

# **A CRITICAL REVIEW OF THE PRESENT PRACTICES OF DESIGN & CONSTRUCTION MANAGEMENT OF INFRASTRUCTURE & OTHER DEVELOPMENT WORKS IN BENGALURU AND SUGGESTIONS FOR IMPROVING THEM FOR BETTER UTILISATION OF PUBLIC FUNDS**

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## **INTRODUCTION**

Infrastructure and other development works are intended for the welfare of the general public including road users. But as is the present way of addressing this issue in our country, especially in Bengaluru, the public and road users are never in the consideration of the agencies which execute and maintain the works. In most of the cases, the original planning itself is faulty, the constructions are always delayed for years, and they are of poor quality, but no one is accountable. When works are taken up, the roads which are already narrow as compared to other cities in the country, are dug up and the road users have to suffer for a very long periods for want of usable roads. Even their safety is not anybody's concern during the endless construction periods. Contracts are awarded without transparency, very often to incompetent contractors. It is obvious that the tax payers' money is getting wasted, with further sufferings to them by not being able to attend to their daily chores due to long closure of roads, debris strewn all around, with dust which adds to their misfortune.

Based on a critical review of some of the BBMP files obtained under RTI and the general observations of the way the works are handled, the suggestions for improving the design and construction management of infrastructure and other development works in Bengaluru are indicated below. The write up also includes some very basic factors, which are being pointed out, in view of their importance.

### **1. PLANNING OF FLYOVERS/UNDERPASSES TO BE REORIENTED**

The demands of the fast growing city of Bengaluru, with the ever increasing traffic and the resulting congestion would necessarily call for more and more grade separators to be constructed in the near future to mitigate the problems. But, this should not be taken up on a piecemeal basis to cater to individual road inter-sections as is presently being done. A full - fledged comprehensive traffic survey and planning should be carried out considering various options, not only at the particular location but also in the surrounding areas. The solution arrived at should also match with the master plan for the whole city, and a holistic approach should be taken with inputs from the works already carried out, calling for opinions from national and international experts, in addition to the local experts and residents so that a realistic integrated solution at the optimum cost is arrived at and it should be implemented scientifically, speedily and with needed quality levels and fulfilling safety requirements. It is also required that environmental aspects are complied with as per the stipulated guidelines.

In other words, the practice of taking up grandiose projects such as flyovers and underpasses without consideration of their effect on the traffic movements in their neighbourhood areas, including the different arms at the intersection causing bottlenecks all over should be discontinued. In many cases of underpasses taken up/ completed, they have been planned without consideration of the road width at the particular location, to ensure whether it is sufficient to carry the remaining traffic on the slip/service roads and also of the width inside the underpass is sufficient to provide for pedestrian footpaths and storm water drains. Even the heights provided inside are inadequate and not as per standards. If there are such constraints, the choice should be a flyover of appropriate design and not underpass. While providing an underpass or flyover, the traffic at grade level should be satisfactorily taken care of, by providing signals, signs and safety markings.

The present practice of constructing an underpass without due consideration of the above factors, but only on political pressure, and subsequently realising that it was a wrong decision is a wastage of public funds. Due to construction of underpass at a location which is not ideal, it is the public who suffer and such a situation would not arise if detailed exercise as indicted above had been gone into initially. Similarly to get the maximum benefit from an underpass, apart from its meeting the adjoining area requirements, the inside dimensions should be as per IRC specifications. The drains should be correctly designed so that at no time the underpass gets flooded, thus making it not useable till the water is drained out. In many of the underpasses already constructed hurriedly, there is no provision for storm water to flow out without flooding it and making it unusable for the duration of even moderate rains.

## **2. CONTRACT DOCUMENTS TO BE MODIFIED TO BE MORE RATIONAL**

The present out dated and defective conditions of contract used by BBMP or similar agencies should be forthwith scrapped. The clauses should be very clear binding the contractor on quality and progress. The penalty for delays should be clearly indicated which should act as deterrent for default and should be enforced without any compromise. It is advisable to adopt **FIDIC** (*Federation Internationale Des Ingenieurs-Consels- International Federation of Consulting Engineers*) or equivalent conditions of contract, both for contractors and consultants which are adopted in national and international practices. The FIDIC conditions were used initially for World Bank sponsored projects. Presently, they are available as FIDIC REDBOOK for general works, as ORANGEBOOK for design-build projects, and as YELLOWBOOK for plant design and installation as in M&E works. The documents can be downloaded from the internet. The adoption of such accepted documents could lead to better contract administration, and only then the value for the amount spent could be realised as against the wilful wastage of public funds by not following such standard practices. Even the presently used conditions of contract in the state exist only on paper at the time of bidding and award of contract, to be violated throughout the duration of the contract by the contractor and the consultant and the government agencies with no one being accountable.

**3. PROJECTS SHOULD NEVER BE DELAYED AND INCONVENIENCE PUBLIC, AND THEY SHOULD HAVE SCHEDULES OF ONE OR TWO YEARS ONLY**

In order to avoid public inconvenience, it is important that the duration of projects is kept to the minimum, preferably one year only and in rare cases two years, unless the work involved is really complicated and of value more than five hundred crores. It is the practice abroad to complete projects of value up to two hundred crores within one or two years. The contractors chosen will have the capacity to complete the tendered work within the scheduled period. Penalties per day of delay should be clearly indicated in the tender document and should be enforced mercilessly. If such a procedure is followed here also, no project will be delayed beyond approved schedule.

It is also necessary that the clients such as BBMP should honour conditions of contract with regard to payments to contractors and consultants as delays in payments would result in delays to the projects inconveniencing the public. Approvals for budgets and allocations for the particular works should be obtained in right time to avoid lapses on this aspect.

**4. LAND ACQUISITION SHOULD BE BEFORE THE START OF A PROJECT AND SHOULD NEVER DELAY A PROJECT**

The land acquisition should be assessed in advance at the design stage and action initiated before the start of the project. The usual excuse of delays to the project on this account is not tenable. In no case, the acquisition should be carried out beyond the mobilisation period allowed to the contractor under the contract which is usually one or two months depending on the size of the project.

**5. ASSESSMENT OF UTILITES AND SHIFTING TO BE PART OF THE CONTRACT AND NO ADDITIONAL AMOUNT TO BE PAID**

Similarly, the shifting of utilities should be assessed at the design stage and verified by the contractor and his bid should be inclusive of the cost of shifting and no additional payment or extension of time should be allowed on this account, as the conditions of contract clearly indicate this item is to be taken care of by the contractor at the time of bidding. Many times the contractor, and the consultant, and the client bring out this issue as an excuse to cover the delays and the consultants and client approve additional payments violating the contract conditions, thus making the public suffer.

**6. ROAD CUTTING / DIGGING SHOULD BE MADE PUNISHABLE**

The present practice of digging a newly laid road by BBMP or BWSSB or BSNL or BESCO or private service providers for broadband or even the general public to pass utility lines underneath or even by the side of the road by cutting trenches should all be stopped forthwith. The violations should be dealt with severely and concerned offenders should be penalised, even if they belong to Govt. agencies. If a new road is being made, ducts should be provided at regular intervals to accommodate utilities (as per IRC guidelines). If ducts are to be provided after construction, horizontal thrust boring should be carried out to insert ducts and utilities, as

per international practice. Similarly, excavations for sewage or other utilities outside the carriageway should be filled back instantly as soon as the pipes are installed using granular materials and appropriate compacting equipment depending on the size of the excavation. The ancient method followed in Bengaluru of waiting the excavated material to consolidate before doing further work should be stopped. For compaction to be completed at the earliest, trench vibrators or regular rollers as needed should be used and compaction carried out in layers, checking the density achieved for each layer. The works should only be done with proper planning so as not to inconvenience the general public. It may not be out of place to mention that in many countries, even an accidental breaking of utility or other lines or causing undue hardship to the general public due to the above acts are not tolerated and the concerned personnel including the officials will be severely penalised.

#### **7. AUGMENTING OF BBMP STAFF AND TRAINING THEM TO MAKE THEM CAPABLE OF HANDLING INFRASTRUCTURE PROJECTS EFFICIENTLY**

It is learnt from the files of BBMP obtained through RTI that the BBMP do not have the technical staff who have the exposure and expertise to supervise the high value projects. Therefore the technical staff of BBMP should be strengthened to be more knowledgeable and competent to handle such high cost projects efficiently. It may not be impossible to make direct recruitment of qualified, experienced and competent staff specifically for handling such works by BBMP. It is also important to depute them to refresher courses conducted by research institutes such as CRRRI, training institutes such as National highway training institute or IITs or Universities and similar organisations to enable them to keep abreast of various codes of practices and standard specifications to ensure correct engineering practices are used and quality of such constructions is ensured. The present practice of transferring staff from other departments based on considerations other than merit should be stopped. There should not be so many officials involved to run a project of such nature causing waste of time while giving decisions. There could be one official to handle the day to day decision making and one for authorising the payments based on the advice of the former and he could be supported by one audit and accounts officer to check on the admissibility and availability of budget provision before sanction.

#### **8. PROJECTS TO BE AWARDED ONLY TO COMPETENT CONTRACTORS**

Contracts should not be awarded to incompetent contractors to satisfy political influences, but only to proven and capable contractors with adequate tools and plants, having all the required machinery for the particular project in good working condition, trained personnel at all levels, and with the capacity to ensure quality by setting up a full - fledged site laboratory to carry out all tests in the laboratory needed to ensure quality. Turn – key projects or Design – Build contracts should be chosen only if the situation demands it, provided the contractor chosen has the capacity to meet the design, planning, project management, quality assurance and other resources including financial backing needed for such projects. The practice of awarding works to empanelled consultants or contractors should be stopped as they may not have the required staff and/or machineries which they claimed to have possessed at the time of empanelling, thus delaying and compromising with the schedules and quality leading to waste of public funds. Lump – sum contracts should be avoided as far as possible and contracts fully measureable with

BOQs only should be preferred to avoid subjective assessments of work carried out with consequent over payments. Contractors who delay projects beyond acceptable time periods or provide substandard work should be black listed and no further contracts should be given to them even if they quote the lowest.

## **9. QUALITY SHOULD NEVER BE COMPROMISED**

Quality should never be compromised and any work not accepted by the consultant should be replaced immediately before further work is taken up as per conditions of contract. The contract should be explicit and not leave any room for laxity on this account and the contractor, the consultant and the BBMP engineers involved should be fully conversant with relevant specifications, construction procedures and quality aspects. It is noticed that as per BBMP's practice, attaching some test results and photographs to the bills is all that is done for passing the bills, even when they are of value of one crore or above. It is not a good practice as it is only to help the contractor who may not adhere to time schedules, or overlooking actual quality achieved and not bothering to complete all the items as per the scope of work under the contract.

For bituminous or concrete works tests on materials, mix designs and subsequent quality assurance tests as well as quality control tests should be carried out on daily basis and results should be submitted for review and decision. Whenever the sources of supply of materials are needed to be changed checks should be made on their quality before using them in the works. As for ready mixed concrete, whenever the supplier is changed, mix designs should be got done and checked and approved before approving the change of supplier. It is also to be kept in mind that though there are about a hundred suppliers of ready mixed concrete in the city only a fraction of them are accredited, whose quality could be accepted with confidence.

## **10. MONTHLY PROGRESS REPORTS FROM CONSULTANT AND CONTRACTOR ARE MANDATORY**

As per general practice, full details are needed to be submitted by the contractor every month to the consultant, attaching grade sheets (level sheets), all test results of materials and on constructed layers, the actual machinery and manpower at site, percentages of physical and financial progress and any constraints causing delays and how he would overcome them to keep the progress to the approved schedule. The consultant will then check all the submissions and forward to the client with his remarks and recommendations along with his own report giving his assessment of the achieved quality, the general procedures followed by the contractor while executing the work, whether they are as per specifications, and the adequacy of machinery and manpower employed by the contractor during the month and whether the progress is satisfactory etc. and forward to the client. Based on the report and the consultant's remarks or recommendations only, the bills are to be approved and paid as and when submitted by the contractor and certified by the consultant.

## **11. REQUESTS FOR APPROVAL FOR DAILY ACTIVITIES AT SITE**

It is the international practice to use proforma called RFA (request for approval) which are to be submitted to the consultant every day informing him of the next day's schedule of work proposed by the contractor, indicating the name of work item, the chainage, the item number in the BOQ along with a copy of the consultant's approval for the earlier work preceding the proposed work, and the consultant would give consent after verifying the relevant information. If he feels the procedure is likely to cause delay, he could permit the contractor orally to proceed with the work subject to the condition that the contractor would be held responsible for any deficiency that may come to notice after verification of results of various tests and levels and thicknesses of layers or any other factor which could lead to unsatisfactory quality. The consultant when he receives the RFA will depute his team consisting of site supervisor, materials engineer, surveyor and quantity surveyor to monitor the work on daily basis and they have to indicate their consent on the RFA and provide the required data of test results, grade sheets of proposed and achieved levels of each layer, and any observations made by the site supervisor regarding the contractor following standard procedures and the quantity surveyor's observation of quantities actually executed on a particular day. After satisfying himself on all these aspects, the consultant would accord his approval for the particular work by signing on the RFA. These approved RFA's will be again reviewed by the quantity surveyor who will then keep his measurements ready to check when the contractor submits his progressive monthly bills and first he certifies them and then the consultant who checks and forwards them to the client for approval and payment. Such a system needs to be followed here also so that all contractual conditions are complied with. It is to be emphasised that the system of keeping full records would ensure quality, indicate causes of delays so that the same could be sorted out timely and ensure progress as per schedule is achieved and even help the contractor to get compensation for legitimate claims, since in the case of any dispute, the records are readily available to verify and establish the correct picture.

## **12. PROVIDING PROPER ROADS TO THE PUBLIC DURING CONSTRUCTION IS MANDATORY**

The maintenance of roads adjacent to projects should be part of the contract and it must be ensured that the public is not inconvenienced due to bad roads, broken down for any construction activity of the proposed project. In fact, before taking up any new project, before cutting open an existing road to do a new work, asphalted road should be provided for the traffic, and the cost should be included in the new work being undertaken. At no time, the public should be inconvenienced for lack of proper road. But this aspect is totally ignored by all agencies in Bengaluru, including BMRCL, and BWSSB. Even when the elevated road was constructed on Hosur road, the same attitude of indifference was noticeable by making the heavy traffic to move over muddy or unprepared stretches due to cutting of existing road to make way for construction of foundations and superstructure for the elevated road. No one ever bothered to provide the facility of ride-able road to the public for the full duration of work and even subsequently for a very long time. Similar is the story of the Bellary road improvements. The excuse is always that the road maintenance is the responsibility of BBMP and the other agencies that spoil the existing road are allowed to go free by passing the buck.

The hurriedly cut Sarjapur road was left as dug for more than a year even when the elevated road/ underpass proposal was dropped, in spite of the stretch passing through a hospital and residential area. It is to be emphasised that as per international practice the public should never be put to inconvenience due to construction or repair activities. It is learnt that shortly a major multilevel construction is to come up near city railway station towards Rajaji nagar. It could be anybody's guess how long it is going to take to get completed and how long the public will be put to hardship or whether at least now the agencies involved will take the public's difficulties into consideration and adopt suitable measures to avoid undue delays and provide suitable roads and other facilities to the general public for the duration of the project which should be the minimum required with proper planning and execution.

### **13. PEDESTRIAN FACILITIES SUCH AS FOOTPATHS**

The pedestrian is totally ignored in Bengaluru and his safety is no one's concern. The footpaths, if at all provided, do not meet any specification and the width and height are unacceptable. It is also not clear why BBMP should use cut stone slabs for foot paths in 21<sup>st</sup> century. Or, is it the contractors use them by deviating from the specifications to make profits at the cost of pedestrians. In most cases, the height of footpaths is too much for anyone to negotiate, not to mention the senior citizens and the disabled. In market areas, shopkeepers occupy parts of footpath to display their merchandise. In many areas BESCO have installed their transformers on the footpath blocking its use by pedestrians and forcing them to walk on the road endangering their lives. It is very clear that the civic agency or the contractors are not aware of IRC guidelines stipulating the width and height of footpaths. It is also common sight in Bengaluru that two wheelers merrily use footpaths to deviate from crowded traffic especially at signals where vehicles wait to get their turn. At majority of the signals, no marking is there to indicate pedestrian crossing and even if it is there, the motorists do not stop to allow the pedestrian to cross. It is the international practice, if the pedestrian enters the pedestrian crossing, all vehicles should stop till the pedestrian crosses the full width of the road. In Bengaluru, the vehicle owners do not have any such concern for the safety of pedestrians or to follow the rules, and the authorities; including the police do not seem to be bothered if lives are lost. Further, it is a common sight that construction materials are dumped on the footpaths, either by BBMP or by private individuals occupying both footpaths and part of the carriageway blocking the pedestrians and the traffic. The petty contractors doing drain construction or other works dump boulders and employ manual labour to break them into smaller sizes, taking months for such works to be completed. Obviously the broken pieces will not be of the required sizes and the works are completed without bothering about the sizes and grading of aggregates specified for concrete works. The works are of very poor quality, and is a wasteful expenditure.

A separate lane should be provided for cyclists as many poor people use this mode of transport. In the long run, it will also encourage more people to avoid motorised transport at least for short distance chores.

For the benefit of the pedestrians skywalks and pedestrian underpasses could be planned depending on each location.

#### **14. PROJECTS ARE ALWAYS LEFT INCOMPLETE IN BENGALURU**

It is very common in Bengaluru that projects are left half way, and many work items are left incomplete. This is so, whether the project is a major one such as flyover or underpass or new road construction or overlaying, or even a small one such as covering the drains, or de-silting of drains. Obviously, the payments would have been made and the extra amount would not have been accounted for. This wastage of public funds should be stopped by taking strict action against the perpetrators.

#### **15. MAINTENANCE IS ALWAYS NOT TAKEN CARE OF IN BENGALURU**

Similarly, it appears that no one is interested in maintaining existing infrastructure. It is also true that here the construction is done very badly in the first instance that repairs are needed within a short period. This is outrageous considering that all the countries are concentrating on preservation of existing assets so that they could postpone new construction till it is absolutely necessary. Of course, the construction will fall in the category of asset only if it is done as per specifications and good engineering practice which can never happen in Bengaluru with the present setup, unless reforms in tendering, contracting, and project management and administration are brought in urgently. The maintenance is a term unheard of by all concerned in Bengaluru, whether it is sealing of joints, or attending to local cracks in case of flyovers or underpasses or even replacing broken cover slabs of drains across footpaths. It is to be added that all construction contracts have a clause on maintenance period, which is usually one year, after which only the contractor is to be issued completion certificate and final payment is to be released. Obviously the concerned officials do not bother to insist on this clause. Only the officials in Bengaluru can take pride in stating that out of 30000 plus potholes, they have repaired 10000 and the balance will be repaired in one month. While the one month period extends for years, it is a pity that they do not understand that having so many potholes is a slur on their technical capability as well as their professional honesty. It is really difficult to digest that in other countries even a single pothole will not be tolerated and our public is prepared to live with such a disgraceful situation without any outcry, but only some grumbling. The repairs to potholes are done so badly by dumping some mud or debris in them and covering them with a thin bituminous coat. No one is interested to see what the specifications stipulate. Such repairs do not last even for a couple of months in dry weather and if it rains it is dislodged in no time.

The only solution would be to implement performance based contracts, wherein the contractor would get full payment only if the work done lasts for a pre-specified period.

#### **16. LAYING OVERLAYS OVER POTHoles WITHOUT RECTIFYING THEM IS UNSCIENTIFIC AS THE OVERLAY IS BOUND TO FAIL**

Recently there is an announcement in the press that the civic agency proposes to only overlay long stretches where pot holes are present without repairing the pot holes. It is surprising that the agency tends to overlook that the pot holes below such overlay are needed to be attended to first as without repairing them any overlay will not stand even for a very short period as the

failure will start at the location where pot holes existed and the money spent will be infructuous expenditure at the cost of the general public.

It is also the practice to go on overlaying the existing pavements even if they do not need an overlay leading to raising the road level above kerb lines or even plinth levels of adjacent buildings.

If the condition of the top layer really calls for an overlay due to structural or riding quality deficiencies, it is better to go in for milling alone and relaying or milling and recycling which would be more economical and also solve the problem of increasing level of top surface of the road. Recycling would also help in preserving scarce road aggregates.

## **17. UNACCEPTABLE PUBLICITY CLAIMS BY CIVIC AGENCY**

It is very common to hear claims from the civic agency that they do innovative works. For example, they call precast construction as magic when the technique has been in vogue for more than half a century. The agency claimed that the work would be completed within a month because of their magic work. Then, it was stated that they encountered utilities and shifting them would need more time before the magic could be performed. It is an irony that the so called experts did not anticipate utilities lying under their work area earlier, which even an untrained engineer, would look for, before starting work in a city like Bengaluru. Similar is the case with plastic road which they plan to try for the first time (!) in Bengaluru. May be they are not aware that IRC guidelines existed for several years on modified binders and several states already use the method. Some of the underpasses opened with a lot of publicity are now being found to be at wrong places or of inadequate width and depth needing modification. When additional funds are being spent for them, only the public money is wasted and none involved in their constructions are questioned for the wrong decisions.

Recently it was announced that the civic agency is to take up long lasting pavements with necessary roadside facilities in CBD areas. It is not clear what prevented them from going in for such pavements all these years. It is obviously their ignorance of our own national standards and codes of practice which they intentionally ignored and constructed public facilities of poor quality without caring for life and wasting public funds.

## **18. SAFETY OF ROAD USER IS ALWAYS IGNORED IN BENGALURU**

Another factor which affects the safety of road users in Bengaluru that is not cared for is the provision of proper signs and road markings. Even at the entry or exit of flyovers or underpasses, which are poorly lighted, there are no indications and also the side service roads suddenly deviate or merge with entry and exit points leading to frequent accidents. Similarly, at construction sites safety measures are totally ignored. Many a time workers and general public get injured or even get killed due to non-enforcement of safety measures at work sites. There would be no demarcation and no signs to indicate where these are located. At nights, the vehicles using the road would not know that they are entering a construction zone and may land in excavated pits endangering their lives. As per specifications, these are to be clearly indicated during the day time with flags and barricades and during the nights, provided with serial

coloured lights to indicate the boundary of work area, and beacons and adequate lighting are to be provided to clearly indicate that work is in progress.

Similarly, the medians, dividers and road humps provided as speed breakers (mostly at all and sundry locations of non - standard constructions) on most of the roads do not have any safety warners such as reflectors and markings. At nights with no visibility these are potential accident spots. It is seen that many have been injured or even lost their lives at these locations and at potholes and craters. The client, the consultants and the contractors should bear responsibility for such mishaps.

## **19. MISUSE OF HEAD LIGHTS WITH HIGH BEAMS**

It is also common to see vehicles, whether two wheelers or cars using high beam lights within the city and that too in crowded roads as in our city, blinding the drivers coming from the opposite direction. This would obviously lead to catastrophic accidents, especially since most of roads do not have central verges, but only dividers. It may be recalled that some years back, the authorities insisted on blocking the upper part of head lights to prevent accidents due to blinding of opposite direction drivers, which was discontinued suddenly. It is also common that high end cars use four or more head lights that too with different colours and the traffic police do not regulate them. The other serious offence committed by drivers who drink and drive, thus causing accidents almost daily and killing road users or killing themselves. Here it is to be emphasised that the police should only deal with offenders, and not harass all innocent drivers.

It is also the practice of drivers in Bengaluru to keep on honking making the other road users jump up losing control of the vehicle. The traffic police should pull up people honking unnecessarily, not only in No-Horn zones identified by them such as hospitals etc., but also in general. It may be added that unnecessary honking is not tolerated in other countries, and people get fined for such irresponsible behaviour on roads.

## **20. DRAINAGE**

The other aspect completely ignored is drainage. There is hardly any roadside storm water drains in any of the roads and wherever they exist, the depth and width are inadequate leading to water stagnation, which apart from causing inconvenience to public also flows over and damages asphalt pavements. Further, there is no regular maintenance of the drains, thus leading to blockage. Actually in other countries based on detailed topographic and aerial surveys combined with rainfall data flood maps are available for each of the roads based on which drainage designs are done and executed. Of course, in our country and especially in Bengaluru, it is too much to expect from our departments to adopt such rational methods to mitigate the perennial drainage problem. The construction of each layer of a road should be done after the surface levels are checked for each and approved to satisfy the slope and cross fall for facilitating draining of surface water as well as the thickness of the construction. This is how the construction is to be done, but it is a pity that neither the contractors nor the consultants or the clients are aware of the actual method of construction in Bengaluru.

The flooding of underpasses and the approaches flyovers/ elevated highways even under minimal rains clearly demonstrate the lack of knowledge and experience to mitigate this problem.

## **21. FAULTY TRAFFIC MANAGEMENT**

The traffic management in the city is also very faulty. Signalisation is not based on scientific designs and long waiting times at each junction is a common sight. Not even two successive signals are synchronised. Even when signals are provided, during peak hours they are switched off, and the police try to manage manually, defeating the very purpose of signals. If the signal had been scientifically designed there would be no necessity for such an approach, which is based on individual judgement and can never be satisfactory as compared to properly designed signal system. This way of traffic control can be seen daily on almost all junctions where vehicles pile up causing delays to the vehicles already crowding the roads. Further, in many junctions the signal phasing is such that the turning traffic is combined with straight traffic. This is causing conflict points which are likely to lead to accidents. Such arrangement is feasible only in roads having a separate lane for turning traffic (acceleration / deceleration lanes). But in our city with narrow roads and clustered traffic, we should never combine straight and turning traffic at the junctions. The other factor which should cause serious concern is the total disobedience of traffic rules by drivers of all vehicles who can indulge in all sorts of misbehaviour on roads, including jumping of red signals and do not show any concern for their own safety or for that of other road users. The driving ethics are vanishing day by day. Similar is the behaviour of pedestrians who are also very careless endangering the safety on roads. Another very critical aspect is that ambulances are not given right of way and even the police do not make any effort to clear the traffic for them. It is high time that both traffic police and the regional transport officers try to implement very strict measures to do away with such a serious problem. It is a sad state of affairs that even the police vehicles and government vehicles violate traffic rules very often.

Another critical factor which should be addressed urgently is the increasing number of accidents on our roads. Bad roads, drunken driving, rash driving, total disregard for traffic rules, poor regulatory methods by traffic police and licensing authorities are some of the reasons for increase in accidents. Buses and heavy trucks cause maximum accidents. The attention given to their regular maintenance is not sufficient. Also the drivers of these vehicles are not given the required rest before their next long distance trips. Speed governors are mostly non-existent. There have been fire accidents in passenger buses and deaths due to safety measures not being implemented.

It is also a common sight to see that heavy vehicles use fast lane blocking other light vehicles using them and force them to overtake from all sides and due to their visibility being blocked by the heavy vehicles, they tend to be accident-prone and many a time lives are lost. It must be ensured that in a two lane carriageway, the left lane is the normal driving lane and the right lane is the overtaking lane (till the vehicle crosses the immediate slow vehicle ahead, and should revert to the left lane). In the case of a three lane carriageway, the extreme left lane is for slow vehicles and heavy vehicles, the middle lane is the normal running lane and the right lane is for

overtaking. Though this is very basic and common practice everywhere, this system should be enforced in our country and our state.

It is to be accepted that in a city like Bengaluru, where traffic is chaotic with vehicles increasing day by day, traffic management is a herculean task. Therefore the efforts of the police force in this direction are to be appreciated. However, it is also to be mentioned that for managing the gigantic traffic problems the present set up of traffic police, which mainly consists of police personnel drawn from their other wings and deputed to manage traffic cannot succeed. The personnel with day to day experience may be useful in implementing traffic rules with their enforcement powers, but to approach the problem of traffic safety in a sustained manner, a long term vision is needed which can be obtained, only if they have exposure to some knowledge of traffic engineering and traffic safety.

For this, some of them are to be sent to training and refresher courses periodically to organisations imparting such training. In other countries the traffic police have in their cadre traffic engineers also, and in some cases, even doctorates of traffic engineering also work in the department who could be with uniform or even civilians. Any construction or repair activity on the roads can only be started after the drawings and methodology are submitted to the Director General of Traffic Police, who reviews and approves them in advance as he has several traffic engineers under him and if needed, he also co-opts experts for advice before decision making. He would also review the proposal of the construction agencies for traffic diversions during the construction period to ensure public and traffic safety. It is understood that the arrangements are only for the minimum period and the construction has to be completed within that period without any extension.

It is more important to meet the present and future challenges in ensuring safety on roads, to minimise fatalities on roads.

## **22. CONCRETE ROADS ARE NEEDED, BUT CONSTRUCTING THEM WITHOUT KNOWLEDGE AND EXPERIENCE, WITHOUT PROPER MACHINERY AND WITHOUT TOTAL QUALITY CONTROL WILL LEAD TO CRACKED ROADS WASTING PUBLIC FUNDS**

There is an announcement in the press that the state government is proposing to build cement concrete roads on a large scale. It is a good decision since concrete pavements have many advantages over the conventional bituminous pavements such as needing no maintenance, except for sealing of joints, and can serve for 40 to 50 years if properly designed and constructed. Also, as against bitumen which is obtained from imported crude, cement is manufactured indigenously with our own resources. Further heating of bitumen for mixing and laying is against green construction practice about which there is a lot of discussion and awakening recently in our country and with concrete pavements, no such constraint exists. Even in cement production, a lot of innovation has been carried out to minimise carbon emission.

Though the concrete pavements are costlier initially, considering the life cycle costs they would prove cheaper, since in the case of bituminous pavements, overlaying would be needed every 5 years. But it is to be emphasised that design and construction of concrete pavements is a

specialised job to be carried out with expertise both at contractor's level and the consultant and BBMP level. If not done with meticulous care, such pavements would crack on the first day of construction. However, as can be seen from some of the works done by BBMP recently, such expertise is not available and it would be waste of public funds if the works are awarded to inexperienced people who do not have any idea of how a concrete pavement is designed or constructed. For large scale usage, the contractors should have the required knowledge and expertise, with all the necessary machinery, equipment, tools and plants, with engineers having enough background and experience in design and construction, fully trained workers in adequate numbers as well as laboratory facilities to provide assured quality of work at every stage of construction. The consultant and BBMP should have engineers who have had full exposure to all the aspects of design and construction. There is also recent interest in constructing thin topping and ultra thin toppings to strengthen bituminous pavements in different conditions of distress While it is a useful technique, again expertise is needed to succeed with this type of construction also. It is important to properly assess the condition of the existing bituminous layers and decide the type of bonding needed between the topping and the bottom bituminous layer.

Concrete for pavements should be obtained from established RMC suppliers who could provide the required quality and who follow all standard procedures to ensure uniformity of quality of the concrete supplied. It is to be kept in mind, as already indicated, that there are scores of RMC suppliers in the city whose quality cannot be assured and the use of their concrete may lead to failures in the concrete pavements.

Recently, there has been tender notifications from BBMP about 350 in number, of the value of 20 crores or so including for concrete roads. It is surprising that the BBMP officials do not have any idea how concrete pavements could be constructed within this amount, as even a paver would cost more than a crore of rupees. Further providing steel formwork is mandatory unless slip form pavers are used. Further machines are needed for cutting joints at the appropriate times. It appears that they think that it is like filling up potholes with mud and debris as they normally do. It is for the benefit of all that such useless efforts are scrapped and public funds be saved.

### **23. CUTTING OF CONCRETE ROADS FOR UTILITIES WILL DESTROY THEM**

It is necessary to point out that cutting across newly laid pavements is a common practice in Bengaluru as mentioned earlier, but with concrete pavements unless ducts are provided initially, such practice would destroy the concrete slabs totally since there are several structural aspects as flexural action, which are beyond the perspective of the common people.

### **24. LACK OF ADEQUATE QUALITY CONTROL IN BITUMINOUS CONSTRUCTIONS**

While doing bituminous works, very little attention is paid by the contractor or the consultant and the client to ensure quality. It is doubtful whether proper mix designs are done for the different layers such as wearing course, binder course, and base course. The gradation of aggregates seems to be not being taken care of from the size of aggregates seen being used in the works. It is clear that the specifications are not being taken care of with regard to voids,

density, stability, compaction achieved, bitumen content in the mix, or even the temperatures of mixing, placing, compacting and the surface levels etc. Before starting work every day, cutting of the previous day's work to get straight edges using a diamond cutter is very necessary. Similarly, the lane edges should also be cut to avoid feather edge joints which get dislodged very fast. But such practice does not exist here and no contractor has been seen to possess or use a diamond cutter.

## **25. EARLY INTRODUCTION OF PROJECT MANAGEMENT SYSTEMS**

It is a sad state of affairs that no one in Bengaluru, except those in academic institutes, has any knowledge of Pavement Management Systems (PMS). In order to use the available limited funds judiciously, it is very essential that a PMS should be practiced so as to prioritise pavement works by BBMP, BDA, or PWD. Even small developing countries do have a system to compare different pavement options, based on a consideration of initial costs, maintenance costs, life cycle costs considering remaining life, etc. In USA, and in many European countries, funds are released for works only if a system is adopted to optimise network level, programme level and project level investments.

It is also to be mentioned that BMS, i.e. Bridge Management Systems are being introduced in many countries to plan new constructions as well as preservation of existing bridges by initiating timely maintenance measure.

## **26. PAVEMENT PRESERVATION AND ASSET MANAGEMENT**

Asset management has been gaining importance for the last several years. In order to reduce investments for new projects, it is necessary to preserve and protect the existing assets such as roads, bridges and other infrastructure, which had been built over the years with big investments of public money. Periodic maintenance of these structures would enhance their service life. But anybody can see that such a systematic maintenance is never done by our civic agency or for that matter, even by the PWD in respect of infrastructure under their domain. It is also clear that even routine maintenance is not done. Such attitude will only result in early damage to the structures and the assets will in due course become liabilities and call for huge funds for repair or reconditioning or even demolition and new construction. Therefore, the concerned authorities should take interest in preserving the assets on top priority.

## **27. SETTING UP A SEPARATE UNIT FOR DATA COLLECTION AND DATA MANAGEMENT**

A separate unit should be set up to collect information with regard to the present condition of a road, the year of construction, the pavement layers and thicknesses, the cost, any maintenance or repair done, the existing road levels, drainage provided and its adequacy, the temperature and rainfall conditions etc. The existing condition may be assessed by subjective rating (serviceability), by making measurements of crack length and width, rut depth, area of potholes, measuring riding quality using a bump integrator or profilograph, evaluating the present strength using falling weight deflectometer (FWD) and the information could be stored in computer and the data base made available to the Pavement Management System team for further processing and arriving at rational decisions regarding the treatment options.

## **28. APPLICATION OF ARTIFICIAL INTELLIGENCE OR KNOWLEDGE BASED SYSTEMS FOR PROBLEM SOLVING IN HIGHWAY AND TRANSPORTATION ENGINEERING**

The advent of artificial intelligence or knowledge based systems in different fields has opened up several applications including in highway and transportation, wherein the knowledge and expertise of experts in these fields could be digitised and used for problem solving. Models could be evolved from data bases and validated from the captured expertise and further corroborated by the intervention of experts available and used in both highway and traffic engineering, which in spite of the advances made over the years still have several dark areas needing attention. For this purpose, with Bengaluru's expertise in computer applications, the joint efforts of computer engineers with domain experts could be nurtured to make a mark in evolving and advancing in knowledge based systems pertaining to highways and transportation.

## **29. NEED FOR AN INDEPENDENT TENDER BOARD AS IN SOME OTHER COUNTRIES TO STOP FAVOURITISM IN TENDERING PROCESS**

The present tendering process appears to be not so transparent in spite of following E-tendering process. With a view to bringing complete transparency in tendering process, we may also consider an independent State Tender Board as is the practice abroad. Contracts above one crores could be handled by this board, having its own experts to look after every aspect of tendering, including review of consultant's proposals feasibility study, preliminary design, detailed design, drawings, tender documents, general and special specification, B.O.Q and pre-bid meetings, replies to queries, opening of tender, verification of bank guarantees, issue of work order, sorting out any disputes, etc. The Chairman of the Tender Board will have the rank of a state minister. The board will co-opt officials from the concerned departments while making decisions. The present system can be seen to lead to mal –practices and appears to favour particular consultants and contractors in spite of their not delivering projects in time and of good quality as per conditions of contract or good engineering practices. The above suggestion may seriously be considered if public is not to be cheated due to unhealthy practices.

## **30. THE NEED FOR CHANGE IN MINDSET OF USING OBSOLETE CONSTRUCTION METHODS**

It is daily experience of the public that works are carried out by the various civic agencies and other government agencies to following age old practices of construction which are obsolete even as per our own national standards, not to mention international standards which are almost a half century ahead of the practices here. In order not to waste public funds, the old mind set has to change. This observation is not further elaborated here since the narration in the earlier paragraphs throw light on the deficiencies of the present practices, and what needs to be done in the short term and on long term basis. The intention of the write up is to make the city and the state advance commensurate with modern day needs. In order to meet the expectations of our younger population who constitute majority, it is very necessary to break away from the past and prepare ourselves for changed work practices and ethics and project planning and administration.

It is also true that contracts are now continuing to be awarded to firms with very poor track record in carrying out original or repair works; by avoiding the accepted tendering process (which itself needs to be change in view of the flaws, as discussed in earlier sections). The present decision of the Karnataka Govt. to award road works of Rs. 243 crores without calling for tenders to its subsidiary, The Karnataka Rural Infrastructure Development Limited is also surprising since the organisation is already under scanner for submitting fake bills, very poor performance with many roads built by them either washed away or totally damaged in view of lowest quality work. Further it is learnt that they charge 11percent more than the tender price and then get the work done through BBMP, BDA, BWSSB contractors who have also never performed works of quality.

It is high time the Government comes out of the old ways which have miserably failed over last several years and continues wasting public funds doing bad quality work, spoiling its own image, especially in the eyes of the younger generation who form the majority of the population and who are well aware of how good works get done all over the world except in Bengaluru.

### **31. SERIOUS ACTION NEEDED TO ERADICATE CURRUPTION**

Last but not the least, the rampant corruption prevailing in construction activities, especially in the road sector in Bengaluru should be addressed very seriously to take corrective action so that people are fully benefitted from the money spent.