CASE STUDY OF ROAD CONSTRUCTION

Aniket Raj Singh
Nilanshu Yadav
Sarim Hussain
Md Wasiuddin
Qazi Saad Anwar
GALGOTIA COLLEGE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

ABSTRACT
Road transport is important to the Indian economy. It enabled the country's transport sector to account for 4.8 percent of India 's gross domestic product, compared to one-percent trains, for 2009-2011, despite the railways carrying passengers and clean goods. Road transport has gained importance over the years despite major obstacles and operational inefficiencies between provinces and passenger movements compared to the railway line and air. The Indian government views the road network as an important factor in the country's development, social cohesion, and national security needs. Indian roads carry more than 65.5 percent of their goods and about 85 percent of passenger cars. The Indian Road network is controlled by various government officials, depending on the type of government in India. National highways connect topics, key areas, ports and strategic strategic points to various provinces. Although national highways cover only 2% of the total length of the road, they carry about 1/3 of the total traffic.

KEYWORDS
ACWC: Asphalt concrete wearing coarse
BC: Bituminous concrete
NHAI: National Highway authority of India
RCC: Reinforced concrete
WBM: Weight mix macadam
NH: National Highway
CBR: California bearing ratio
QC: Quality control

INTRODUCTION

Land development depends on the connectivity of various areas with adequate road network.
Roads are an important part of communication in areas where railways have not yet been developed.
India currently has a network of highways worldwide (over three million) km currently.
For the purpose of administration and administration, the roads of India are divided into the following five categories
1- National Highways (NH)
2- Provincial Roads (SH)
3- Regional Highways (MDR)
4- Other Regional Roads (ODR)
5- Rural Roads (VR)
"... it is not the wealth that builds roads but, the roads that build our wealth." - John F Kennedy
The current state of the Indian road network
National Highways ---- 58,112
Regional Highways ----- 1,37,119
Metropolitan Roads ----- 4,70,000
Village and other roads ----- 26,50,000
Total Road Length ----- 33,15,231 KM
NH is less than 2% of the network but carries 40% of the total traffic.

WHAT ARE ROADS
Roads are defined as trails or paths that start in one place and lead to another.
Roads are an open, often public road passing by cars, people and animals.
Road project involve important item during execution.
One Earthwork and a small base.

Asphalt works more than any other material like this culverts bridges, stone and road markings etc.
In order to do all this work there are three key engineers involved activities, supporting from the outset such as road design to project completion.
That is one quality control related to mixed design and laboratory testing.
Two-dimensional survey relating to estimates and billing during project implementation.
And finally the most important technical support is field testing that plays a key role during design and project implementation and also supports capacity testing.
The work of the earth begins with cleaning up the surface, which means removing everything unwanted substances such as grace sludge etc until we find a clean or rough surface of the existing soil to the required minimum level.
Based on the proposed road level as a road design.
The cleaning process is usually carried out with heavy equipment as a grader or dozer the choice of materials is based solely existing soil condition.
After cleaning and before the start of filling, we should measure the existing reduced levels and keep a record for future fulfillment.
calculate the amount of land completed for payment and then land.
Start with filling the selected soil from the approved barrel fit this activity includes mining loading and transport a place to put in irrigation water.
Mix well and cover the top area up to 95 of the related value filling should be done with layers and the combined strength of these layers it is usually used for no more than an inch [20 cm].
A subgrade or sub base is usually a mixture of fine soil and granite or soft rock formations.
All other remaining processes to perform such as setting in compaction etc is like doing earthwork.
Now we will make water bound macadam and water mix macadam.
Water-soaked macadam is the oldest form of road construction.
This layer falls between subgrade and bituminous macadam.
It is usually laid in two layers each layer covering 7.5 inches to 12.5 inches based on the construction of a particular road and the types of vehicles traveling on that road.
Water-soaked macadam is killed by spreading 25 to 70 millimeters rates in subgrade.
Automatically or mechanically and assemble it with a heavy roller.
Test material 1 to 10 mm powdered crushed stone or gravel is spread over aggregates and fills in the gaps between aggregates.
Irrigation and mixing should be done in the required quantity.
In this type of method most of the work is done by hand although great care is taken.
At the time of the murder there were usually voids and divisions affecting the firmness at the end.
It leads to failure this may be right on rural roads and in urban areas traffic compaction is increasing because this type of work is not suitable.
Modern technology has helped engineers design a wet mix macadam.
In this way aggregate and test materials are mixed using a plant to grind the pug before laying and set using mechanical pavers or grades and covered with vibrating rollers.
In this way the voids and the divisions are eliminated and lasts longer.
Now we will do asphalt work asphalt work involves the following thing
of jobs.
First the main coat and tack coat.
The second bituminous macadam
The third thick bituminous macadam
Then for the fourth time he wears rags
Binding layer between bituminous and non-bituminous surfaces as wet mix macadam about one kilogram per square meter of cutback 70 tar is sprayed as a main coat and is usually allowed for 24 hours to soak in the wet mixture.
Sprinkle evenly over the ground with the help of machine tools and the market coat is a binding layer between the two bituminous surfaces about 0.5 kg per square meter of bitumen is used as a paste and sprayed evenly over the bitumen surface just before laying another layer with the help of mechanical sprays ...
To process asphalt activity there are two types of asphalt plant is Available.
One is a drum mixer and the other is a batch plant
A batch plant is the best quality product
The flammable bituminous temperature is over 180 degrees ,therefore the asphalt is heated to 160 to 170 degrees and melts into a liquid stage and is stored in the final tanks. Aggregates are heated up to 150 degrees and purified by spraying during the heating of the drum and are tested and packaged as a mixed design and transferred to a pug mill mixture there.

The required percentage of bitumen is added and the mixing is done for two minutes to find the right combination.
The mixture is then transferred to a storage cell from where it is stored and loaded onto trucks and transported to the site.
There are different types of deer found in one.
A simple mechanical paver is an automatic two paver controlled by The senses.
Fully computer permeable The setting temperature of the asphalt mixture is 120 plus or minus 5 degree.
The asphalt mixture is placed in pavers at room temperature and compacted up to 98 of compaction using a vibratory roller and pneumatic rollers before digging deep into the execution.

SURVEYING
we will see from the plural level removing the bug fixes from this level
tool and measure distance without using measuring tape.
Prior to the commencement of any activity the reduced natural face levels will be taken
to obtain a record that will support calculating the amount of excavations performed
during the cleaning process usually.
The subgrade will need some adjustment to suit the building purposes and this process is known as subgrade formation or degradation which is a bad practice to build a paved road over vegetation or topsoil.
As living material it will rot which can lead to the formation of Spaces in closure systems that may lead to suspension of pavements.
The simplest form of subgrade site design this process involves the removal of all the top vegetation and root area and any topsoil many projects will involve.
A certain level of excavation has dropped to the level of formation there are two common reasons for digging to meet completed standards plastering and removal of rough or soft soil removable items.
After finishing the cleaning area the surface of the existing cleaning material the soil should be slightly compacted and the reduced level will be constant taken as a record.
Before you start filling the subgrade calculate the amount of embankment filling is required.
The next element of the work is a subgrade also known as embankment in many construction projects the required road size is designed and identified in advance.
Once the completed road level has been established the size of the paving can be removed and this will establish the composition level.
The level of formation is the highest level of subgrade foundation for road construction
Some paved layers will be covered if the soil is poorly structured which may have unusual loads or far below the proper level of formation of small land-filling machines from a designated loan hole that includes loading loads.
Transport to place and irrigate watering with portable water to complete humidity
content and mix well before compaction compaction will be made up of 95 percent of the traffic compaction associated with the proctor highway compaction modifications are considered.
For relative density, the details to be followed are that the selected soil will have the capacity to carry one soil and in addition the maximum moisture content should not exceed 5 to 6 percent.
Ground plastic will be between one and five percent zero to one percent plastic.
it is regarded as sand that can slip off the edge during the rainy season
and more than 5 per cent will be regarded as improper clay soil and roads are the next thing to operate a small foundation.
much compaction depends on supporting the base layer below the main load-bearing layer of the pavement.
It is designed to distribute the load of paving and any traffic there evenly
to a lesser extent below the link between the adjacent particles of the lower base ensures the ground capacity to carry relatively heavy loads.
There are two different types of specifications that are followed in the basement
one is a non-bonded granular sab foundation and the other is a ground base bound with cement.
A concrete foundation is an inexpensive way to build heavy work
a well-paved solid surface offers another alternative to traditional variables.
Bonding material can be a quick setting such as cement or slow-moving materials such as pfa and slag.
Non-bonded granular materials, however, are the most widely used on the road projects.
These resources are usually found in many riverine areas in some parts of the country under natural soil itself which has a mixed natural origin.
The material shall be spread in uniform layers such that the compacted thickness shall not exceed 200 to 250 millimeters with due consideration to lose thickness for compaction factor each grader run shall overlap one third of blade length.

The moisture content shall be checked for omc if it is less than required then the water may be added by sprinkling and if it is more than required.
Then it shall be exposed to the sun until it reaches omc the compaction shall be done mechanically by using vibratory rollers of 80 to 100 kilo newton static weight for the entire width of the pavement.
The rolling shell commence from the lower edge and proceed to the upper side with one third of overlap generally six to eight passes are required for compaction of 98 percent of lab density each layer shall be tested by the sand replacement method.
The specifications to follow in sub-bases.
The selected blend of sub-base shall be free from organic materials and shall have the minimum soil bearing capacity of two and above normally a good granular sub-base
Materials have the bearing capacity more than three the gradation of material shall pass the designated sieve analysis.
The maximum size of granular stones shall pass the 75 millimeters sieve 100 percent.
Means the granular stones used in sub base shall be less than 75 millimeters in size.
The higher properties of subgrade soil shall be blended with granular aggregates.
To ensure more durability normally the mixture of one is to two by volume that is one part of granular aggregates and two part of good subgrade soil is blended thoroughly to produces a good sub-base material
To control the width and thickness of every pavements such as where mix and asphalt works before the commencement of any item of work the tow line that is fixing of pegs to mark the limits of granular sub base shall be done by surveyors the width of pavement for tow line shall be calculated by referring to the drawings with due considerations to formation width plus the offsets and slopes of different layers depth and the current layer from the formation road level control pegs at every 10 meters shall be fixed on both sides of the bed in such a manner that they are not disturbed by greater movement and 5 meter interval pegs are suggested on curves.
The required level of pavement top shall be marked on the pegs with a suitable vertical offset after rough initial spreading a cotton or nylon string which is known as line.
Dory shall be held at the marks on the control pegs on both sides.
The string's height from the bed top is measured at a fixed horizontal offset the grader operator shall be directed according to measurement in the above.
Step to cut and fill at every point now the next item of work is wet mix macadam .
Wet mix macadam is the next generation of water-bound macadam and it is intended to be an alternative and more durable pavement in roads and highway work it is generally used as a base course of flexible pavement.
WMM provides uniform and strong support high resistance to deformation and distress.
wet mix macadam shall be prepared as per approved proportionate of aggregates in the pug mill plant with controlled addition of water.
Water to be maintained within the limit generally one to two percent extra over the omc shall be maintained in the mix to compensate the evaporation losses depending upon the lead and season.
The mix shall be transported from the plant to the laying site.
If the existing sub-bay surfaces found to be dry water shall be sprinkled before lying of wet mix.
Considering the compaction the loose laying thickness shall be kept 15 to 17 percent extra.
For compaction the test trail shall to be done to check the number of passes required to achieve the 98 of relative density the number of passes shall be made as at the beginning one plane pass.
And two to three low vibration pass and at the end of compaction again one plane pass the speed of roller.
During the compaction shall not exceed five kilometers per hour.
Generally high vibration passes are notused in wet mix because it may crush the aggregates used which may reduce the durability of pavement.
Similar to sub bass the surveyor shall fix the control pegs at every 10 meters on both sides of the bed and repeat the procedure to control the width and thickness of pavement.
The level of finished layer shall not vary from the project design level for a particular layer
The tolerance on surface levels of wet mix plus or minus 10 millimeter for checking compliance with the above requirement measurements of the surface level shall be taken on a grid of 10 meters longitudinally and 3.5 meters transversely along the pavement
The average of ten measurements shall not be more than three millimeters above
the permitted limit.
The specification of material to be used for wet mix macadam shall be the gravel zero to six millimeters crushed aggregates and the stone 6 to 50 millimeters crushed aggregates
The proportionate of this blended material shall conform the grading requirements as per the specification in india the moth v table 400 to 13 is followed
The next item of work is curb stone the curbstone provides a clear physical and visual marking and delineation

It makes the drivers conscious of the pavement and greenery areas in demarcating roads streets car parks etc it makes a clear-cut view of the carriageway it helps in preventing any kind of spreading from the carriageway There are many types of curbs available the types are mainly based on the purpose of usage and the type of materials used to produce and also available in different textures colors and standards where the central medians are very narrow their high raised concrete dividers are used to separate the carriageway.
The specifications to follow is high-strength concrete shall be used for kerbstone to withstand the vehicle's load and traffic pressure.
Expansion joints shall provide at every 10 meters intervals hunting shall provide to support the kerbstone.
Now we do asphalt work
Asphalt work is the most expensive and important work in the road project
It involves the following item of works
First the prime coat and tack coat
second bituminous macadam third dense bituminous macadam and then
fourth is wearing coarse the prime coat is the binding layer between bituminous and non-bituminous surfaces such as wet mix macadam the cutback bitumen 70 is used as a prime coat the material shall be heated around 150 to 160 degrees temperature and well blended for two to three hours and uniformly sprayed around one kilogram per square meter over the dry and clean wet mix surface with the help of a mechanical sprayer.
Normally it shall be allowed not less than 24 hours to penetrate in wet mix before laying of asphalt work the tack coat is the binding layer between two bituminous surfaces the bitumen grade 80 to 100 is used for the tack coatcand it is heated around 150 to 160 degrees temperature and uniformly sprayed around 0.5 kilograms per square meter with the help of a mechanical sprayer.
Normally it is sprayed just before laying of next layer of asphalt item
The next item of work is the dense bituminous macadam dbm
The dbm consists the laying of a single or two layers on a previously primed and approved wet mix macadam in accordance with project specification each layer shall be not more than 100 millimeters thick
The materials used are coarse aggregates ; fine aggregates and the binder content the coarse aggregate shell be the blend of crushed aggregates from six millimeters to 25 millimeters and it shall be cubical or angular in shape and it shall satisfy all other specification.
Fine aggregates shall be passing of 2.36 millimeters sieve and retained on 75 micron sieve consisting of crusher run screening
The important things to know is their natural sand is not allowed as a fine aggregate in any of the asphalt work generally the 80 to 100 grade bitumen is used as binder content in highways
The percentage of binder content shall be determined to achieve the requirements set out in specifications and the traffic volume specified in the contract.
The marshall method shall be adapted to determine the maximum percentage of binder content.
Normally the percentage of bitumen used for dbm is between 4.0 to 4.5 percent
Apart from conformity with grading and quality requirements of individual ingredients
The mix shall meet the requirements set out in the specifications of the project job mix formula shall be prepared and approved by client
Before start the asphalt work the formula should be within the limit and shall satisfy the quality control criterias as per project specifications
After the job mix formula approved the plant trial should be done to confirm
the bituminous mix design construction procedures to follow are weather conditions
the work of laying shall not be taken up during the rainy or foggy weather and if the surface of base is damp orwet or during dust storm or when the atmospheric temperature in shade is less than 10 degrees preparation of base
The surface of laying shall be free from dust and foreign matters shall be swept clean by using mechanical broom or blown off by using compressed air the transverse joint shall be cut vertically with the asphalt cutter and a coat of hot bitumen shall be applied
Before placing materials prime coat or tack coat shall be applied as per the specifications
Preparation of mix the dbm should be produced on batch basis by weight in hot mix plant the mixing shall be done
In a twin shafted pug mill which will produce a homogeneous mix
The mixture shall be transported from the batching plant by tippers if required covered with tarpaulin to maintain the temperature and to control the dust spreading or laying the mix shall be slowly discharged in the paver hopperwhile both the tipper and paver will move forward steadily and slowly if possible the paving shall be done
in one go for the full width of the road the normal temperature of the mix at the time of lying shall be 140 to 160 degrees celsius
However it shall not be less than 120degrees celsius

The automatic sensor shall ensure that the mix is being laid to the proper line
and grade and level this center of the paver will be guided by the string lines fixed by
surveyors with the stack and arms on both sides 0.5 meters away from the edge
The compaction as soon as the mix has been laid on the surface the compaction shall be done with the help of set of rollers moving at a speed not exceeding five kilometres per hour following close to the paver rolling sequence shall be
as established during the laying trial stretch
The compaction shall be completed before the temperature falls below the rolling temperatures 90 to 100 degrees Celsius the joint shall be rolled immediately behind the paving operation after this the rolling shell commence longitudinally at the lower edge to the upper edge and parallel to the centre line of the pavement rolling shall be done continuously until all roller marks have been removed from the bituminous surface
During rolling the wheels of rollers shall be kept moist by sprinkling water from the water storage fitted with the roller to prevent the mix adhering to the wheels after final compaction the tolerance of the surface level shall be less than plus or minus six millimetres
The specifications of selected aggregates shall be as follow
The water absorption of aggregates shall not be more than two percent
The impact value shall not be more than twenty seven percent
The flakiness and elongation index shall not be more than 35
The loss Angeles abrasion test result shall not be more than 35
The striping value of minimum retained is 95 and above the next item of work is wearing course wc also known as asphalt work
Ac the wearing courses the final and finishing layer of asphalt work
The material selection and the construction procedure is a similar to dbm but the difference between the dbm and wc is the gradation of the mixed aggregates varies between dbm and wc the maximum size of aggregates used in wc are less than 20 millimeters around four to five percent of filler materials are used to get smooth finished surface
In order to ensure 100smooth top surface the percentage of
binder material that is bituminous content in wc is slightly higher than the dbm and this layer is always used to be a single course to the maximum thickness of 100 millimeters
Normally the existing road has the camber and slope at both the sides when the existing road developed as full laning the slop on both side is not required and it is corrected as one side slope with the camber correction layers.
The bituminous macadam is used as camber correction and it is generally laid in two layers
The specifications and the method of construction of bituminous macadam is a similar to dmb and wc but the gradation of the aggregates for bm is varies from other asphalt mix
In this mix the 25 millimetres aggregates are used as maximum size and the percentage of binder material that is bituminous is slightly lower than dbm.
Once the camber repair has been completed then there is a similar road edge
the stone will be erected at the end of the existing road.
Then the dbm and wc will be set as similar to the proposed road description the next thing to do shoulder shoulder work is a necessary part of highways and perform several functions.
It serves as a support along the paved roadway.
It provides a way to protect the highway from water intrusion which is one of the major culprits of our highways.
Wide shoulder provides temporary parking for people who wish to stand and enjoy the scenic vistas view easily accessible.
A single layer of road foundation 10 inches thick and a thin layer of asphaltic screed is used as shoulder height to cover the road foundation.
Eventually the mix acts as a mid-sized road sign such as a pedestrian lane and the suspension of the signs will be fixed before the project is completed.
Site Development Suggestions and Safety Measures: -
· All employees must use workplace protective equipment, provided by the contractor.
· All employees must wear light jackets, while working in a motor vehicle.
· Proper measures should be taken to prevent accidents due to power outages during excavation.
Employees employed in bituminous works, stone layers, concrete plant etc. should wear protective goggles, gloves, gumboots, ear plunge etc.
· Those who do welding work should wear protective light.
· All scaffolding, stairs and other safety equipment must be kept in a safe and sound condition.
All construction vehicles must have reversible horns.

Conclusions

Practical training is very helpful to me. Theoretical knowledge and practical knowledge are essential to entering any industry. We usually learn theories but keeping practical information is a reflection of the application of this theoretical knowledge. So we would be trained to do things to learn more. The material and our website developer provide the best information possible. He taught us many things such as personnel management, how to communicate effectively with employees to provide the best possible outcome, how to take the right level of road alignment, the need for BIS / IRC Codes in road construction. The need for transportation, the design of the highest point, etc.

REFRENCES

IRC:58-2002, guidelines for the design of plain jointed rigid pavements for highways.
IRC:15-2002,code of practice for construction of cement concrete roads.
IRC:44-2008,guidelines for cement concrete mix design for pavements.