using a Falling Weight Deflectometer (FWD) survey was carried out for the project section (excluding Bypass, Major Realignment, and Reconstruction Stretches). The FWD survey was conducted following the guidelines provided in IRC:115-2014 “Guidelines for structural Evaluation and strengthening of Flexible Road Pavement using Falling Weight Deflectometer (FWD) Technique”. The FWD survey was conducted when surface layer temperatures were between 20^0C- 45^0C.

1.7.1 Selecting existing pavement layer Modulus for Overlay Design:

For each overlay stretch mentioned in 15th percentile moduli values were calculated for each layer from the back-calculated (corrected) moduli. The calculated 15th percentile moduli values are presented in **Table 6**.

Table 6: Back Calculated Moduli Value

	Unit	15 Percentile Value Considered for Design Corrected Moduli Values
Bituminous Layer	MPa	2000
Granular Layer	MPa	108
Sub-Grade Layer	MPa	60

1.8 Pavement Design For Overlay & Widening Portion

The overlay pavement layer thickness has been designed for each overlay section under IRC:115-2014, based on the existing pavement layer properties and estimated design traffic. The pavement layer thickness and its specification for the overlay and widening of flexible pavement for the project are given in **Table 7.** The Typical Cross section drawing for the overlay & Widening of Flexible pavement is shown in **Figure 6.**

Table 7: Design Pavement Layer Thickness

Items	**Overlay Zone**	**Widening Zone**
Section	Km 229+282 to 254+575	
Design Life	15 Years	15 Years
Design Traffic (In MSA)	20	20
Wearing Course BC (VG-40)	40mm	40mm
Binder Course-1 DBM (VG-40)	50mm	50mm
Binder Course-2 DBM (VG-40)	NA	50mm
Base Course WMM	NA	250mm
Sub Base GSB	NA	200mm
Sub Grade (CBR > 8%)	NA	500mm

Modeling of Pavement Overlaying And Widening With MX Road Software

Different methods of overlay design

The pavement design method considered as a hybrid system developed to utilize a cross-section model in combination with technology of MX Chain Modeling to perform and mechanize pavement design. The program allows the design of road overlapping and/or widening schemes, through a process that applies transverse slopes between predetermined tolerances and, through its optimization, applies an optimal slope to establish control lines with variable transverse slopes that result in the minimum amount of sidewalk Without compromising the minimum designed pavement depth.

Overlay Design includes a set of programs based on a subset of the MX Road Design System. The system was developed to allow the user to apply overlay and extension designs to existing pavements in a very easy to use automated and interactive process. There are four pavement layer modeling menus in MX Road as shown in **Figure 7.**

Pavement and Subgrade Design:

Pavement and Subgrade Design is a wizard which allows you to create pavement layers for a carriageway. You can produce working drawings of the cross sections, which show the pavement construction in detail and calculate volumes between the different construction surfaces and the existing ground. This design option is used for completely new construction sections, where if the existing pavement layer is encountered it will treat as the ground surface. Overlaying, Scarification, Reconstruction, and Fit to existing profiles options are not available in this design menu. Design menus under the pavement and subgrade design options are shown in **Figure 8**.

Overlay Design-Features

The concept of the program is one where the focus is on optimizing pavement surface amounts by selecting the best option for the existing pavement profile. There are several innovations in the program for the layering process and generally accepted design standards. They are: -

i. Possibility of obtaining the best fit profile by means of cross cuts and conventional templates

ii. Controlled elevation with independently named overlay pavement depth at centerline and edges

iii. We present the 'flapping' of the cross leech profile for another elevation that is not controlled. The designer can choose to allow the program to vary the cross slope, say 0.5% in a positive or negative direction from the nominal 3.0% (see Figure 9)

IV. Optimize pavement quantities to the minimum necessary while meeting pavement design requirements, including profile correction layer (PCC layer)

v. The designer's ability to examine the effects of the pavement layer on the entire project when the program compares the design road surface profile to that of the existing road.

vi. The program will also calculate all earthworks, including drains and shoulders, and can, if necessary, handle a full design where the existing pavement is of no value or where the design may require a deviation, such as grade improvement. a horizontal curve.

The outcome of the design using the above features is to create a road for the traveling public that:

- The variance in the cross fall and the vertical alignment over what could be called a conventional design is not apparent to the driver either by eye or riding comfort
- Riding comfort is within the level for that particular class of road
- Save the construction cost as far as possible while still meeting the structural (pavement design) criteria necessary for the design traffic.

4.1 Overlay Design Process in MX Road Software:

Overlay design forms the main component of MX Road. Overlay design is an application that allows you to fit new designs onto the existing pavement for rehabilitation, reconstruction, or re-alignment purpose. It is accessed from the DESIGN-> OVERLAY DESIGN (TABULAR) menu. The general process of the overlay design with MX Road is presented in the flow chart as given in **Figure 10**.

Before using Overlay Design, the Existing Ground model and Design models were analyzed to fit the requirements of overlay design. There are some essential prerequisites for the models.

RESULTS AND DISCUSSION

Different Design Models Used For Optimisation

The project road section considered for the study is situated at Daringibadi Ghat Road in the District of Kandhamal, Odisha, NH-59 Km 229+282 to km 254+575. A length of 5km section of road out of the total project length of 25.2 km is considered for the study. All the site investigation data as discussed, required for the study were collected from the site with the help of the Design Consultant "CADD Consultant India Pvt. Ltd, Bhubaneswar, Odisha, India"

Following is the list of site data collected from the site, for the study:

i. Topographic Survey Data
ii. Road Inventory
iii. Soil sample Collection & Testing
iv. Pavement Inventory & Condition Survey
v. Falling Weight Deflectometer test
vi. Traffic study (Volume Count, Axle Load Survey, OD Survey)

The existing pavement section where overlay and reconstruction were required was analyzed based on the pavement condition survey and proposed alignment design. The process of finding the overlay section not only depends on the pavement investigation it also depends s on the geometry of the proposed road. The process of finding the section where the overlay and reconstruction are applied is iterative and based on economic analysis of pavement construction, so before finalizing the overlaying section for the road, the horizontal and vertical geometry of the road need to be modeled in MX Road. The section of the road where due to the proposed road geometry, profile corrective course layer quantity is huge and overlaying cost is more than the reconstruction, the section of the road is proposed for reconstruction.

For the same project road section, six different design models were created in the MX road, with different design parameters. The design parameters which affect the volume of profile corrective course were changed for the different models. The class of road considered for the design is two lane paved shoulder configuration, with total carriageway width is 10m.

As discussed in the literature review sections, two design models were also created based on AASHTO(USA) and DMRB(UK) standards, considering the same class of road classification. The list of design models created in MX Road software for the thesis work, with the adopted design parameters for the same road section is given in **Table 8**.

5.1 Visibility Analysis for Design Models

All the design models adopted for the study were analyzed with the visibility requirements as per the respective codal provisions. Through visibility is used to evaluate visibility along a road using plan, profile, cross-section, and respective views simultaneously. The evaluation of sight conditions can be done for existing road conditions or proposed design work. For evaluating sight conditions for the proposed design model, then it is recommended to generate a composite model of the proposed design into existing details.

Design basis requirements for the visibility parameters for all the design models were given in detail in chapter 3: Literature Review. For all the models twice, the safe stopping sight distance as per respective codes provisions was adopted. Design Visibility parameter has a huge impact on the optimization of the profile corrective course layer, so the minimum standard prescribed value of sight distance is adopted for all the models. After modeling the design models, all the models were analyzed for the visibility requirements in MX Road.

Riding Comfort Quality

Functional needs, characterized by geometric features and surface characteristics are of paramount importance in ensuring road user comfort and safety. Roughness is the key indicator of surface quality of pavement which is the prime concern for the road users who judge it with regards to smoothness or riding comfort, they derive while traveling on their vehicles.

Surface evenness and roughness are mostly dependent on the construction quality, Pavement material quality, and environmental factors. This is not dependent on geometric design parameters adopted for the study i.e. Vertical grade design and Pavement cross fall. The riding comfort quality variation to the road user due to tweaking of design parameters i.e. Vertical grade design and Pavement cross fall is not confirmed in the study.

5.2 Result Discussion

Benefits of MX Renew Technology Promotes a cost-effective, innovative, and easy-to-use solution to what has been a tedious and time-consuming process. Universally applicable for any design project Automation saves considerable amounts of design time Promotes consistency of design standards and drafting output efficient iteration to achieve best design solution Optimization saves considerable amounts of material and design time Allows ‘What if’ scenarios Promotes consistency of design standards and drafting output.

Table 8: Outcome of Different Design Models

SL. NO	DESIGN MODEL NAME	DESIGN STANDARDS & PARAMETERS
1	DESIGN-01	1. Road Configuration: Two lanes with Paved shoulder (Rural Section) 2. India Roads Congress Standard 3. Distance between two vertical intersection points (VIP) greater than 150m 4. The design speed of 100kmph 5. Conforming to Intermediate Sight Distance requirement 6. of 360m as per IRC.
		Result Discussion: Regulation /PCC Qty.= 1705 cum Approximate Amount= 127 lac per 5km for the Existing width of 5.5m
2	DESIGN-02	1. Road Configuration: Two lanes with Paved shoulder (Rural Section) 2. India Roads Congress Standard 3. Distance between two vertical intersection points (VIP) greater than 150m 4. Applying cross fall flapping of (+/- 0.5%) 5. The design speed of 100kmph 6. Conforming to Intermediate Sight Distance requirement of 360m as per IRC.
		Result Discussion: Regulation /PCC Qty= 1512 cum Approximate Amout= 113 lac per 5km for Existing width of 5.5m
3	DESIGN-03	1. Road Configuration: Two lanes with Paved shoulder (Rural Section) 2. Applying a relaxation to India Roads Congress Standard 3. Distance between two vertical intersection points (VIP) between 70m to 80m 4. The design speed of 100kmph

SL. NO	DESIGN MODEL NAME	DESIGN STANDARDS & PARAMETERS
		5. Conforming to Intermediate Sight Distance requirement of 360m as per IRC.
		Result Discussion: Regulation /PCC Qty= 1320 cum Approximate Amout= 99 lac per 5km for Existing width of 5.5m
4	DESIGN-04	1. Road Configuration: Two lanes with Paved shoulder (Rural Section) 2. Applying a relaxation to India Roads Congress Standard 3. Distance between two vertical intersection points (VIP) between 70m to 80m 4. Applying cross fall flapping of (+/- 0.5%) 5. The design speed of 100kmph 6. Conforming to Intermediate Sight Distance requirement of 360m as per IRC.
		Result Discussion: Regulation /PCC Qty= 1237 cum Approximate Amount= 92 lac per 5km for the Existing width of 5.5m

It is apparent from the analysis that the DESIGNO4 model is more optimized comparatively than other models used in the analysis.

CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

From the findings of the research, the subsequent conclusions are drawn.

- For the different categories of road works based on the functionality of the Road e.g (Rural Road, State Highway, National Highway, etc.) design standards for the vertical alignment design parameters can be differentiated so that maximum optimization of PCC layer volume can be achieved.
- As in current practice, for the overlaying and widening of road projects in India, the Cross fall flapping option is not mentioned in any design standards, but the use of this option leads to optimization of PCC quantitates for the road overlay projects.
- PCC Layer Volume is one of the major cost items (approximately 5% of the construction costs) in road construction projects. The amount of PCC volumes therefore mostly depends on the geometry of the road's vertical alignment. We can conclude that an optimized vertical alignment has a profound impact on PCC volume costs. In this research, we solve the task connected to the minimization of PCC volume cost by optimizing vertical alignment by the development of a linear optimization model with different categories of unknown variables including vertical offsets between road and surface at different points as well as extremum points' numbers. A proposed linear optimization model is supposed to be implemented with the application of the simplex method as the component of the complex branch and bound approach. The developed model has been implemented based on a practical example. After the optimization of vertical alignment, earthwork volumes have been calculated in the road design software with the average end area volume calculation method. We also have provided numerical results which include earthwork volumes and cost improvements over the preliminary design.
- Minimizing earthwork volumes by optimizing vertical alignment is a difficult road engineering problem for computers to solve without human guidance.

Computerized methods are crucial to automate the optimization to determine the solution that incurs minimal earthwork costs. In this paper, we developed a linear optimization model which ensures optimization of vertical alignment over a fixed horizontal alignment on a given terrain. The initial vertical alignment, as well as convexity-concavity (crest-sag) segments, should be determined by the designer. The optimization process has been applied and parameters have had significant effects on solutions.

6.2. Scope of the study.

MX Road software enables the design of a new length of the road, including the tie-in existing road, controlling the design standards with the following features:

- Surface Analysis and Surface Checking
- Horizontal & Vertical Alignment Design
- Corridor Design (Carriageway, Shoulder)
- Pavement Layer Design
- Overlay Design with Parametric fitting options
- Plan, Profile & Working Cross Section drawing Productions
- Pavement Layer and Earthwork volume report

The study done for the works can be done with other software products available on market like Autodesk Civil3D, and Bentley Open Road Design Software. The Workflow for the overlay and widening project for different software is comparatively more difficult than the new construction or Greenfield projects. The optimization of the Profile corrective course based on the process established for the MX Road software can be studied with other competitive software available on market.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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