PROJECT MANAGEMENT CONSULTANCY FOR IMPLEMENTATION OF SMART CITY MISSION PROJECTS FOR MANGALURU CITY

DETAILED PROJECT REPORT – IMPLEMENTATION OF E-SMART SCHOOLS IN ALL GOVERNMENT SCHOOLS : INFRASTRUCTURE

Attachment to letter no. WTESL/2292/MSCL/345 dated 14.02.2019

The purpose of the Detailed Project Report is to provide details of various considerations made towards the elements proposed for the project as mentioned in the title above. It aims to give a basic design idea to all the stakeholders before proceeding for final design and estimates.

MANGALORE SMART CITY PROJECT

Lalbaug, M.G. Road, Mangalore

Mangaluru Smart City Limited (MSCL) 575003

12/02/2019

ISSUE AND REVISION RECORD

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0.3	13.02.2019	WTESL/LBI/ CDAC – Vikash Singh	Nitin Bhavvsar	Urvi Bhatt	3rd Version	

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ABBREVIATIONS

ABD	Area Based Development
BEO	Block Education Office
DPI	Department of Public Instruction
DPR	Detailed Project Report
GHS	Government High School
GLPS	Government Lower Primary School
GPUC	Government Pre-University College
GUPS	Government Upper Primary School
ICT	Information and Communications Technology
LMS	Learning Management System
MCC	Mangaluru City Corporation
MSCL	Mangaluru Smart City Limited
NCERT	National Council of Educational Research and Training
O&M	Operation and Maintenance
PC	Personal Computer
PMC	Project Management Consultant
RFP	Request For Proposal
SATS	Student Achievement Tracking System
SCP	Smart City Proposal
SI	System Implementer
SPV	Special Purpose Vehicle
ToT	Transfer of Technology
UAT	User Acceptance Testing
USB	Universal Service Bus

LIST OF REFERENCE CODES, STANDARDS, AND GUIDELINES

The following documents have been referred in preparing the document

1. DPR
   - http://www.apts.gov.in/procurepdf/DPR_TemplateV1.2%20-7.pdf
   - http://mhrd.gov.in/sites/upload_files/mhrd/files/Student-Teacher%20Ratio.pdf
   - http://www.ncert.nic.in/programmes/education_survey/index_education.html
2. Educational indicators proposed by National Council of Educational Research and Training (NCERT):
   - http://www.ncert.nic.in/programmes/education_survey/index_education.html
3. Civil & Infrastructure upliftment work
   - Schedule of Rate 2016 – 2017 PW, P & IWTD, South Zone Bangalore.
   - Mode Of Measurement - IS 1200 Part 1 to 28
4. Sports Infrastructure
   - Inputs received from Mr. Pradeep D'Souza, Deputy Director, Department of Youth and Sports.

Executive Summary

1 - Mangaluru Smart City Proposal

This section includes the SCP proposals in brief, which is summarized below:
Mangaluru was a proud Participant in second round of this Challenge and now aspires to translate the vision i.e. the broad components across both 'area-based' and 'pan-city' heads identified in the Smart City Proposal (SCP) into Reality.

Mangaluru Smart City Proposals (SCP) is considered as Area Based Development Proposals (ABD) and Pan City Proposals. The SCP has identified various projects/sub projects to be taken up under ABD and Pan City Proposal. Following Figure shows the ABD area considered under Mangaluru Smart City Proposal and

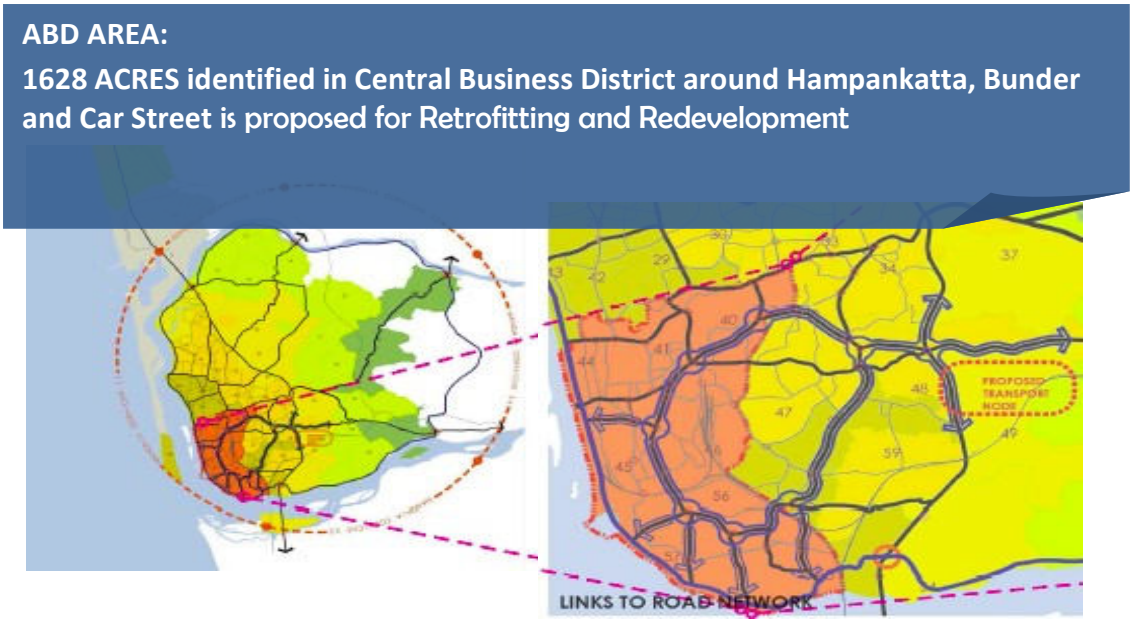


Figure 1 ABD area considered under Mangaluru Smart City

E-Smart School: Scoping of the Proposals under Mangaluru Smart City

Transforming the existing Government School in ABD Area into the Smart Schools has been envisaged under the Mangaluru Smart City Mission. In this regard, Mangaluru Smart City Ltd (MSCL) intends to implement the proposals related to the project.

The project was initially perceived aligned to the vision of developing the "E-Smart" Solutions in the Government Schools. The Identification of Government Schools for implementation of proposal carried out restricting to the coverage of ABD Area.

Detailed site reconnaissance surveys for the shortlisted schools were carried out. It was noted during the detailed site reconnaissance, that the school lack the desired quality of basic infrastructure

Discussions were held with the SPV and it was decided to allocate fund from the project and include the comprehensive Architectural and Civil Infrastructure Upliftment as part of the project

Thus the project entails proposals for comprehensive Architectural and Civil Infrastructure Upliftment as well as introduction of Smart ICT Solutions/function in Government School and has been perceived for implementation in 2 parts:

- ***A: Architectural and Infrastructure Improvements/Upliftments***
- ***B: ICT/ Smart Solutions***

E-Smart Schools under Mangaluru Smart City

As per the details received from MSCL/MCC, there are thirty-one (31) Primary schools and twelve (12) No. of secondary schools governed by Government in Mangaluru City[1].

After various discussions with MSCL, the following Government Schools falling under ABD Area have been identified for implementation of the project.

- GUPS, (Government Upper Primary School) Basthigarden, Ward No-41
- GUPS, (Government Upper Primary School) Neereshwalya, Ward No-45
- GUPS, (Government Upper Primary School) Pandeshwara, Ward No-46
- GLPS, (Government Lower Primary School) Hoigebazar, Ward No-57
- GHS, (Government High School)Hoigebazar, Ward No-57
- Government Practicing HS, Mangaluru, Ward No-46
- GUPS, (Government Upper Primary School) Bunder (Urdu), Ward No-44
- GHS, (Government High School) Bunder (Urdu), Ward No-44
- Primary School, Jyothi Circle, Balmatta, Ward No-40
- Secondary School Jyothi Circle, Balmatta, Ward No-40
- GUPS, (Government Upper Primary School) Bolar, Ward No-58
- GUPS, (Government Upper Primary School)Bolar West (Urdu), Ward No-58
- Govt. Womens Pre-university college Rathabeedi, Carstreet Ward No-43

[1] ***http://www.schooleducation.kar.nic.in/html/binfra.html. Navigate to Mysore Division → Dakshina Kannada and the list is downloaded under primary school list and secondary school list.***

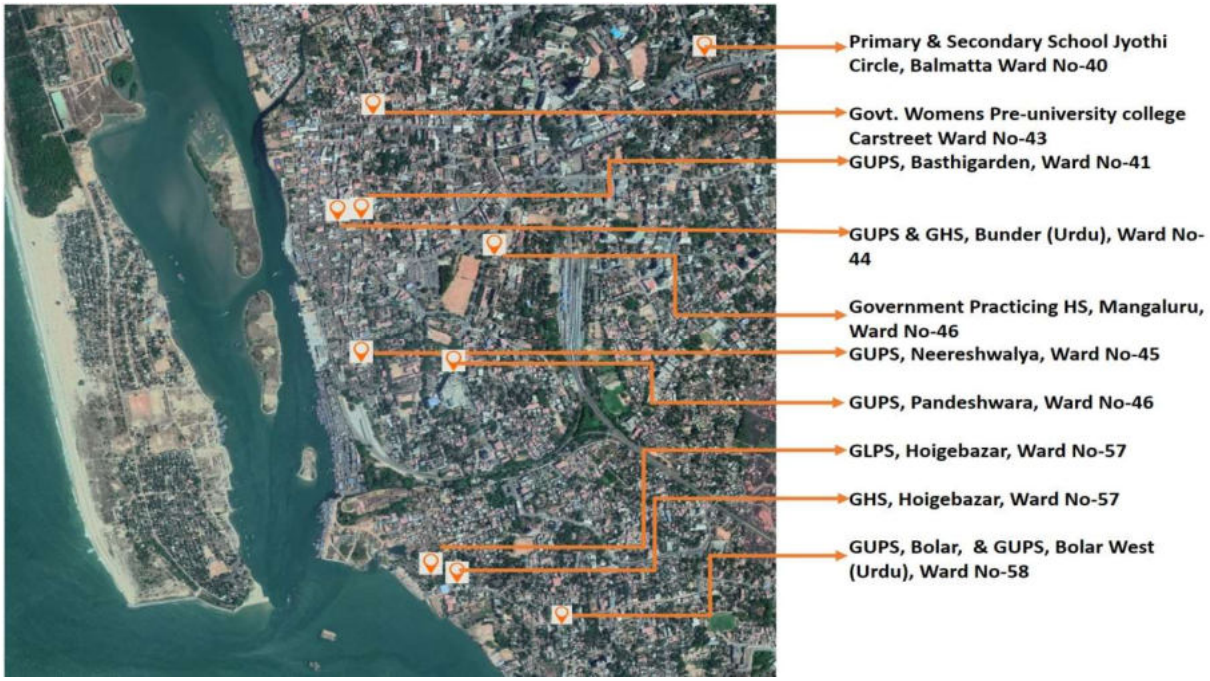
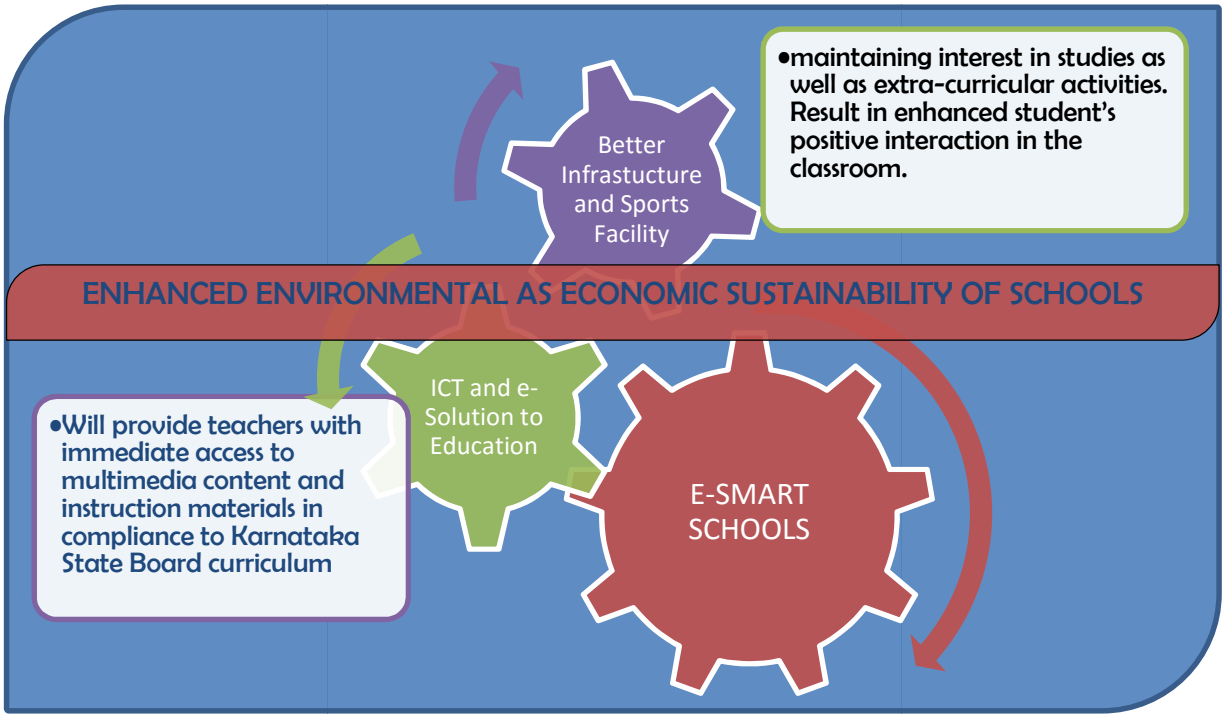


Figure 2 : Locations of Proposed Schools for Development as E- Smart School

2 - Project Vision, Goal and Smart Objectives:

This section includes the details on Project vision, goal of the project and Smart Objectives, which is summarized below:

Project Vision



The E-Smart solutions to be taught in government schools will be a complete solution intended to help teachers in in improving students' academic performance with the help of Smart solution through better infrastructure, lab, sports & ICT.

Goal of the Project

- To establish and facilitate the environment to promote the usage of ICT in Government Schools. Critical factors of such an enabling environment include widespread availability of access devices, connectivity to the Internet and promotion of ICT literacy.
- To enable every student to become "Digitally Literate".
- To achieve the goal of the 'Khelo India' programme which has been introduced by Government of India to revive the sports culture in India
- To train the school teachers in effective delivery of education by using IT tools for teaching with latest methodologies & aids.
- To ensure the availability of safe and clean basic amenities in school like Drinking water, toilets, drainage etc
- To develop the open reading plaza designed to encourage read-aloud & group reading habit which will inculcate the skill of public speaking & confidence.
- To encourage and develop health and fitness idea in student
- Compulsory ICT Education for all students.
- Promote critical thinking and analytical skills by developing self-learning. This shall transform the classroom environment from teacher-centric to student-centric learning.

3 - E Smart School: Site Reconnaissance and Situation Analysis

This section of the report covers existing Situation Analysis including Site Reconnaissance carried out by the team, Benchmarking of current state of Infrastructure vis-à-vis NCERT Indicators for education and benchmarking of available facilities, Building Measurement Survey carried out pertaining to the project.

Preliminary Site Assessment

Initial Site Assessment of the schools was carried out. The main objective was to carry out the condition assessment of these schools with respect to Infrastructure and sports facility. This includes covers existing Situation Analysis including Site Reconnaissance carried out by the team, Benchmarking of current state of Infrastructure vis-à-vis NCERT Indicators for education and benchmarking of available facilities, Building Measurement Survey carried out pertaining to the project.

The survey was done against following indicators:

1. Type of School	2. Total number of Boys and Girls in each standard
3. Standards Covered	4. Total number of toilets for boys and girls
5. Subject Taught	6. Drinking water Facility
7. Total number of Teachers	8. Current status of ICT in schools
9. Total number of Students in each school	10. Observations regarding Infrastructure availability

Overall Inference

- Lack of Proper civil & sports infrastructure in the schools surveyed.
- Lack of maintenance and age of existing structures
- Absence of school furniture & sports equipment's like chairs, table, and library racks etc.
- Tube Lights present in classrooms do not provide sufficient lighting which makes reading difficult for students to see what is written on the blackboard.
- Lack of provision of basic amenities such as ceiling fan and water purifier by local education bodies. Most of the Computers, water purifier, Ceiling Fans and notebooks are donated by PSU organizations such as State Bank of India, Canara Bank; private organizations Mphasis HP, Educomp and NGO & charitable organizations.
- Poor Student Enrollment.
- Poor Teacher to Subject to Classroom ratio.
- Multiple e-governance initiatives across entire Karnataka State related to education each in different silo where end-user like teachers and education officials need to visit to upload statistical information.
- Data entry of attendance of teachers, students and students' performance is done on Student Achievement Tracking System http://sts.karnataka.gov.in/STS/# .It is an online Portal where teachers have to periodically update the details about the student's attendance and student's performance based on the template given in the portal.

Benchmarking of current State of Infrastructure vis-à-vis NCERT Indicators

For the implementation of ESmart School in government schools, a number of critical factors have to be taken into consideration before investing in hardware and software infrastructure. Following are the educational indicators proposed by National Council of Educational Research and Training (NCERT):[2]

1. Indicators of Demography (School-Age Population)
2. Indicators of Access to Schooling
3. Indicators of Participation
4. Indicators of Equity
5. Indicators of Infrastructure
6. Indicators of Quality Inputs
7. Indicators of Finance
8. Indicators of Efficiency

Survey was carried out based on the following indicators:

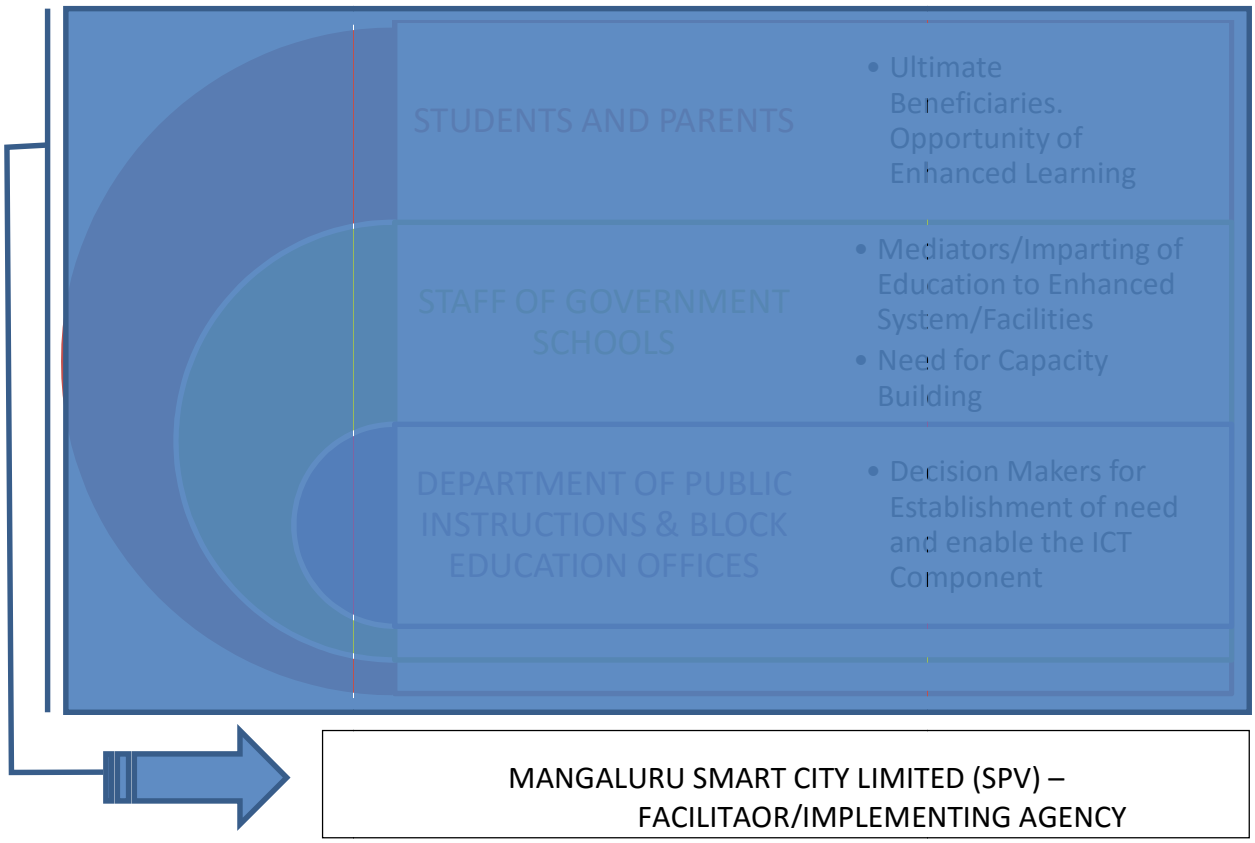
1. Indicators of Infrastructure
2. Indictors of Quality Inputs

[2] ***http://www.ncert.nic.in/programmes/education_survey/index_education.html***

4 - Stakeholder's Engagement

This section includes the process and details of stack holders' engagements. The details are summarized below:

The identified Stakeholder's for the project are as mentioned above



PMC, in coordination with MSCL and MCC, conducted stakeholders meeting during the month of July – 2018 – on 7th July 2018 and 11th July 2018, where in the proposals were explained to the education department officials as well as Principals of each school and Teachers of the schools. The attendance sheet s attached hereto as Annexure-A. It was discussed that, the schools shall be forwarding their requirements in writing, which they forwarded to MSCL(Annexed hereto as Annexure- B). Based on the feedback from local education authorities, the feasibility of implementing the smart school in schools were identified, evaluated and after discussion with MSCL, the same were finalised. Before arriving to the final conclusion, consideration of the teacher student ratio, physical infrastructure of school, which can result in success, or failure of the E-smart School, were also taken care of. Recently, another Stakeholders meeting was also convened on 08.02.2019, the attendance sheet is attached at Annexure-A

Salient features infrastructure & ICT component of these school are as listed below:-

1. Smart Class in almost all the class room accept Rotary English medium School, Kinnigolli with 6 classroom
2. Atal Tinkering lab in two school - Shri Vyasa Maharshi Vidya Peeta,Mulki & Govt. Compound High school Volakadu
3. Science lab for all three major stream of science
4. Audio Visual hall
5. Common Library & computer lab
6. CC Cameras installed in the all the classrooms, common area, toilet corridor entry and monitoring will be done in HM chamber
7. Biometric attendance system for teachers
8. School infrastructure developed school fund
9. Shri Vyasa Maharshi Vidya Peeta, funded by donor and complete new building has been done on donation fund
10. Sports, cultural activities & science/art workshop are the active part of school curriculum etc.
11. Shri Vyasa Maharshi Vidya Peeta, Mulki school provide milk & mid-day meal to all student free.
12. Infrastructure Development
13. School entrance area & circulation is paved/interlock tile.
14. All the grounds having softscape.
15. School building blocks are maximum G+2.
16. Computer class for all student both theory & practical.
17. Smart Class features
    - Time : As per school timing as all class are equipped
    - Teaching Subjects : As per the state board and NCERT syllabus.
    - Vendors : TeachNext, Educomp, Mahamahi foundations Manipal & Pre loaded CD with 5 Year AMC.

    Facilitated with Atal tinkering lab in two schools Shri Vyasa Maharshi Vidya Peeta,Mulki & Govt. Compound High school Volakadu

    Improvement Envisaged for the Schools

    - Proper Civil Infrastructure for the setup of smart classroom should be in place, the present civil status of government school should be surveyed by civil authorities

whether minor repairs can be undertaken or complete upliftment of whole infrastructure to make good for future use with longer life.

- Proper electrical & lighting mechanism should be in place so as the students do not get spectacles at younger age while accessing the computer for long hours.
- Proper plumbing and drinking water/ RO facility for all students and staff
- Drainage and water logging issues should be addressed with complete survey for all weather.
- The project should be rolled out in phases - based on the health condition of the school; readiness and acceptance of the ICT by academic staff of the school as well as block education office.
- The academic staff of the school should be ready to cooperate with the implementation agency i.e. system implementer for sharing the feedback for preparation and updation of e-content.
- The officials of the block education office should be prompt enough to keep the record of the ICT inventory issued to school and should log the records.
- In case of any service and support is required for the repair of IT hardware, quick action should be taken so as to resolve the issue as soon as possible.

5 - E Smart School: Proposals for Mangaluru Smart City

This chapter includes the proposals, the main features being:

Infrastructure Upliftment / New Facilities: -

- Conservation architecture of existing heritage Mangalore roof tile. By retrofitting, cleaning, & replacing.
- Redevelopment of all boundary wall with complete removal of vegetation and dampness. All boundary wall to be provided with painted with some portion of wall with graffiti art showcasing the social message related to education for all.
- Beautification through landscaping and plantation. Brick/stone circular tree guard, Grass turfing, under planting, setback landscaping, etc are few option depending upon the location and area size.
- Development of barrier free all weather circulation inside school campus with proper pedestrian walkway and vehicular entrance, exit & drop off area/route.
- External development of all open area with proper drainage and zero water logging issue

- Storm water RCC drains to resolve water logging issue during monsoon seasons. We can have saucer drain in low discharge area & Rcc drain to take care of high volume water discharge.
- Redevelopment of all toilet blocks as per the particular school requirements for students and teachers with proper lighting, water and security facility.
- Treatment & remedial of all unwanted biological growth on buildings walls and roof. With permanent solution of waterproofing and anti-root/anti-fungal treatment.
- Redevelopment of existing cultural stage and flag post as a amphitheater for all cultural, sports and exhibition purpose.
- Timber work improvement, painting and treatment against termite/weathering for all wooden doors, windows, railing & floorings
- Overall renovation and upliftment of buildings. Ex paint, plaster, waterproofing, door window & architectural improvements for retaining and improving aesthetics of the building.
- Drinking water facilities for all building blocks as per existing capacity.
- Improvement of existing lighting wiring, fixtures for proper illumination and lux value required for healthy reading writing.
- Provision of high mast light pole of external illumination and night sports competition
- Green and Black chalkboard in classroom
- Name plate, signage's & school entrance signage

Sports facilities: -

- Outdoor hard surface sport ground that houses a basketball cum tennis
- Grass turf court for badminton, kho kho, kabaddi & volleyball court.
- Mini track and field ground for athletic sports.
- Sports seating gallery and podium as per the available space.
- Procurement of sports equipment's

Other facilities

- ICT based Smart Class rooms.
- Open gym & yoga center to encourage health and fitness idea in student and community.
- Redevelopment of existing stage with roofing work for all weather use.
- Open reading plaza designed to encourage read-aloud & group reading habit.
- Parking area in some school as per existing use.

Smart Class Room Facilities:

With the use of interactive modules such as videos, and presentations as a medium of learning, students get to understand complicated concepts with ease. It has helped in

increasing their interest and curiosity level. Will help student have learnt how to make presentations, their confidence level will go up. The digitally interactive environment encourages even shy or hesitant students to participate better in classroom discussions. The teachers get helped to explain subjects while here the education is via videos, pictures, and presentations. Learning is now more exciting and interesting. An audio-visual description of any topic is more understanding & interesting. It gives more clarity on the subject; the pictures and videos shown to student help in remembering it even after the class." These digital classrooms have helped increase student attention; teachers maintain that there has been a reduction in absenteeism and school dropouts. It has also improved student familiarity and comfort with technology.

Process Re-Engineering (Suggestive/ Policy Related)

After the survey done by PMC with Municipal Commissioner and BEO officials the following suggestions may be considered for the possible merging of the schools:

1. Merging of infrastructure & sports facility for GPUS & GHS Bunder
2. Merging and sharing the infrastructure, lab & other facility of primary & secondary school Balmatta

The merging may facilitate the effective upgradation and subsequent use of facilities by the students and teachers. BEO officials to decide based on the government schemes, constraints and guidelines.

Process Re-engineering

Sr. No.	Activity Name	As -Is Process	To- Be Process
1	Infrastructure Upgradation	Lack of Sports & Lab facility	After the infrastructure up-gradation, we can have all weather working outdoor sports ground for Basketball, Badminton, Volley Ball etc. As well uplifted civil infra of existing labs & library
2.	External Development & Landscaping	Water logging, blocked circulation, lack of define vehicular movement etc	With the introduction of concept of landscaping we will have zero water logging, barrier free circulation, defined drop off – pick up area etc.
3.	Reading plaza & Open Gym	Indore class room reading available	Open reading plaza designed to encourage read-aloud & group reading habit. Open yoga center to encourage health and fitness idea in student

Sr. No.	Activity Name	As -Is Process	To- Be Process
3.	Online Education Content	Textbooks can be downloaded online through http://ktbs.kar.nic.in/New/index.html#!/	With the introduction of e-content in smart classroom, supporting study material such as animation videos will be available to students for tough topics.
4.	Teachers Information Software	Teacher's information software http://ktbs.karnataka.gov.in/TeachersInfo/ serves as a repository about teachers where service record of all government teachers is stored.	Student Management Software will provide information about subjects and topics taught by teacher in class.
5.	Student Tracking System	Student Achievement Tracking System http://sts.karnataka.gov.in/STS/# is an online Portal where teachers have to periodically update the details about the student's attendance and student's performance based on the template given in the portal. The portal is an intermediate entity between school academic staff and education	System Implementer SI can develop Student management software which will use the same format used by teachers to upload about the student's details, attendance and academic progress report. The portal will act as an intermediate entity between school academic staff and parents and guardians.

The Proposals for each school based on the above is described in Chapter -5, and illustrated with drawings of existing and Proposed intervention, supported by 3D images of the respective school.

6 - Specifications work of Non-SOR Work

This chapter deals with the detailed specification for the NON SOR items like PU Coating System has been described in the Chapter-6, which is concisely mentioned here.

PU-COATING System:- Green Label certified, low VOC as per ISO, solvent free, flexible polyurethane coating system providing a colourful watertight, hardwearing surface for exterior and other trafficable floors consisting of 3 component, solvent free, Polyurethane based primer/body coat/binding agent having solid content of approximately 100% which accepts silica aggregate scatter to produce an anti skid surface as well as 2 component, coloured, flexible polurethane coating of having 100% solid contents to seal the aggregate layer where UV light staibility chemical resistance property to Petrol, Diesel, Antifreeze, Hydraulic Fluids, Chlorides & Battery Acids etc. Technical profile having Fire resistance, Slip Resistance, Abrasion Resistance. HDPE Sheet below the VDF flooring/foundation in order to avoid floor coating damage due to negative hydrostatic pressure. It Has zero fading life of almost 10 years.

7 – General Instructions

This Section mainly Include:

1. Contractor's Suprindence
2. Checking of the Contractor's Temporary Works design

3. Site and work area details along with Use and Access to the site, barricads, signages, clearance of the site
4. Surveys to be undertaken, Safety and care of the works, testing to be done, methodologies etc.

8 - Drawings

This section includes the data of following, which has been attached as part – II of the DPR:

1) Existing Plans Prepared based on Building Measurement done
2) Proposed Plans
3) 3D Views: Before and After

9 - Budget and Cost Estimates:

This Section include budget for each school as well as detailed calculation for various items, the same is summarized below:

Sr.No.	School List	Amount in Rs.
1	Dakshina Kannada Zilla Prathamikta Hera School, Pandeshwara, Ward-46	9,823,545
2	Govt. High School, Urdu, Bunder, Ward 46	9,385,062
3	Govt. Higher Secondary School, Hoigebazar ward-57	5,808,677
4	Lower Primary School, Hoigebazar, Ward-57	4,980,811
5	Gov. Upper Primary School, Neereshwalya, Ward-45	3,084,924
6	Block Education Office and Govt High School, Bolar	15,064,948
7	Govt.primary and secondary school and College, Balmatta, Ward-40	19,866,738
8	Govt. Practicing School, Opp. Maidan Road near Railway Station	11,261,875
9	Govt.Primary School, Bastigarden, Ward-41	5,670,004
10	Govt. Women's Pre-university College, Rathabeedi, Car Street	11,297,024
	Total Cost	**96,243,608**
	Add Tender Premium @ 5%	4,812,180
	Add Contingency @ 3%	2,887,308
	GST @ 12% on SOR & Non SOR	8,368,178
	GST @ 18% on Market Rate	3,907,362
	Adminstrative charges,Miscellaneous and rounding off (LS)	11,364
	Grand Total	**116,230,000**

Infrastructure Upliftment Cost Under Each Sub Head Of Infra Work						
Infra Components (A)	**Building works In Cr**	**Electrical Works In Cr**	**Plumbing Works In Cr**	**External Development In Cr**	**Sports Equipments In Cr**	**Total Amount in Rs. Cr**
Total Cost - A	**6.96**	**0.45**	**0.21**	**1.99**	**0.022**	**9.62**
Other Cost - B						
(i)Add Tender Premium @ 5%	0.35	0.02	0.01	0.10	0.0011	**0.48**
(ii)Add Contingency @ 3%	0.21	0.01	0.01	0.06	0.0006	**0.29**
(iii)GST @ 12% on SOR & Non SOR						**0.84**
(iv)GST @ 18% on Market Rate						**0.39**
(iv) Adminstrative charges,Miscellaneous and rounding off (LS)						0.0011
Total Cost - B	**0.80**	**0.28**	**0.26**	**0.40**	**0.247**	**2.00**
Grand Total (A + B)	**7.76**	**0.73**	**0.48**	**2.39**	**0.27**	**11.62**

10- Conclusion and Recommendation

Conclusion:

Schools, being the second home, serve a number of purposes in a child's life. From boosting their confidence to making them learn the importance of team work and socialization, schools do it all. Away from home, schools become the place for children to spend their maximum time. Kids are sent to school considering the fact that there is an experienced hand to guide them and also a safe environment promoting growth. We also accept the fact that infrastructure plays a budding hand in creating a favorable environment for a child's growth.

- Sending children to a school where the building looks rundown and playgrounds need work can never be a good idea. Can parents feel safe sending their child to an environment like that? Well, even children won't feel satisfied in a place that

lacks physical comfort and other basic facilities. Let's read between the lines to understand the impact of a school's infrastructure on the overall growth of students. However, there are times when irrespective of poor infrastructure, students perform meritoriously. People may argue that physical space is secondary and concentration is what matters but researchers and psychologists suggest that environmental factors can increase the academic performance and motivate attendance.

- It's proven that overcrowded and stressful environment can affect the learning capabilities of children. The site for educational institutions like schools is a crucial concern as noise and temperature levels are said to affect the understanding levels in students. Physical conditions can leave both positive and negative effects on the students' all-inclusive development. School buildings, classrooms, playgrounds and libraries are the most important aspect of school infrastructure. Spacious and refurbished buildings and well- ventilated classrooms are a must in schools. Well-equipped labs enable them to perform lab activities more effectively. Facilities like extracurricular workshops, libraries, halls, games equipment, assembly area and proper sanitation facilities are some of the infrastructure essentials that every school should provide to its students. Properly planned school infrastructure is an out-and-out key factor in effective teaching and learning. This can also be an encouragement for the school faculty.
- The quality of nation’s political, social and economic future will depend on the capabilities of their young generation. Smart schools have been proposed as a solution to increase the capabilities of the new generation in the era of ICT. Recently, many smart schools have been established in India. The aim of this study is to compare smart training method and traditional training method in learning-retention processes. A Smart School is an educational establishment that adopts instructional processes and educational management practices that foster systemic changes that are intended to enable learners to surmount the challenges posed by the information technology era. Smart schools have been systemically reinvented in terms of teaching and learning practice and school management in order to prepare students for the Information Age. In the Information Age, a Smart School will evolve over time continuously developing its professional staff, educational resources and its administrative capabilities to adapt to changing condition, while continuing to prepare student for his/her future life. Smart schools will seek to make learning more interesting, motivating, stimulating and meaningful. Smart schools are using an appropriate mix of learning strategies to ensure mastery of basic competencies and promote holistic development, accommodate individual different learning styles, to boost

performance and foster a classroom atmosphere that is compatible with different teaching-learning strategies. Smart School pedagogy will seek to make learning more interesting, motivating, stimulating and meaningful for students. It is also involve students mind, spirit and bodies in the learning process

In the modern era of rapid changes of information and technology, the process of teaching and learning is changing. Using ICT in education has been proposed to be led to increase in education quality, expansion of learning chances and accessibility of education beyond the classroom.

Smart training has led not only to higher learning scores, but the higher retention of the learned materials. It could be proposed that teachers in smart schools could be able to make the inappropriate and inflexible content of textbooks more attractive for students. Also, the teacher's role as the sole speaker is changed into a director where the former is resulted in presenting educational materials by emphasizing the memory and speed which is boring for students.

Recommendation

Yes, smart schooling is the answer to making learning interesting, purposeful and giving a direction to a dream and pathways to achieve the same, Undoubtedly most schools recognize this need and are working towards it. The advent of digital boards, online tools, and programmes, the media links and modules are some of the basic smart school tools. But the need is far greater and below listed are some ways of changing the game.

- **Design spaces in school buildings for flexibility and adaptability of use** – for example, classrooms that can be converted to auditoriums. Consider new ways of organizing the classroom to facilitate collaboration and creativity (eg 'didactic corners' or round tables and circular seating instead of fixed desks and chairs) while also ensuring space for privacy and reflection when needed.
- **Use the school as a multi-purpose, cultural utility** that provides resources and services to the wider community such as libraries, internet access, performance/arts spaces, playgrounds, gardens, etc.
- **Consider building designs with shared spaces and central patios/courtyards** surrounded by classrooms. The central patio can serve as a meeting point, auditorium and play area.
- Consider the furniture, finishing, floors, ceilings, toilets, sanitary, safe drinking water and plantings as a **'third teacher'**
- Understand how students, teachers and parents commute to schools and ensure safe, multi-modal options are available to all families. Ensure pedestrian

safety and accessibility in the vicinity of schools (traffic calming, reduced speed limits, crosswalks and crossing guards) **Provide safe drop offs and circulation inside/outside school compound**

- **App-based Learning:** This tool is immensely useful when one needs access to mobile learning resources. Whilst you are on the move, you can access the app and revisit concepts taught in various disciplines namely maths, sciences, social studies etc. Besides being easily available it also provides a learner-friendly atmosphere and could be helpful as it also addresses the need for differential learning strategies.
- **Video-based Learning:** Giving a face to the name, helps remember someone. Same is with teaching and learning today. Instead of written theory, a very easy and impactful way to reach the child's mind is the use of video-based lessons. Adopting the digital learning way to impart education makes understanding easy, especially so for a visual learner. Today the tools available in this medium are so vast that you can use it to enhance any learning activity. Right from using it in class, to showing virtual experiments which don't require learners to use labs, teaching art through this medium and many more. Teachers lectures can be recorded too, which can be used to help students who can't attend school due to various reasons or students who don't understand can revisit lectures at a later date.
- **Use of Artificial Intelligence in Schools:** Digital content is created using AI with the same proficiency as that of humans and is extremely popular given the short period of time that they are created in. Digital textbooks or digital learning interfaces are user-friendly and child-friendly. Digital lectures, video conferences help better the understanding of a child. Artificial Intelligence helps here by automating the grading methodology which also makes it more accurate.
- **Virtual Lecturers:** The virtual facilitator is a new phenomenon that responds just like the same actual teacher. Although one can never replace a teacher-learner interaction in class this definitely is a great substitute for various contingencies like teacher absenteeism, illness etc. Once fine-tuned, these will be very popular in the classrooms.

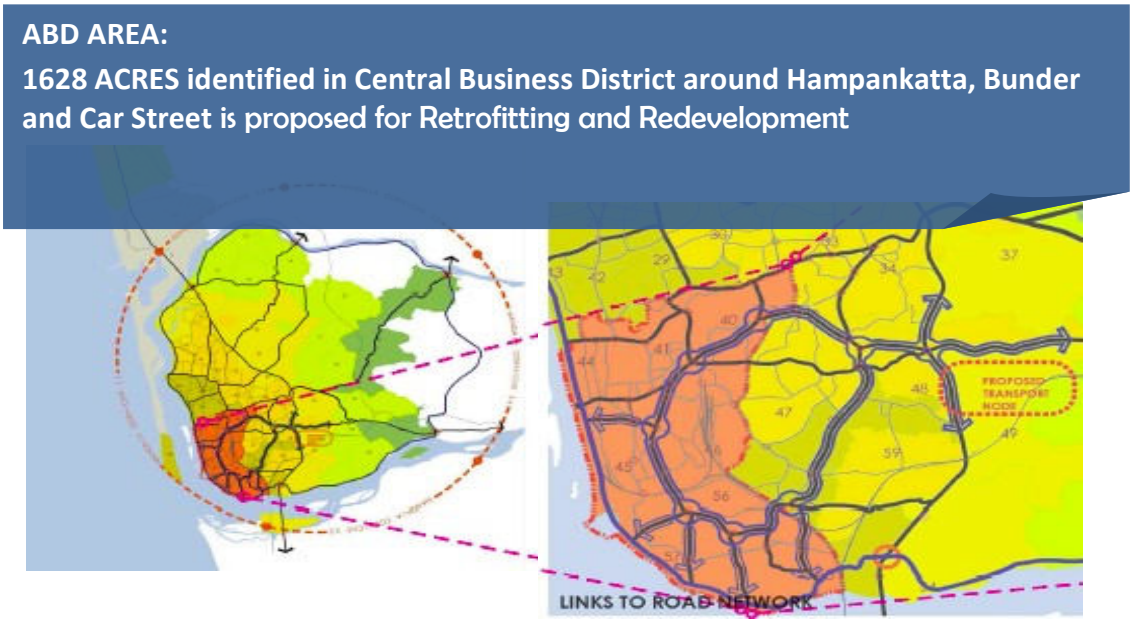
1 INTRODUCTION

1.0 Mangaluru Smart City Proposal

Mangaluru was a proud Participant in second round of this Challenge and now aspires to translate the vision i.e. the broad components across both 'area-based' and 'pan-city' heads identified in the Smart City Proposal (SCP) into Reality.

Mangaluru Smart City Proposals (SCP) is considered as Area Based Development Proposals (ABD) and Pan City Proposals. The SCP has identified various projects/sub projects to be taken up under ABD and Pan City Proposal. Figure below shows the ABD area considered under Mangaluru Smart City Proposal and

Figure 3 ABD area considered under Mangaluru Smart City



1.1 E-Smart School: Scoping of the Proposals under Mangaluru Smart City

Transforming the existing Government School in ABD Area into the Smart Schools has been envisaged under the Mangaluru Smart City Mission. In this regard, Mangaluru Smart City Ltd (MSCL) intends to implement the proposals related to the project.

The project was initially perceived aligned to the vision of developing the "E-Smart" Solutions in the Government Schools. The Identification of Government Schools for implementation of proposal carried out restricting to the coverage of ABD Area.

Detailed site reconnaissance surveys for the shortlisted schools were carried out. It was noted during the detailed site reconnaissance, that the school lack the desired quality of basic infrastructure

Discussions were held with the SPV and it was decided to allocate fund from the project and include the comprehensive Architectural and Civil Infrastructure Upliftment as part of the project

Thus the project entails proposals for comprehensive Architectural and Civil Infrastructure Upliftment as well as introduction of Smart ICT Solutions/function in Government School and has been perceived for implementation in 2 parts:

- ***A: Architectural and Infrastructure Improvements/Upliftments***
- ***B: ICT/ Smart Solutions***

The document/ DPR covers Part A: Architectural and Infrastructure Improvements/Upliftment of the project.

Part B: ICT/Smart Solutions are covered under separate DPR

1.1.1 E-Smart Schools under Mangaluru Smart City

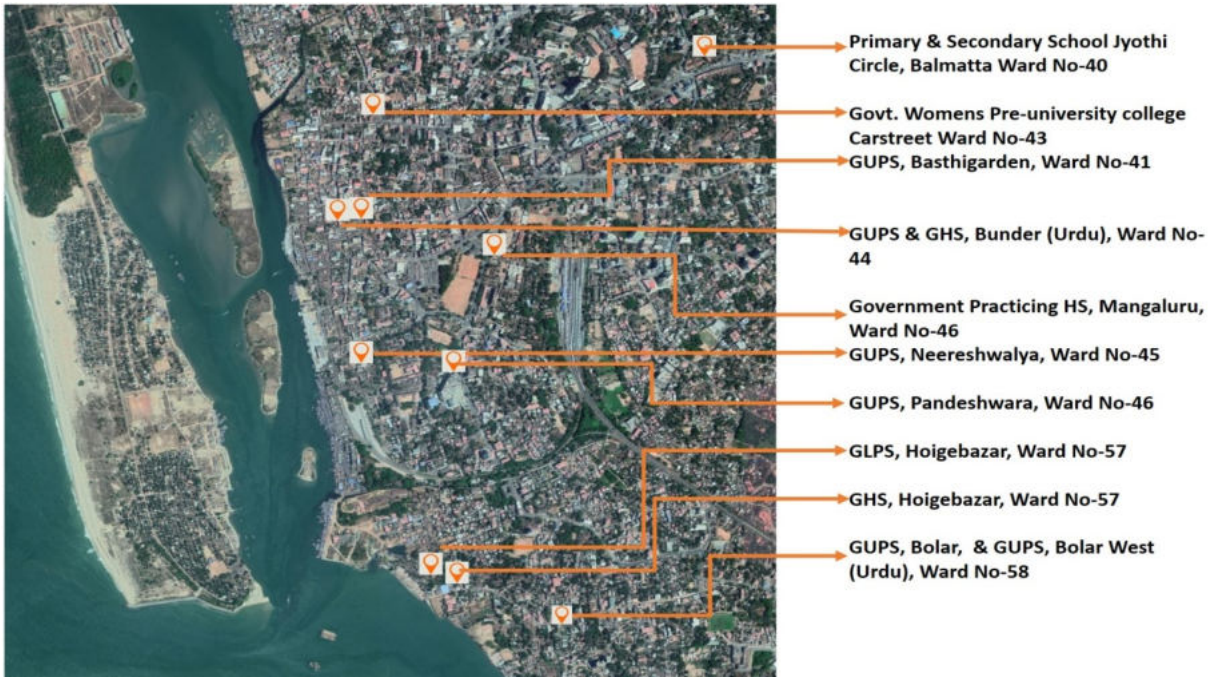
There are thirty-one (31) No. of Primary schools and twelve (12) No. of secondary schools in Mangaluru City[3].

The following Government Schools falling under ABD Area have been identified for implementation of the project.

- GUPS, (Government Upper Primary School) Basthigarden, Ward No-41
- GUPS, (Government Upper Primary School) Neereshwalya, Ward No-45
- GUPS, (Government Upper Primary School) Pandeshwara, Ward No-46
- GLPS, (Government Lower Primary School) Hoigebazar, Ward No-57
- GHS, (Government High School)Hoigebazar, Ward No-57
- Government Practicing HS, Mangaluru, Ward No-46
- GUPS, (Government Upper Primary School) Bunder (Urdu), Ward No-44
- GHS, (Government High School) Bunder (Urdu), Ward No-44
- Primary School, Jyothi Circle, Balmatta, Ward No-40
- Secondary School Jyothi Circle, Balmatta, Ward No-40
- GUPS, (Government Upper Primary School) Bolar, Ward No-58
- GUPS, (Government Upper Primary School)Bolar West (Urdu), Ward No-58
- Govt. Womens Pre-university college Rathabeedi, Carstreet Ward No-43

[3] ***http://www.schooleducation.kar.nic.in/html/binfra.html. Navigate to Mysore Division → Dakshina Kannada and the list is downloaded under primary school list and secondary school list.***

Figure 4 : Locations of Proposed Schools for Development as E- Smart School



1.2 Objective of the Report

The purpose of the Detailed Project Report is to provide details of various considerations and the elements proposed for the Architectural and Infrastructure Improvements/Upliftments proposed under Identified Schools to be developed as Smart School. It aims to give a basic design idea to all the stakeholders before proceeding for final design and estimates.

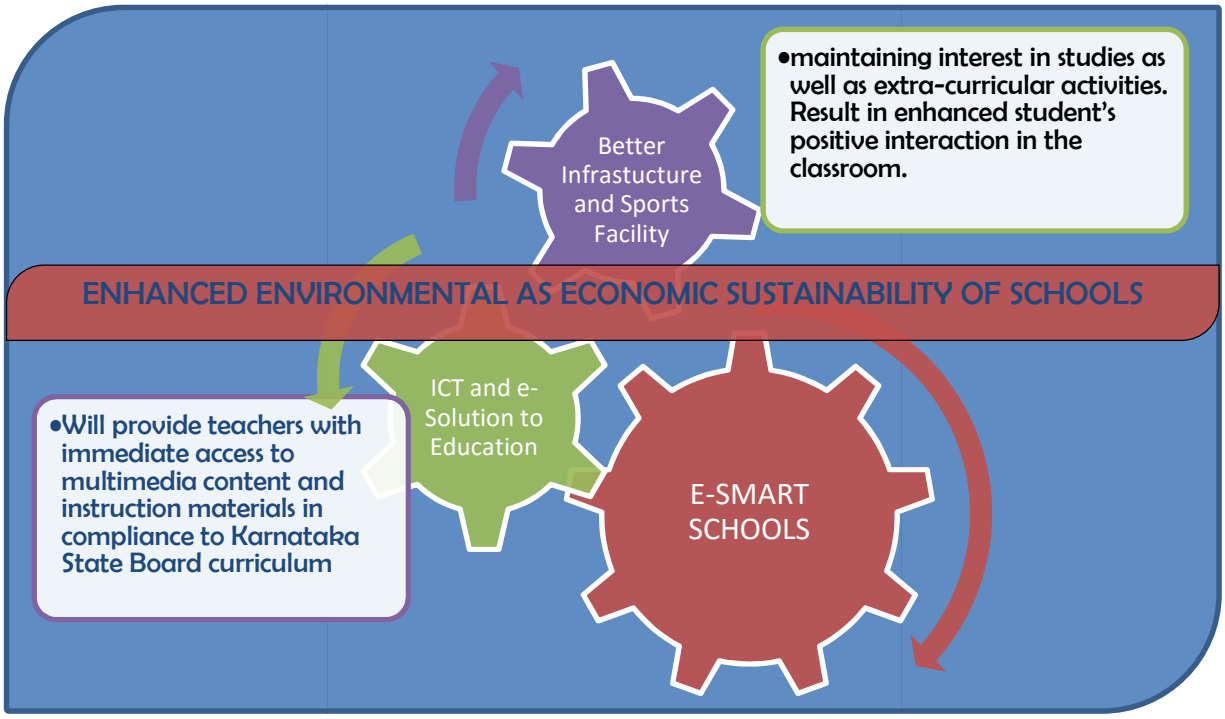
1.3 Structure of the Report

This report is organized as follows:

- Chapter 1 – Introduction
- Chapter 2 – Project Vision, Goal and Smart Objectives
- Chapter 3 – E Smart School: Site Reconnaissance and Situation Analysis
- Chapter 4 - Stakeholder's Engagement
- Chapter 5 – E Smart School: Proposals for Mangaluru Smart City
- Chapter 6 – Specifications work of Non-SOR Work
- Chapter 7 – General Instructions
- Chapter 8 – Drawings
- Chapter 9 – Budget and Cost Estimates
- Chapter 10- Conclusion and Recommendation
- Annexure- A Stack-holders' representation

2 PROJECT VISION, GOAL AND SMART OBJECTIVES

2.0 Project Vision



The E-Smart solutions to be taught in government schools will be a complete solution intended to help teachers in in improving students' academic performance with the help of Smart solution through better infrastructure, lab, sports & ICT.

2.1 Goal of the Project

- To establish and facilitate the environment to promote the usage of ICT in Government Schools. Critical factors of such an enabling environment include widespread availability of access devices, connectivity to the Internet and promotion of ICT literacy.
- To enable every student to become "Digitally Literate".
- To achieve the goal of the 'Khelo India' programme which has been introduced by Government of India to revive the sports culture in India
- To train the school teachers in effective delivery of education by using IT tools for teaching with latest methodologies & aids.
- To ensure the availability of safe and clean basic amenities in school like Drinking water, toilets, drainage etc
- To develop the open reading plaza designed to encourage read-aloud & group reading habit which will inculcate the skill of public speaking & confidence.
- To encourage and develop health and fitness idea in student
- Compulsory ICT Education for all students.
- Promote critical thinking and analytical skills by developing self-learning. This shall transform the classroom environment from teacher-centric to student-centric learning.

2.2 Smart Objectives

S.M.A.R.T refers to the acronym that describes the key characteristics of meaningful objectives, which are Specific, Measurable, Achievable, Realistic and Time Bound

Specific: To uplift overall infrastructure of school campus & implement ICT in classrooms so as to make the learning process more interesting and productive.

Measurable: Exposure to modern amenities, new facility & ICT techniques used inside and outside smart classroom will impart analytical skills & grasping power to students.

Achievable: Playing sports & modern labs facility will inculcates team spirit, develops strategic & analytical thinking, leadership skills, goal setting and risk taking. The subject knowledge of teacher can help the understanding process of difficult topics in simpler way through ICT.

Realistic: Students will get used to the ICT and advent new information which would reflect their outlook in resolving subject problems.

Time Bound: The initial setup of the ESmart School and requirement gathering for content development should be done before the commencement of next academic year of the school.

3 E Smart School: Site Reconnaissance and Situation Analysis

Assessment of existing Status of Infrastructure and Services in the identified schools is pre-requisite to propose solutions for achieving the vision of the project. This section of the report covers existing Situation Analysis including Site Reconnaissance carried out by the team, Benchmarking of current state of Infrastructure vis-à-vis NCERT Indicators for education and benchmarking of available facilities, Building Measurement Survey carried out pertaining to the project.

3.1 Preliminary Site Assessment

Initial Site Assessment of the schools was carried out. The main objective was to carry out the condition assessment of these schools with respect to Infrastructure and sports facility. The survey was done against following indicators:

1. Type of School	2. Total number of Boys and Girls in each standard
3. Standards Covered	4. Total number of toilets for boys and girls
5. Subject Taught	6. Drinking water Facility
7. Total number of Teachers	8. Current status of ICT in schools
9. Total number of Students in each school	10. Observations regarding Infrastructure availability

3.1.1 GUPS, Basthigarden, Ward No-41

- **Type of School:** **Primary**
- **Standards Covered:** 1st to 5th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers:** Two -2

- **Total Number of Students :** 17
- **Toilets:**

Boys	Girls	Physically Disabled
1	1	1

- **Water Purifier Drinking Water:** Yes Donated
- **Computers:** Two Desktops present – One is Working
- **Other Observations** CCTV surveillance is required in school premises. A report about miscreants doing illegal activities in school premises is registered in North Police Station.

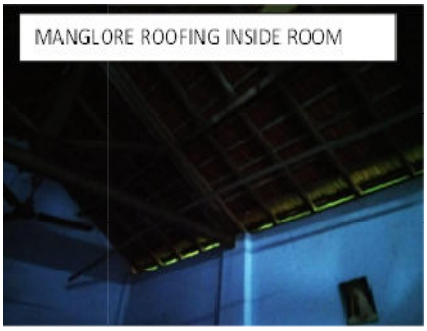
3.1.2 GUPS, Neereshwalya, Ward No-45

- **Type of School:** **Primary**
- **Standards Covered:** 1st to 7th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers :** Three - 3
- **Total number of students :** 14
- **Toilets:**

Boys	Girls
1	1

- **Water Purifier Drinking Water:** Donated
- **Computers:** No
- **Other Observations** -

3.1.3 GUPS, Pandeshwara, Ward No-46



- **Type of School:** **Primary**
- **Standards Covered:** 1^{st} to 7^{th}
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science

- **Total Number of Teachers:** Four -4
- **Total Number of Students :** 77
- **Toilets:**

Boys	Girls
1	3

- **Water Purifier Drinking Water:** Yes Donated
- **Computers:** Yes Donated
- **Other Observations**

Basic of Computers that is drawing in ms paint, typing in word and excel is taught.
Textual material replaced by learning cards.
Learning sequence is broken into the smallest possible units.

Physical Infrastructure:

- Mini Library and Science Lab needs to be set up.
- Flooring and Roof of Dining Hall needs to be repaired.
- Easy foldable Partition needs to be present between the classes.
- Painting is required.

Sports Infrastructure:

- School has won many accolades in Kabaddi.

Sports Facility Provision Suggestion: Kabaddi Ground + Coaching

3.1.4 GLPS, Hoigebazar, Ward No-57

- **Type of School:** **Primary**
- **Standards Covered:** 1st to 5th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers:** Two -2
- **Total Number of Students:** 16
- **Toilets:**

Boys	Girls	Physically Disabled
1	1	1

- **Water Purifier Drinking Water:** Yes
- **Computers:** No
- **Other Observations** School building in dilapidated state

Physical Infrastructure:

- Electrical fitting needs to be set up.

- Cost of Electrical maintenance was worked out (Rs. 50,000) by the school authorities and proposal was submitted to the block education office.

3.1.5 GHS, Hoigebazar, Ward No-57

- **Type of School:** **Secondary**
- **Standards Covered:** 8th to 10th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers:** 7
- **Total Number of Students:** 40
- **Toilets:** Yes entire building is constructed
- **Water Purifier Drinking Water:** Yes
- **Computers:** Yes 10 laptops donated by Mphasis HP in 2006-07, out of which 2 are in working condition
- **Other Observations** 6th and 7th Standards are present in Bolar school.

Physical Infrastructure:

- Water pressure in tap is quite low
- Water leakage from ceiling in Dining room of the school

Sports Infrastructure:

- Badminton and Basket Ball courts setup + Coaching schedule could be established.
- Kabbaddi courts setup + Coaching schedule could be established.

3.1.6 Government Practicing HS, Mangaluru, Ward No-46

- **Type of School:** **Secondary**

- **Standards Covered:** 8th to 10th Standard
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers:** Eight -8
- **Total Number of Students:** 37
- **Toilets:**

Boys	Girls
6	6

- **Water Purifier Drinking Water:** Yes
- **Computers:** Yes
- **Other Observations:** Total number of classrooms -3
  ICT Lab has been setup -10 desktops are allocated out of which four are in working condition.
  Basics about Computer such as Word, Excel, and Paint are taught to students.
  Teachers have to periodically upload the attendance on student tracking system developed by Infosys across Karnataka State. Internet connectivity is provided

Physical Infrastructure:

- Proposal for redevelopment of school has been sent to Block Education Office.

Sports Infrastructure:

- Nehru Maidan is used for sports related activities.
- Basket Ball court, Volley ball, and Athletics activities can be setup.

3.1.7 GUPS, Bunder (Urdu), Ward No-44

- **Type of School:** Primary
- **Standards Covered:** 1st to 7th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science, Urdu
- **Total Number of Teachers:** Four -4
- **Toilets:**

Boys	Girls
1	1

- **Water Purifier Drinking Water:** Yes
- **Computers:** No

▪ **Other Observations**	Total number of classrooms -7 Laptop is required for teacher staff for making data entry about student details in Student Management System.

3.1.8 GHS, Bunder (Urdu), Ward No-44

- **Type of School:** **Secondary**
- **Standards Covered:** 8th to 10th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science, Urdu
- **Total Number of Teachers:** Seven -7
- **Total Number of Students:** 70
- **Toilets:**

Boys	Girls
5	5

- **Water Purifier Drinking Water:** Yes
- **Computers:** Yes
- **Other Observations:** Laptop as well as projector is present.
10 desktops are donated by Educomp which are not in working condition.
Students are taught basics in Word, Excel and Paint.
Computer Theory and Practical exam each of 50 marks is conducted.

Physical Infrastructure:

- No proper toilets are present for girl students in GUPS school.
- One can deploy the eLite eToliet.

Sports Infrastructure:

- Common Play ground is present between two schools which is approximately of size 20 m * 50 m.
- Football and Hockey Nets can be set up on either sides of playground.

3.1.9 *Primary School, Jyothi Circle, Balmatta, Ward No-40*

- **Type of School:** **Primary**
- **Standards Covered:** 1st to 7th Standard
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science

- **Total Number of Teachers I:** Four -4
- **Total Number of Students:** 35
- **Toilets:**

Boys	Girls
1	1

- **Water Purifier Drinking Water :** Yes. donated by State Bank of India (SBI).
- **Computers:** No
- **Other Observations**

School Building in dilapidated state

School Building Roof is leaky. Buckets are kept in class room so that the water from the roof doesn't make the floor wet. The school building is in very bad state. Water gets choked in toilet. Current civil work undergoing with iron rods kept in open has made the movement of children across the classroom a risky affair.

There are no chairs for teachers and students are made to sit on ground due to lack of benches. Poor lighting is present in classroom which makes students impossible to see what is written on blackboard.

3.1.10 Secondary School Jyothi Circle, Balmatta, Ward No-40

- **Type of School:** **Secondary**
- **Standards Covered:** 8th to 10th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers :** 8
- **Total Number of Students :** 103
- **Toilets:** 30
- **Water Purifier Drinking Water:** Two
- **Computers:** Two
- **Other Observations**

This school is selected out of 100 schools in Karnataka under National Skill Qualification Framework.

Students have to opt for any of the two courses:

Course 1 : Hindi Language.

Course 2 : Beauty/Wellness and HealthCare.

3.1.11 GPUC, Balmatta, Ward No-40

- **Type of School:** **Higher Secondary**
- **Standards Covered:** 11th to 12th
- **Subjects Taught:** PCM-Physics, Chemistry, Maths, Biology, Kannada, English, Sanskrit, Hindi
- **Total Number of Teachers:** Nineteen -19
- **Total Number of Students :** 770
- **Toilets:**

Girls
5

- **Water Purifier Drinking Water:** Yes
- **Computers:** Yes (10-15)
- **Other Observations**

Special mid-term classes conducted for SC/ST students.
Total 15 computers are present.
Short term courses are required :

- ✓ English Communication
- ✓ Personality Development
- ✓ IT/ITES
- ✓ Career guidance
- ✓ Pharmacy
- ✓ Architecture

Physical Infrastructure:

- Teacher's toilet is required. Place for the construction for toilet is identified.
- Dome Roof needs repairing and heritage structure preserved.
- Water clogging issue is common in entire Jyothi Circle Balmatta Area.

Sports Infrastructure:

- Common play grounds are present in the premises.
- One ground between pre-university school and library buildings (approximately of size 35 m * 20 m) has a requirement of building a share as specified by the school. The covered Badminton court is to be setup in the same structure along with a Table Tennis table set up.
- Other playground is bigger and has basketball poles in the ground. The ground could be readied for Basketball, Volleyball and Throw ball along with the proper coaching schedule for the girls.

3.1.12 GUPS, Bolar, Ward No-58


INSIDE SCHOOL CAMPUS


INDOOR STAGE


MANGALORE TILE ROOFING

- **Type of School:** **Primary with Upper Primary**
- **Standards Covered:** 1st to 7th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers:** 4
- **Total Number of Students:** 52
- **Computers:** Four
- **Other Observations** Ground 20m x 30m.

3.1.13 GUPS, Bolar West (Urdu), Ward No-58

- **Type of School:** **Primary with Upper Primary**
- **Standards Covered:** 1st to 7th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science
- **Total Number of Teachers:** 3
- **Total Number of Students:** 25
- **Computers:** Three
- **Other Observations** Ground 20m x 30m.

3.1.14 Govt. Women Pre-University College, Car Street, Ward No-43

- **Type of School:** **High School**
- **Standards Covered:** 8th to 10th
- **Subjects Taught:** Kannada, English, Hindi, Maths, Social Studies, Science, Drawing and Physical Education.
- **Total Number of Teachers:** 8
- **Total Number of Students:** 44
- **Computers:** Basic Computer operations how to use MICROSOFT Excel, WORD, PowerPoint is being taught.
- **Other Observations** Mid day meal food is provided by ISCKON Foundation Akshay Patra. Drinking Water is available. Volleyball and Kabbadi court is present in premises.

3.1.15 Govt. PU College Women Car Street, Ward No-43

- **Type of School:** **Govt PU Girls College**
- **Standards Covered:** 11th and 12th
- **Subjects Taught:** Kannada, English, History, Economics, Political Science, Sociology, Business Studies, Accountancy, Physics, Chemistry, Mathematics, Biology
- **Total Number of Teachers :** 11
- **Total Number of Students:** 226
- **Computers:** Not available for Students
- **Other Observations** Volleyball Ground is present. ICT Course is not conducted from the past three years. Dedicated Laboratories for conducting Physics, Chemistry and Biology are available. Library is present on 1st floor but no librarian is appointed. CCTV Cameras are installed in every classroom and Monitor and DVR is present in Principal Room.14 Toilets are provided to students. One Toilet for Principal, One toilet for Supporting staff and two toilets for teaching staff. TALP training program was imparted to teachers under State govt initiative which would help teachers in teaching students through projector.

3.2 Overall Inference

- Lack of Proper civil & sports infrastructure in the schools surveyed.
- Lack of maintenance and age of existing structures
- Absence of school furniture & sports equipment's like chairs, table, and library racks etc.
- Tube Lights present in classrooms do not provide sufficient lighting which makes reading difficult for students to see what is written on the blackboard.
- Lack of provision of basic amenities such as ceiling fan and water purifier by local education bodies. Most of the Computers, water purifier, Ceiling Fans and notebooks are donated by PSU organizations such as State Bank of India, Canara Bank; private organizations Mphasis HP, Educomp and NGO & charitable organizations.
- Poor Student Enrollment.
- Poor Teacher to Subject to Classroom ratio.
- Multiple e-governance initiatives across entire Karnataka State related to education each in different silo where end-user like teachers and education officials need to visit to upload statistical information.
- Data entry of attendance of teachers, students and students' performance is done on Student Achievement Tracking System http://sts.karnataka.gov.in/STS/# .It is an online Portal where teachers have to periodically update the details about the student's attendance and student's performance based on the template given in the portal.

3.3 Benchmarking of current State of Infrastructure vis-à-vis NCERT Indicators

For the implementation of ESmart School in government schools, a number of critical factors have to be taken into consideration before investing in hardware and software infrastructure. Following are the educational indicators proposed by National Council of Educational Research and Training (NCERT):[4]

9. Indicators of Demography (School-Age Population)
10. Indicators of Access to Schooling
11. Indicators of Participation
12. Indicators of Equity
13. Indicators of Infrastructure
14. Indicators of Quality Inputs
15. Indicators of Finance
16. Indicators of Efficiency

Survey was carried out based on the following indicators:

3. Indicators of Infrastructure
4. Indictors of Quality Inputs

3.3.1 Indicators of Infrastructure

Student Classroom Ratio (SCR)

Definition: Average number of pupils (students) per classroom in primary/upper primary/secondary schools in a given school-year.

Calculation Method: Divide the total number of pupils enrolled in primary / upper primary / secondary schools by the total number of classrooms in primary / upper primary / secondary schools in a given school-year.

Formula:

$SCR^t = (E^t / C^t)$

Where:

SCR^t = Student classroom ratio for primary/upper primary/secondary schools in school year t.
Et = Total enrolment in primary/upper primary/secondary schools in school-year t.
Ct = Total number of classrooms in primary/upper primary/secondary schools in school-year t.

Percentage of Schools Having x Classrooms

Definition: The number of schools of a given category having x classrooms (x = 1, 2, 3, …,n; where n is the maximum number of classrooms in a school belonging to given category) expressed as a percentage of total number of schools in that category.

[4] ***http://www.ncert.nic.in/programmes/education_survey/index_education.html***

Calculation method: Divide the number of schools of a given category having x classrooms (x = 1, 2, 3, …, n) by total number of schools in that category, and multiply by 100.

Formula:

$$\%SWC^{c}_{x} = (SWC^{c}_{x} / TS^{c}) * 100$$

Where:

$\%SWC^{c}_{x}$ = Percentage of schools having x classrooms (x = 1, 2, 3, ..., n) in school category c.
SWC^{c}_{x} = Number of schools of category c having x classrooms.
TS^{c} = Total number of schools in category c.

Percentage of Schools Having Toilets

Definition: The number of schools of a given category having toilet is expressed as a percentage of total number of schools of that category.

Calculation method: Divide the number of schools of a given category having toilet by total number of schools of that category, and multiply by 100.

Formula:

$$\%ST^{c} = (ST^{c} / TS^{c}) * 100$$

Where:

$\%ST^{c}$ = Percentage of schools of category c having toilet.
ST^{c} = Number of schools of category c having toilet.
TS^{c} = Total number of schools in category c.

Percentage of Schools with Girl's Toilet in a Given School Category

Definition: The number of schools of a given category having girl's toilet expressed as a percentage of total number of schools of that category.

Calculation method: Divide the number of schools of a given category having girl's toilet by total number of schools of that category, and multiply by 100.

Formula:

$$\%SGT^{c} = (SGT^{c} / TS^{c}) * 100$$

Where:

$\%SGT^{c}$ = Percentage of schools of category c having girl's toilet.
SGT^{c} = Number of schools of category c having girl's toilet.
TS_{c} = Total number of schools in category c.

3.3.2 *Indicators of Quality Inputs*

Percentage of Schools Having Mother Tongue as a Medium of Instruction at a Given School Stage

Definition: The number of schools having mother tongue as a medium of instruction at a given school stage is expressed as a percentage of total number of schools having that stage.

Calculation method: Divide the number of schools having mother tongue as a medium of instruction at a given school stage by total number of schools having that stage, and multiply the result by 100.

Formula:

$\%SM^t_c = (SM^t_c/S^t_c)$

Where:

$\%SM^t_c$ = Percentage of schools having mother tongue as a medium of instruction at school stage c (primary or upper primary or secondary) to total number of schools having that stage in school-year t.

SM^t_c = Number of schools having mother tongue as a medium of instruction at school stage c in school-year t.

St_c = Total number of schools having school stage c in school-year t.

Pupil-Teacher Ratio

Definition: Average number of pupils (students) per teacher at a specific level of education in a given school-year.

Calculation method: Divide the total number of pupils enrolled at the specific level of education by the number of teachers teaching pre-dominantly at that level.

Formula:

$PTR^t_h = (Et_h/ Tt_h)$

Where:

PTR^t_h = Pupil-teacher ratio at level of education h in school-year t.

E^t_h = Total number of pupils or (students) at level of education h in school-year t.

T^t_h = Total number of teachers teaching pre-dominantly at level of education h in school-year t.

Remark: A teacher is to be classified according to the stage at which she/he is predominantly teaching, i.e., the stage of education at which maximum time is devoted. If a teacher is teaching at more than one stage of education and devoting equal time at all the stages, then she/he is to be classified at the highest stage at which she/he is teaching.

****Note only Two indicators are calculated for the implementation of eSmart School as the main stake holders of this program are Teachers and Students.***

Indicative Figures will help in deciding the approval of investment in setting up the ICT

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Government of India
Ministry of Human Resource Development

09-February-2017 16:51 IST

Student-Teacher Ratio

The Right of Children to Free and Compulsory Education (RTE) Act, 2009 in its Schedule lays down Pupil Teacher Ratio (PTR) for both primary and upper primary schools. At primary level the PTR should be 30:1 and at the upper primary level it should be 35:1. The Rashtriya Madhyamik Shiksha Abhiyan (RMSA) framework stipulates that the PTR at secondary level should be 30:1.

As per Unified District Information System For Education (UDISE) the PTR at national level for elementary schools is 24:1 and for secondary schools it is 27:1. The PTR in most of the States and UTs is found to be satisfactory. However, since some schools have lesser teachers than the required number, it is clear that while there are sufficient teachers, the main issue is their correct deployment.

Globally, there are variations in the optimum number of students taught in a particular class and as such the data is not uniformly comparable. Data from the UNESCO Institute of Statistics on PTR in primary schools shows that India has a national PTR comparable to countries with similar social-economic indicators.

The recruitment, service conditions and redeployment of teachers are primarily in the domain of respective State Governments and UT Administrations. However, the Central Government through the flagship programmes of Sarva Shiksha Abhiyan (SSA) at elementary level and Rashtriya Madhyamik Shiksha Abhiyan (RMSA) at secondary level provides assistance to the State Governments and UTs for additional teachers to maintain appropriate PTR as per the prescribed norms for various levels of schooling.

The Central Government has been consistently pursuing the matter of expeditious recruitment and redeployment of teachers with States and UTs at various fora. Advisories on this issue have also been issued to States and UTs from time to time.

This information was given by the Minister of State (HRD), Shri Upendra Kushwaha today in a written reply to a Rajya Sabha question.

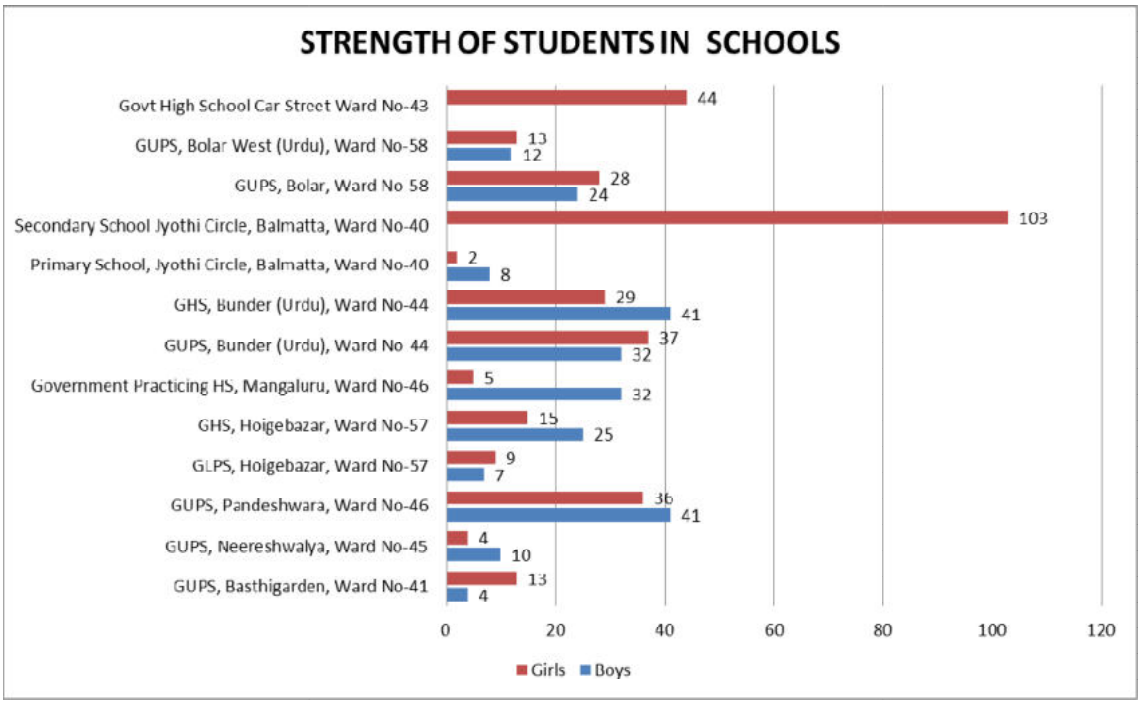
*****

GG/RT/RK/

Infrastructure in each classroom based on the Students Teacher Ratio.

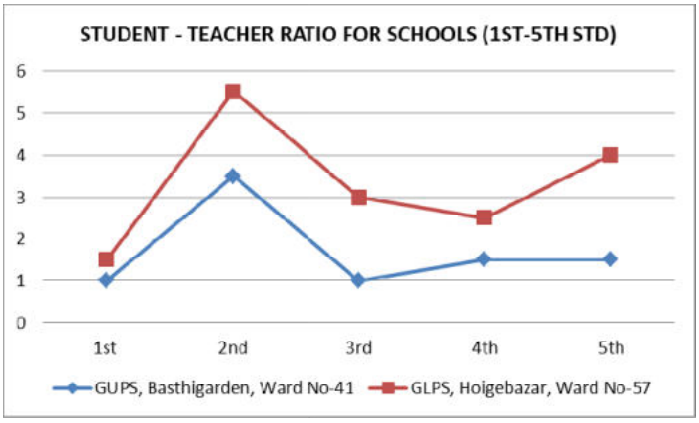
Figure 5 : RTE Act Student Teacher Ratio

Strength of Students

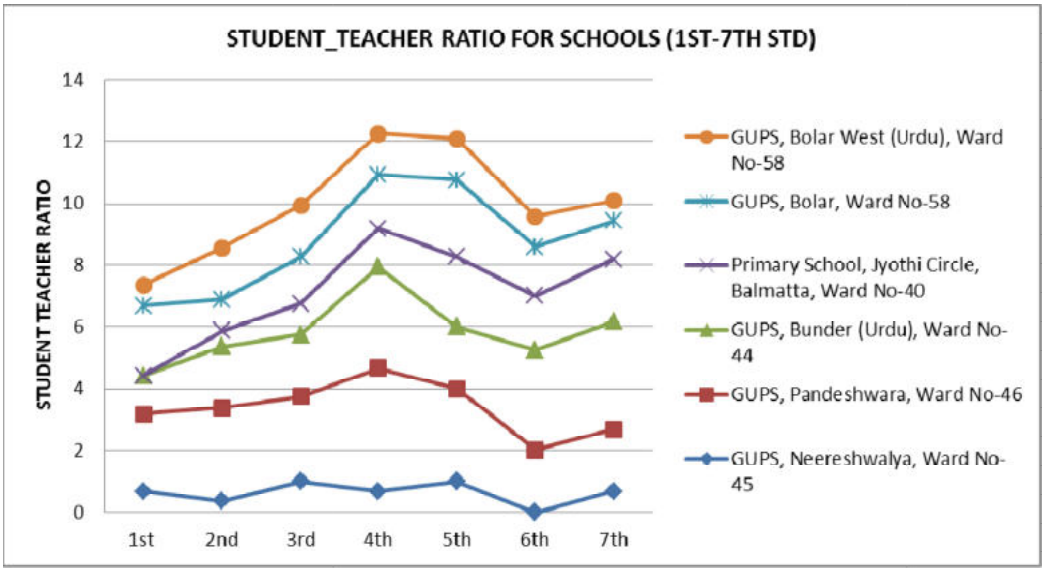


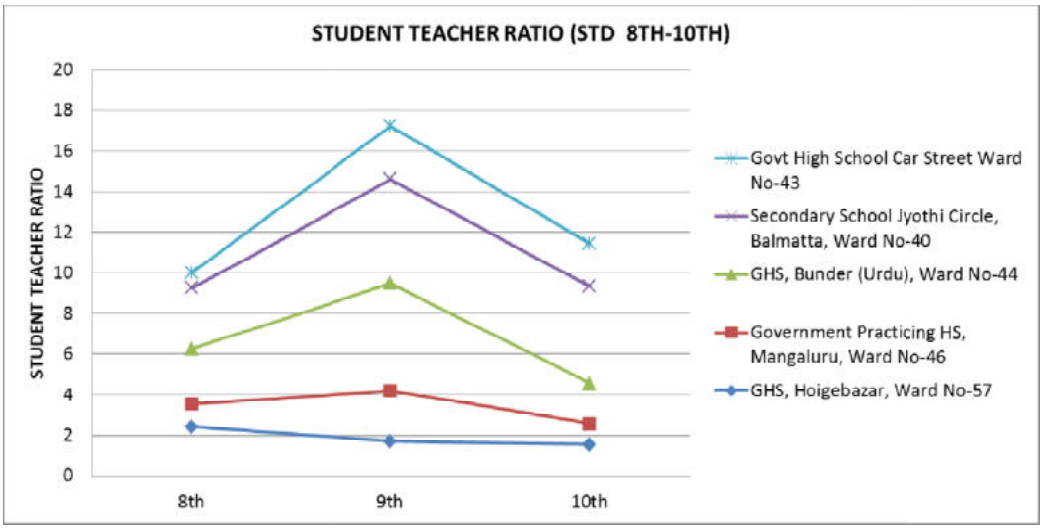
- ***The Average Strength of Student per School is 35 in case of Primary and Upper Primary School (Distributed in 8 Schools)***
- ***The Average Strength of Student per School is 58.8 in case of Secondary School (Distributed in 5 Schools)***

Student-Teacher Ratio

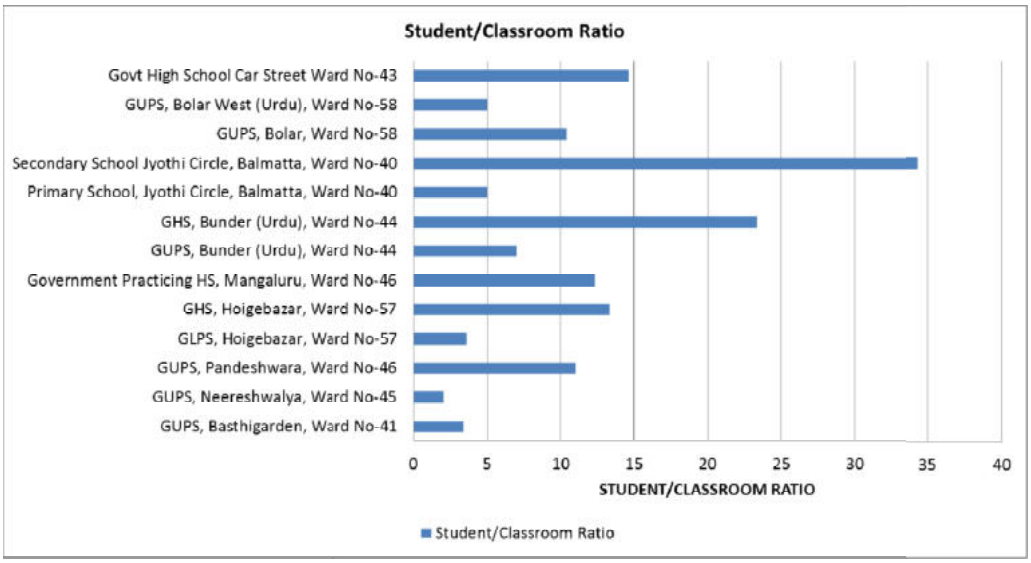


- ***The Student- Teacher Ratio for Primary School is in range of 0.5-3.5 in case of Primary and 0.5-4 in case of Upper Primary School. This is against the Benchmark of 30 and 35 as per RTE Act 2009 and UIDSE Guidelines of 24***
- ***The Student- Teacher Ratio for Secondary School is in range of 0.75-5.28. This is against the standard of 30 as per RMSA Framework and 27 as per UDISE Guidelines***





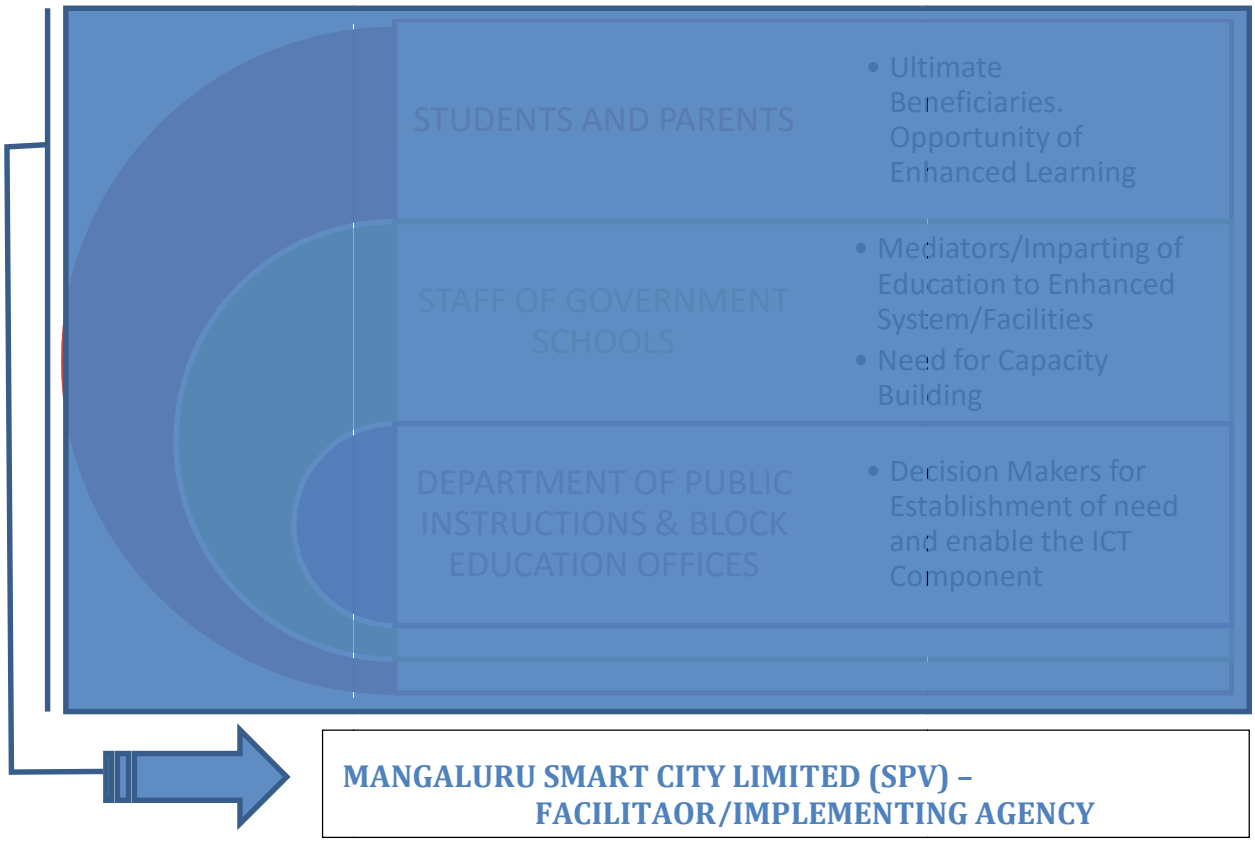
Student-Classroom Ratio



4 STAKEHOLDER's ENGAGEMENT

4.1 Identification of Stakeholders'

The identified Stakeholder's for the project are as mentioned above



PMC, in coordination with MSCL and MCC, conducted stakeholders meeting during the month of July – 2018 – on 7th July 2018 and 11th July 2018, where in the proposals were explained to the education department officials as well as Principals of each school and Teachers of the schools. The attendance sheet s attached hereto as Annexure-A. It was discussed that, the schools shall be forwarding their requirements in writing, which they forwarded to MSCL(Annexed hereto as Annexure- B). Based on the feedback from local education authorities, the feasibility of implementing the smart school in schools were identified, evaluated and after discussion with MSCL, the same were finalised. Before arriving to the final conclusion, consideration of the teacher student ratio, physical infrastructure of school, which can result in success, or failure of the E-smart School, were also taken care of. Recently, another Stakeholders meeting was also convened on 08.02.2019, the attendance sheet is attached at Annexure-A

It was also suggested that, MSCL may decide whether the project can be rolled out in phases by selecting schools based on the estimate proposed, the approvals can be used

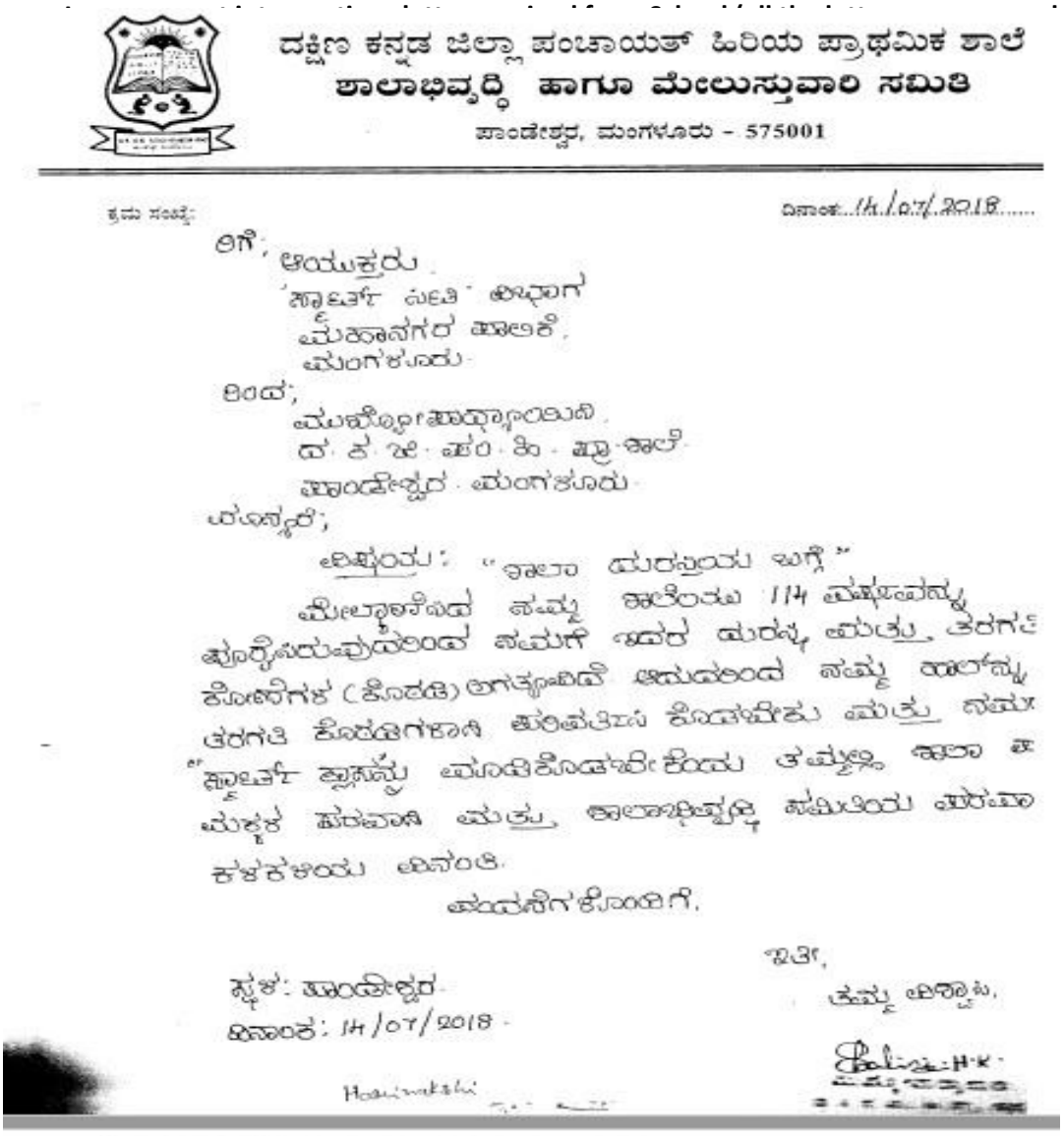
for defining the implementation of civil infrastructure, software and then hardware in preliminary stage.

4.2 Causes & Effect of Problems / Issues

- The bridge between the various classes of the urban environment is widened due to lack of infrastructure, sports facility & ICT initiatives in schools.
- This leads to the bleakly future of the student with respect to career aspects and lack of skills does not result in job creation.
- Due to lack of ICT as well as poor civil infrastructure facilities in the government schools, the dwindling number of students is major issue.

4.3 Stake Holders Consultations:

Stakeholder's Engagement formed inevitable step for deciding on the need for Infrastructure Improvements in each of the school. Stakeholder's Engagement process involved Consultations with School Authorities and BEO regarding the list of Infrastructure as



ದಕ್ಷಿಣ ಕನ್ನಡ ಜಿಲ್ಲಾ ಪಂಚಾಯತ್ ಹಿರಿಯ ಪ್ರಾಥಮಿಕ ಶಾಲೆ
ಶಾಲಾಭಿವೃದ್ಧಿ ಹಾಗೂ ಮೇಲುಸ್ತುವಾರಿ ಸಮಿತಿ
ಪಾಂಡೇಶ್ವರ, ಮಂಗಳೂರು - 575001

ಕ್ರಮ ಸಂಖ್ಯೆ: ದಿನಾಂಕ: 14/07/2018

ಇಂದ;
ಮುಖ್ಯೋಪಾಧ್ಯಾಯರು
ದ.ಕ.ಜಿ.ಪಂ.ಹಿ.ಪ್ರಾ.ಶಾಲೆ
ಪಾಂಡೇಶ್ವರ. ಮಂಗಳೂರು

ಇವರಿಗೆ;
ವಿಷಯ: "ಶಾಲಾ ಮೂಲಸೌಲಭ್ಯ ಬಗ್ಗೆ"
ಮೇಲ್ಕಾಣಿಸಿದ ನಮ್ಮ ಶಾಲೆಯಲ್ಲಿ 114 ಮಕ್ಕಳಿದ್ದು ಪೂರೈಸಬೇಕಾದಂತಹ ನಮಗೆ ಇದರ ಮೂಲಸೌಲಭ್ಯ ಮತ್ತು ತರಗತಿ ಕೋಣೆಗಳ (ಕೊಠಡಿ) ಕೊರತೆಯಿದೆ ಆದುದರಿಂದ ನಮ್ಮ ಶಾಲೆಯ ತರಗತಿ ಕೊಠಡಿಗಳನ್ನು ಹೆಚ್ಚಿಸಿ ಕೊಡಬೇಕು ಮತ್ತು ನಮ್ಮ "ಶಾಲೆಗೆ ಕ್ಲಾಸ್ಸು ಮುಂದಿಕೊಡಬೇಕೆಂದು ತಮ್ಮಲ್ಲಿ ಶಾಲಾ ಮಕ್ಕಳ ಹಿತವಾಗಿ ಮತ್ತು ಶಾಲಾಭಿವೃದ್ಧಿ ಸಮಿತಿಯ ಪರವಾಗಿ ಕಳಕಳಿಯ ವಿನಂತಿ.

ತಮ್ಮವಿಶ್ವಾಸಿಗ

ಇತಿ,
ತಮ್ಮ ವಿಶ್ವಾಸಿ,

ಸ್ಥಳ: ಪಾಂಡೇಶ್ವರ
ದಿನಾಂಕ: 14/07/2018

Various discussion/sessions were conducted to help the stakeholder; to understand the importance of the project, benefits envisaged

Table below shows details of Authorities contacted for assessing the need for each school

Table 1 List of School and contact no.

E-Smart School Principal's Contact Numbers			
S. No.	**School Name**	**Principal's Name**	**Mobile Number**
1 & 2	GPUC Balmatta	Mariot(School) Jagdish(D.Ed. College)	9480156647(School) 9448170990(D.Ed. College)
2	Pandeshwar School	Shalini	9880614511
3	Car street School	Venkatesh (Staff)	9844671258
4	Govt. Practicing School	Narayan Gowda	7996059364
6 & 7	GUPS Bolar & Urdu School	Meenakshi	9535627643
8	GHS Hoigebazar	Lavina	9902172530
9	LPS Hoigebazar	Jayanti	9343564395
10 & 11	LP & HS Urdu Bunder School	Shankrappa Mudnal	9901740802
12	Neereshwalya School	Parwati	9902601461
13	Basthigarden School	Surekha	9449990758

Images of stake holders meeting held with the schools selected for E-smart classroom

We also visited & studied private school so that we can understand the level of education & facilities given by these schools

Observation of survey done in four private schools – The survey was done in presence of MSCL, Joint managing Director, ICT Manager & PMC Consultant. We visited following school

- Shri Vyasa Maharshi Vidya Peeta,Mulki.
- St. Alloysisus school Lady hill Mangaluru.
- Rotary English medium School, Kinnigolli.
- Govt. Compound High school Volakadu Government High School, Udupi

Following observation made during this survey & study

All schools are English & kannad medium which conducts classes from Nursery to 10th Majority of students background is from Upper middle & middle class. Total number of students varies from 600 to 1350 and 30 to 50 numbers of teaching and non-teaching staff are there in school. Student capacity is of 40 to 65 which varies from class to class.

Salient features infrastructure & ICT component of these school are as listed below:-

1. Smart Class in almost all the class room accept Rotary English medium School, Kinnigolli with 6 classroom
2. Atal Tinkering lab in two school - Shri Vyasa Maharshi Vidya Peeta,Mulki & Govt. Compound High school Volakadu
3. Science lab for all three major stream of science
4. Audio Visual hall
5. Common Library & computer lab
6. CC Cameras installed in the all the classrooms, common area, toilet corridor entry and monitoring will be done in HM chamber
7. Biometric attendance system for teachers
8. School infrastructure developed school fund
9. Shri Vyasa Maharshi Vidya Peeta, funded by donor and complete new building has been done on donation fund
10. Sports, cultural activities & science/art workshop are the active part of school curriculum etc.
11. Shri Vyasa Maharshi Vidya Peeta, Mulki school provide milk & mid-day meal to all student free.
12. Infrastructure Development

13. School entrance area & circulation is paved/interlock tile.
14. All the grounds having softscape.
15. School building blocks are maximum G+2.
16. Computer class for all student both theory & practical.
17. Smart Class features
    - Time : As per school timing as all class are equipped
    - Teaching Subjects : As per the state board and NCERT syllabus.
    - Vendors : TeachNext, Educomp, Mahamahi foundations Manipal & Pre loaded CD with 5 Year AMC.

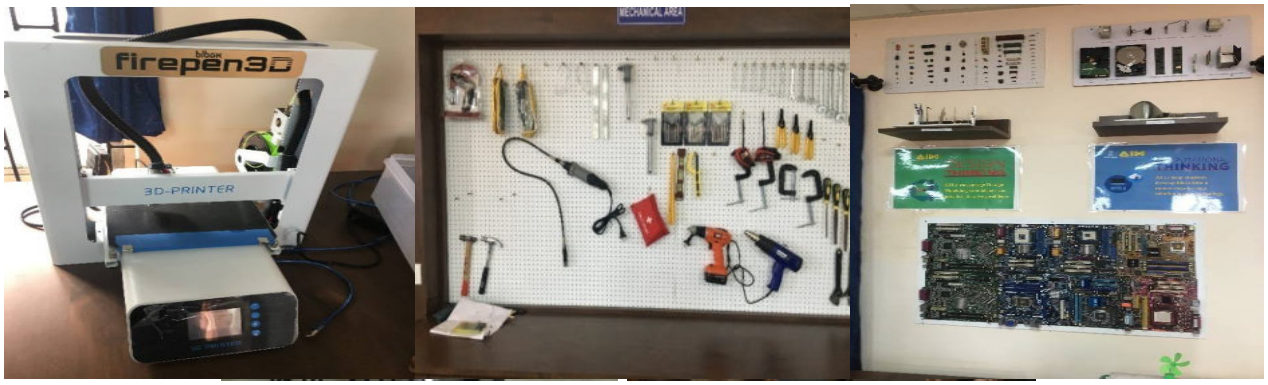
Facilitated with Atal tinkering lab in two schools Shri Vyasa Maharshi Vidya Peeta,Mulki & Govt. Compound High school Volakadu

Background - With a vision to 'Cultivate one Million children in India as Neoteric Innovators', Atal Innovation Mission is establishing Atal Tinkering Laboratories (ATLs) in schools across India. The objective of this scheme is to foster curiosity, creativity and imagination in young minds; and inculcate skills such as design mind-set, computational thinking, adaptive learning, physical computing etc.

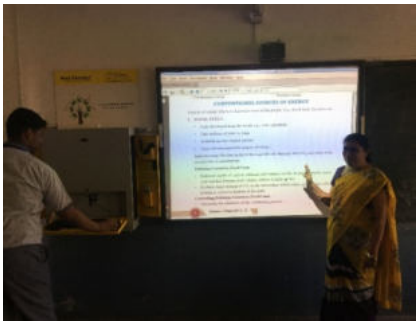
Key Features of ATL - ATL is a work space where young minds can give shape to their ideas through hands on do-it-yourself mode; and learn innovation skills. Young children will get a chance to work with tools and equipment to understand the concepts of STEM (Science, Technology, Engineering and Math). ATL would contain educational and learning 'do it yourself' kits and equipment on – science, electronics, robotics, open source microcontroller boards, sensors and 3D printers and computers. Other desirable facilities include meeting rooms and video conferencing facility.

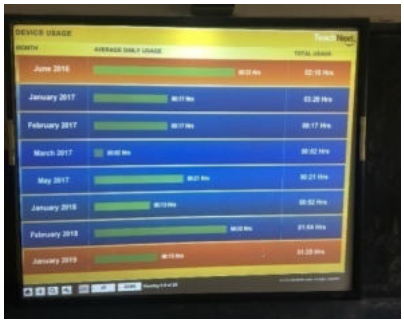
In order to foster inventiveness among students, ATL can conduct different activities ranging from regional and national level competitions, exhibitions, workshops on problem solving, designing and fabrication of products, lecture series etc. at periodic intervals.

Financial Support - AIM will provide grant-in-aid that includes a one-time establishment cost of Rs. 10 lakh and operational expenses of Rs. 2 lakh for period of 5 years to each ATL. Total cost for 5 year is 20 lakhs comes in grant



Atal Think Lab | LKG Class room with E- Smart school | Computer LAB in school





Teacher giving live example of smart classroom | Device Usage Report Yearly | Sports Ground – Badminton & Volley B

4.4 Improvement Envisaged for the Schools

- Proper Civil Infrastructure for the setup of smart classroom should be in place, the present civil status of government school should be surveyed by civil authorities whether minor repairs can be undertaken or complete upliftment of whole infrastructure to make good for future use with longer life.
- Proper electrical & lighting mechanism should be in place so as the students do not get spectacles at younger age while accessing the computer for long hours.
- Proper plumbing and drinking water/ RO facility for all students and staff
- Drainage and water logging issues should be addressed with complete survey for all weather.

- The project should be rolled out in phases - based on the health condition of the school; readiness and acceptance of the ICT by academic staff of the school as well as block education office.
- The academic staff of the school should be ready to cooperate with the implementation agency i.e. system implementer for sharing the feedback for preparation and updation of e-content.
- The officials of the block education office should be prompt enough to keep the record of the ICT inventory issued to school and should log the records.
- In case of any service and support is required for the repair of IT hardware, quick action should be taken so as to resolve the issue as soon as possible.

4.5 Outcomes of Stakeholder's Engagement and assessment of Needed Interventions

- The aim of this study is to compare smart training method and traditional training method in learning-retention processes. Schools, being the second home, serve a number of purposes in a child's life. From boosting their confidence to making them learn the importance of team work and socialization, schools do it all. Away from home, schools become the place for children to spend their maximum time. Kids are sent to school considering the fact that there is an experienced hand to guide them and also a safe environment promoting growth. We also accept the fact that infrastructure plays a budding hand in creating a favorable environment for a child's growth.

  We also four private school and found almost same level of ICT component and is mostly used by junior classes and students. Most taught subject on smart class room is social studies because story type narration that help student to understand and memories. Computer lab are functional in every school by skilled teachers and staff & student get both throry and practical class. Smart class also helps teachers to manage student more efficiently. Every school has outdoor sports ground as per there area capacity. Volley ball & badminton ground are most common

Table 2 Infrastructure details of school taken under E-smart school

Sl. No	School Name		Requirement Given By School Department	Compliance in PMC Proposal
1	**D.K.Z.P.H.P.SCHOOL BASTHIGARDEN**	1	Class rooms Table repair (Lighting, window, doors, etc)	Yes
		2	4 New Class Room	No
		3	Toilet, drinking water, water underground repair	Yes
		4	Sports - Basket Ball, Shettle Court, Vallyball Court, Must be created	No
		5	Anganavadi,Class Room Repair etc.	Yes
2	**D.K.Z.P.H.P.SCHOOL NEERESHWALYA**	1	Toilet door, upstairs Repair, Toilet fit Repair	Yes
		2	Window, door Repair	Yes
		3	Repairs of Computer And Printers	No
		4	Table and Wooden Chair	No
		5	Class room divides	No
		6	School Upstairs Repair	Yes
		7	Racks	No
		8	Almari	No
		9	Paint	Yes
3	**D.K.Z.P.GOVT URDU HIGHER PRIMERY SCHOOL,BUNDER MANGALORE**	1	New Building	No
		2	Audio, video Vissual Smart Hall	No
		3	Laboratory - Show case	No
		4	Library - Interior facility, Cupbords, Chair & Table	Repair Work
		5	Sports Room- Stands & Cupboard	Repair Work
		6	Computer Room- Computers, com table and chairs	Repair Work
		7	Kitchen Room- Wash basin	Repair Work
		8	Toilet for girls and Urinals for boys	Repair Work
		9	Tiles and Painting work to whole school	Yes
		10	Furnitures- Benches, Desks, tables, Chairs Capboards, Umbrella and Tiffin stand.	No
		11	Nalikali- Small wooden chairs and tables	No
		12	Play Ground- Interlock , Vollyball, Throw ball, kho kho, kabadi Courts	Badminton Court
		13	Small garden with play things for Nalikali Children.	Yes
		14	Water Facility with water cooler	No

Sl. No	School Name		Requirement Given By School Department	Compliance in PMC Proposal
		15	Sport things	No
		16	One Vehicle	No
		17	Office room with Wash room	No
		18	Showcase and Cupboards	No
		19	Old Building Repair	Yes
		20	Dining Hall for children- benches and tables,compound wall and stage	Yes
		21	C.C Camera and Sound boxes for respective Classes	ICT
		22	Slab sheets to the whole School	No
		23	Watchman Room Near School Main Gate	No
		24	T.V	No
4	**RATHABEEDI CARSTREET**	1	Sports Items	No
		2	Lab Requirements	No
		3	Roof Mangalore Tiles Repair	Yes
		4	Toilet if CWSN Students	No
		5	Painting for Classroom & Compound hall	Yes
		6	2 Rooms	No
		7	Speaker with mike (2 set)	ICT
		8	Computer Room- Computers com table and chairs	No
		9	Interlock for ground	Yes
		10	4 Racks	No
		11	5 green boards	No
		12	Library books	No
		13	Table & fans	No
		14	Tables- 5	No
		15	Sheet	No
		16	Inter Com for Classrooms	No
		17	Drawing stand	No
		18	Cleaning of well and providing net fecility	Yes (Only Cleaning)
		19	wash basins	No
		20	High jump Pit	No
		21	Name board for school	No

Sl. No	School Name		Requirement Given By School Department	Compliance in PMC Proposal
		22	Drawing board(half- imperial -5)	No
		23	Smart Class	ICT
		24	To separate the Power meter to avoid load shedding	Electrical
5	**D.K.Z.P.GOVT URDU HIGH SCHOOL,BUNDER MANGALORE**	1	Smart Class -5 Room	ICT
		2	Science Laboratory	Repair Work
		3	A.V Room	Repair Work
		4	Library	Repair Work
		5	Sports Room	Repair Work
		6	Auditorium	Repair Work
		7	Stage	Repair Work
		8	Parking lot	No
		9	Drinking water	No
		10	over head tank	Repair Work
		11	Teachers toilet and Rest Room	Repair Work
		12	Furnitures- Seatina+ Capboards+ racks	No
		13	C.C camara , Inside and Out side	ICT
		14	Intercom	ICT
		15	Mike set	ICT
		16	Panel Boards	ICT
		17	Compound Wall- Rennovation	Yes
6	**D.K.Z.P.GOVT URDU HIGHER PRIMERY SCHOOL,PANDESHWAR**	1	Converting Hall into 2 Classrooms	No
7	**GOVT T.T.I COLLEGE BALMATA**	1	Building Upstaires Repair	Yes
		2	Window, door Repair	Yes
		3	Bench & Desk 10+10	No
		4	Tubelight	Yes
		5	Sound System - Mike	ICT
		6	Table	No
		7	Racks	No
		8	Radio	No
		9	Chairs	No
		10	Toilet Repair	Yes

Sl. No	School Name		Requirement Given By School Department	Compliance in PMC Proposal
8	**GOUT COMPOSITE P.U COLLEGE HIGH SCHOOL SECTION BALMATTA**	1	Flooring Tiles	Yes
		2	Construct of Grills for Building Surrouding for Security Purpose of Highschool section	Yes
		3	C.C Camara	ICT
		4	Projector, Laptop, LCD T.V	ICT
		5	Aquagaurd	No
		6	Computer, Printer, Invertor, Scanner, etc.	ICT
		7	Iron Chairs, Plastic chairs	No
		8	Sound box, Amplifier with advanced Mike set	ICT
		9	Laibrary and books	No
		10	Sports Material- Volley ball, Basket ball etc.	No
		11	Uniforms White & track suits	No

5. E SMART SCHOOL: PROPOSALS FOR MANGALURU SMART CITY

As is evident from the Chapter 3 and 4 of the DPR, there is need for improvement of Basic Infrastructure Facilities in the schools proposed for Implementation as E-Smart School. However, it is also learnt through assessment of various current indicators based on NCERT that the Student – Teacher Ratio is too skewed as compared to the prescribed standards. The strength of Students are also too less for each school.

The above led to the consideration of Process Re-Engineering of the Schools.

The Proposal for E: Smart School, thus, are proposed under 2 Categories

- Category 1: Architectural/ Infrastructure Upliftments (Mandatory)
- Category 2: Process Re-Engineering (Suggestive/ Policy Related)

5.1 Architectural/Infrastructural Upliftment (Mandatory)

5.1.1 Infrastructure Upliftment / New Facilities: -

- Conservation architecture of existing heritage Mangalore roof tile. By retrofitting, cleaning, & replacing.
- Redevelopment of all boundary wall with complete removal of vegetation and dampness. All boundary wall to be provided with painted with some portion of wall with graffiti art showcasing the social message related to education for all.
- Beautification through landscaping and plantation. Brick/stone circular tree guard, Grass turfing, under planting, setback landscaping, etc are few option depending upon the location and area size.
- Development of barrier free all weather circulation inside school campus with proper pedestrian walkway and vehicular entrance, exit & drop off area/route.
- External development of all open area with proper drainage and zero water logging issue
- Storm water RCC drains to resolve water logging issue during monsoon seasons. We can have saucer drain in low discharge area & Rcc drain to take care of high volume water discharge.
- Redevelopment of all toilet blocks as per the particular school requirements for students and teachers with proper lighting, water and security facility.
- Treatment & remedial of all unwanted biological growth on buildings walls and roof. With permanent solution of waterproofing and anti-root/anti-fungal treatment.
- Redevelopment of existing cultural stage and flag post as a amphitheater for all cultural, sports and exhibition purpose.
- Timber work improvement, painting and treatment against termite/weathering for all wooden doors, windows, railing & floorings

- Overall renovation and upliftment of buildings. Ex paint, plaster, waterproofing, door window & architectural improvements for retaining and improving aesthetics of the building.
- Drinking water facilities for all building blocks as per existing capacity.
- Improvement of existing lighting wiring, fixtures for proper illumination and lux value required for healthy reading writing.
- Provision of high mast light pole of external illumination and night sports competition
- Green and Black chalkboard in classroom
- Name plate, signage's & school entrance signage

5.1.2 Sports facilities: -

- Outdoor hard surface sport ground that houses a basketball cum tennis
- Grass turf court for badminton, kho kho, kabaddi & volleyball court.
- Mini track and field ground for athletic sports.
- Sports seating gallery and podium as per the available space.
- Procurement of sports equipment's

5.1.3 Other facilities

- ICT based Smart Class rooms.
- Open gym & yoga center to encourage health and fitness idea in student and community.
- Redevelopment of existing stage with roofing work for all weather use.
- Open reading plaza designed to encourage read-aloud & group reading habit.
- Parking area in some school as per existing use.

5.1.4 Smart Class Room Facilities: - (Covered under Part B of the DPR)

With the use of interactive modules such as videos, and presentations as a medium of learning, students get to understand complicated concepts with ease. It has helped in increasing their interest and curiosity level. Will help student have learnt how to make presentations, their confidence level will go up. The digitally interactive environment encourages even shy or hesitant students to participate better in classroom discussions. The teachers get helped to explain subjects while here the education is via videos, pictures, and presentations. Learning is now more exciting and interesting. An audio-visual description of any topic is more understanding & interesting. It gives more clarity on the subject; the pictures and videos shown to student help in remembering it even after the class." These digital classrooms have helped increase student attention; teachers maintain that there has been a reduction in absenteeism and school dropouts. It has also improved student familiarity and comfort with technology.

5.2 Process Re-Engineering (Suggestive/ Policy Related)

After the survey done by PMC with Municipal Commissioner and BEO officials the following suggestions may be considered for the possible merging of the schools:

11. Merging of infrastructure & sports facility for GPUS & GHS Bunder
12. Merging and sharing the infrastructure, lab & other facility of primary & secondary school Balmatta

The merging may facilitate the effective upgradation and subsequent use of facilities by the students and teachers. BEO officials to decide based on the government schemes, constraints and guidelines.

5.2.1 Process Re-engineering

Table 3 Process Re-engineering

Sr. No.	Activity Name	As -Is Process	To- Be Process
1	Infrastructure Upgradation	Lack of Sports & Lab facility	After the infrastructure up-gradation, we can have all weather working outdoor sports ground for Basketball, Badminton, Volley Ball etc. As well uplifted civil infra of existing labs & library
2	External Development & Landscaping	Water logging, blocked circulation, lack of define vehicular movement etc	With the introduction of concept of landscaping we will have zero water logging, barrier free circulation, defined drop off – pick up area etc.
3.	Reading plaza & Open Gym	Indore class room reading available	Open reading plaza designed to encourage read-aloud & group reading habit. Open yoga center to encourage health and fitness idea in student
3.	Online Education Content	Textbooks can be downloaded online through http://ktbs.kar.nic.in/New/index.html#!/	With the introduction of e-content in smart classroom, supporting study material such as animation videos will be available to students for tough topics.
4.	Teachers Information Software	Teacher's information software http://ktbs.karnataka.gov.in/TeachersInfo/ serves as a repository about teachers where service record of all government teachers is stored.	Student Management Software will provide information about subjects and topics taught by teacher in class.
5.	Student	Student Achievement Tracking	System Implementer SI can develop

Sr. No.	Activity Name	As -Is Process	To- Be Process
	Tracking System	System http://sts.karnataka.gov.in/STS/# is an online Portal where teachers have to periodically update the details about the student's attendance and student's performance based on the template given in the portal. The portal is an intermediate entity between school academic staff and education	Student management software which will use the same format used by teachers to upload about the student's details, attendance and academic progress report. The portal will act as an intermediate entity between school academic staff and parents and guardians.

5.3 Proposed Plans for Architectural/ Infrastructure Upliftments

5.3.1 S.No. 1- GUPS, (Government Upper Primary School) Basthigarden, Ward No-41

PLAN

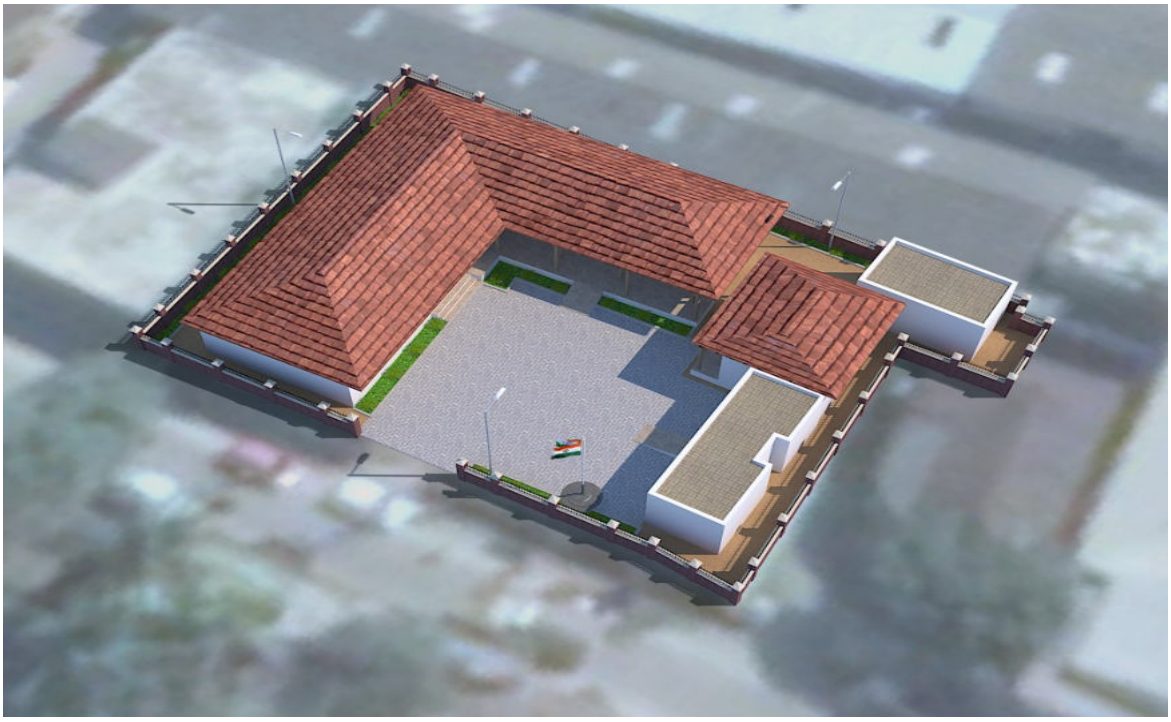
BASTHIGARDEN 3D VIEW

Key Recommendation for Basthigarden:

- Retrofitting of roof & overall building upliftment
- High Mast & Outdoor lighting.
- Sports equipment's.
- Electrical fittings replacement.

5.3.2 S.No. 2- GUPS, *(Government Upper Primary School) Neereshwalya, Ward No-45*

PLAN



NEERESHWALYA 3D VIEW

Key Recommendation for Neereshwalya:

- Fixing of leaky roofs.
- Improvement of doors and windows.
- Flooring of school to be improved.
- Improvements to library facility.
- Walls of school to be plastered.
- Improvements to toilet facility.
- Solution for water logging problem during monsoon.

5.3.3 S.No. 3- GUPS, (Government Upper Primary School) Pandeshwara, Ward No-46

PLAN

PANDESHWARA 3D VIEW

Key Recommendation for Pandeshwara:

- Refurbishment of damaged doors and windows.
- Improvements to the toilet facility.
- Upgradation of existing stage.
- Providing partition between classrooms.
- Drinking water facility.
- Improvements to the roof.
- Open reading & yoga space.

Before- Main Entrance

After- Main Entrance

Before- Stage

After- Stage

Before- Open Passage

After- Pergola Passage

Before- Inside Classroom

After- Inside Classroom

5.3.4 S.No. 4- GLPS, (Government Lower Primary School) Hoigebazar, Ward No-57

LPS HOIGEBAZAR PLAN

LPS HOIGEBAZAR 3D VIEW

Key Recommendation For LPS Hoigebazar:

- Upgradation of abandoned structure to facilitate Anganawadi.
- Replacement of old electrical fittings.
- Surveillance facility to keep out anti social elements after school hours inside the campus.
- Improvements to existing stage facility.
- Solution for water logging problem during monsoon.
- Improvements to flooring.

5.3.5 S.No. 5- GHS, (Government High School)Hoigebazar, Ward No-57

GHS HOIGEBAZAR PLAN

GHS HOIGEBAZAR 3D VIEW

Key Recommendation For GHS Hoigebazar:

- Redevelopment of main gate and entrance.
- Replacement of old electrical fittings.
- Surveillance facility to keep out anti social elements after school hours inside the campus.
- Improvements to flooring & landscaping.
- Development of drainage system

5.3.6 S.No. 6- Government Practicing HS, Mangaluru, Ward No-46

GOVERNMENT PRACTICING HS PLAN

GOVERNMENT PRACTICING HS 3D VIEW

Key Recommendation For Government Practicing HS:

- Improvements to toilet facilities by providing sanitary utilities and electrification.
- Pathway to toilets to be improved by providing interlocks being high school section.
- Upgradation of existing stages with amphitheater concept.
- Providing of outdoor sports ground.
- Permanent solution for water logging problem inside the campus.
- Beautification through landscaping and plantation.
- Compound wall improvements.
- Drinking water facilities.

Before- Main Entrance & Ground (From Inside)

After- Main Entrance & Ground (From Inside)

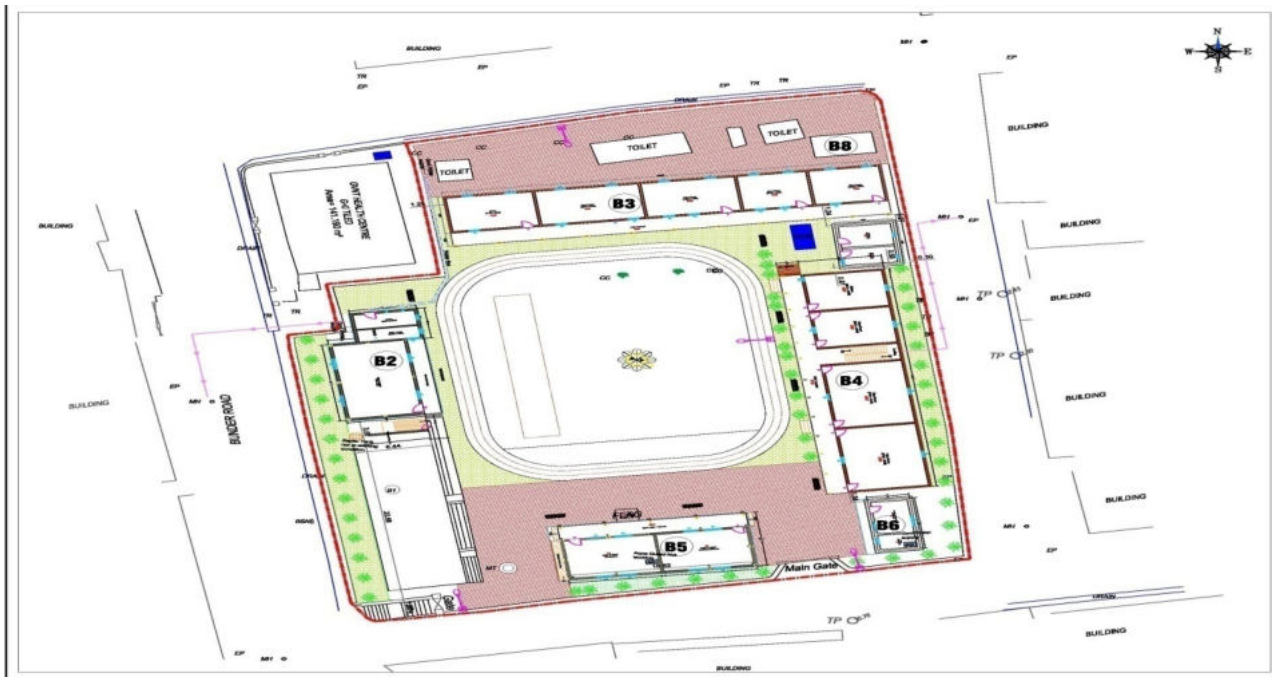
Before- Main Stage

After- Main Stage

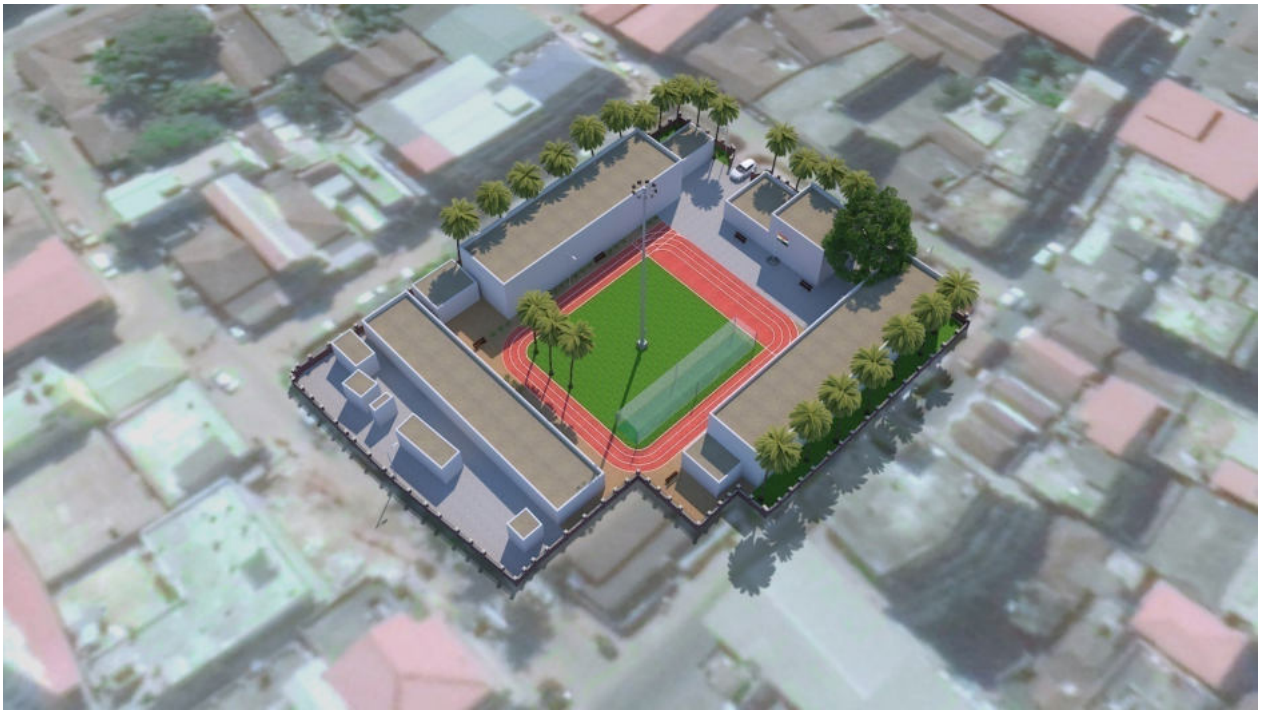
Before- Backside of Building

After- Backside of Building

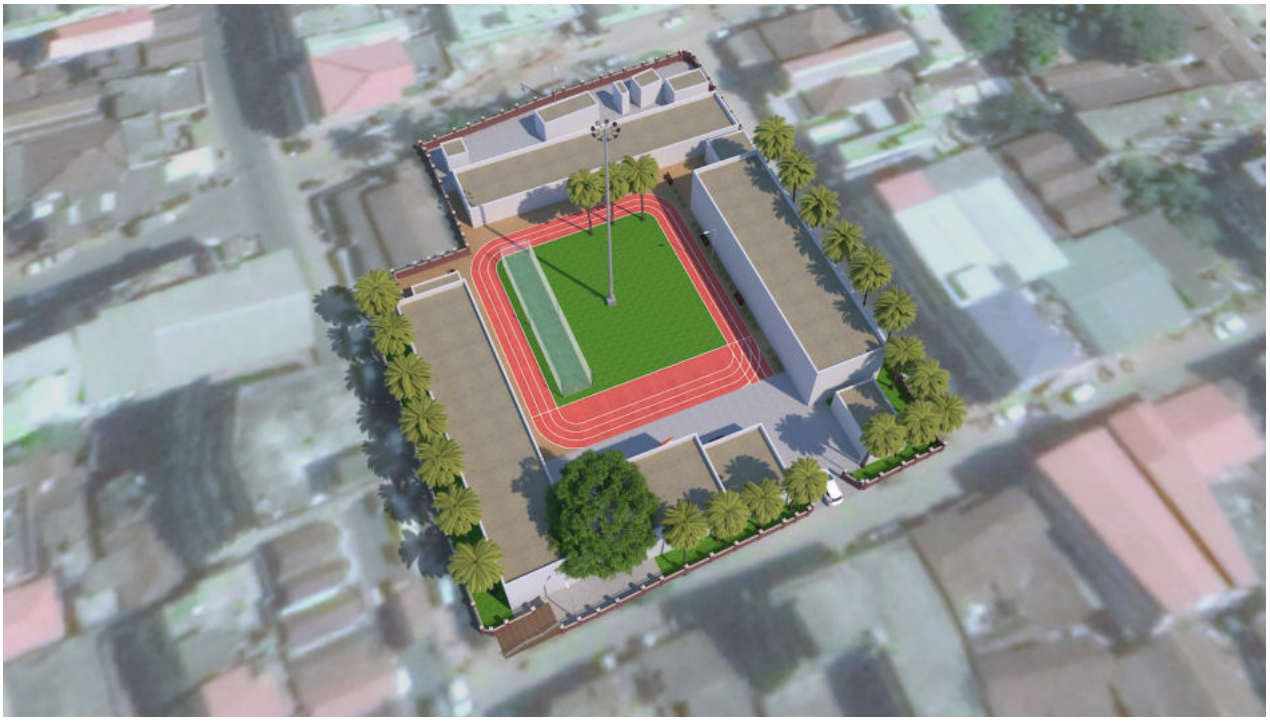
5.3.7 S.No. 7&8- GUPS, (Government Upper Primary School) & GHS, (Government High School) Bunder (Urdu), Ward No-44



GPUS & GHS BUNDER PLAN



GPUS & GHS BUNDER 3D VIEW FROM MAIN ROAD SIDE



GPUS & GHS BUNDER 3D VIEW FROM BACK SIDE

Key Recommendation For GPUS & GHS Bunder:

- Pathways around the school to be improved.
- Development of mini track and field sports ground .
- Development of drainage system.
- Drop off area and circulation for cars
- Parking for two wheeler
- Fixing of leaky walls in some classes.
- Refurbishment of doors and windows.

Before- Sports Arena

After- Sports Arena

Before- Classroom

After- Classroom

Before- Existing Gate

After- Existing Gate

5.3.8 S.No. 9&10- Primary School & Secondary School Jyothi Circle, Balmatta, Ward No-40

BALMATA PLAN

BALMATA 3D VIEW

Keys Recommendation For Balmatta:

- Drop off area and circulation for cars
- Repair and retrofitting work special care to mangalore roofing tile.
- Drainage network to for complete school compound.
- Landscaping by Brick/stone circular tree guard, Grass turfing, Under planting, setback landscaping, Hardscape & soft scape etc
- PU coated high SRV value basketball court
- Redevelopment of toilet block for school staff.
- Treatment & remedial of biological growth on buildings & boundary wall
- Graffiti paint on school walls

Before- Entrance

After- Entrance

Before- Badminton Court

After- Badminton Court

Before- Basketball Court

After- Basketball Court

Before- Road & Drop Off Area

After- Road & Drop Off Area

Before- Entry Ramp

After- Entry Ramp

5.3.9 S.No. 11&12- GUPS, (Government Upper Primary School) & GUPS, (Government Upper Primary School)Bolar West (Urdu), Ward No-58

BOLAR PLAN

BOLAR 3D VIEW

Key Recommendation for Bolar:

- Roof cleaning & retrofitting of mangalore tile
- Improvements to toilet facilities by providing sanitary utilities and electrification.
- Pathway to toilets to be improved by providing interlocks being high school section.
- Upgradation of existing path and parking shed
- Development of loud reading & outdoor panel discussions space in between to building blocks.
- Providing of outdoor sports ground.
- Permanent solution for water logging problem inside the campus.
- Beautification through landscaping and plantation.
- Compound wall improvements.
- Toilet & Drinking water facilities.

Before- Entrance Path

After- Entrance Path

Before- Main Ground

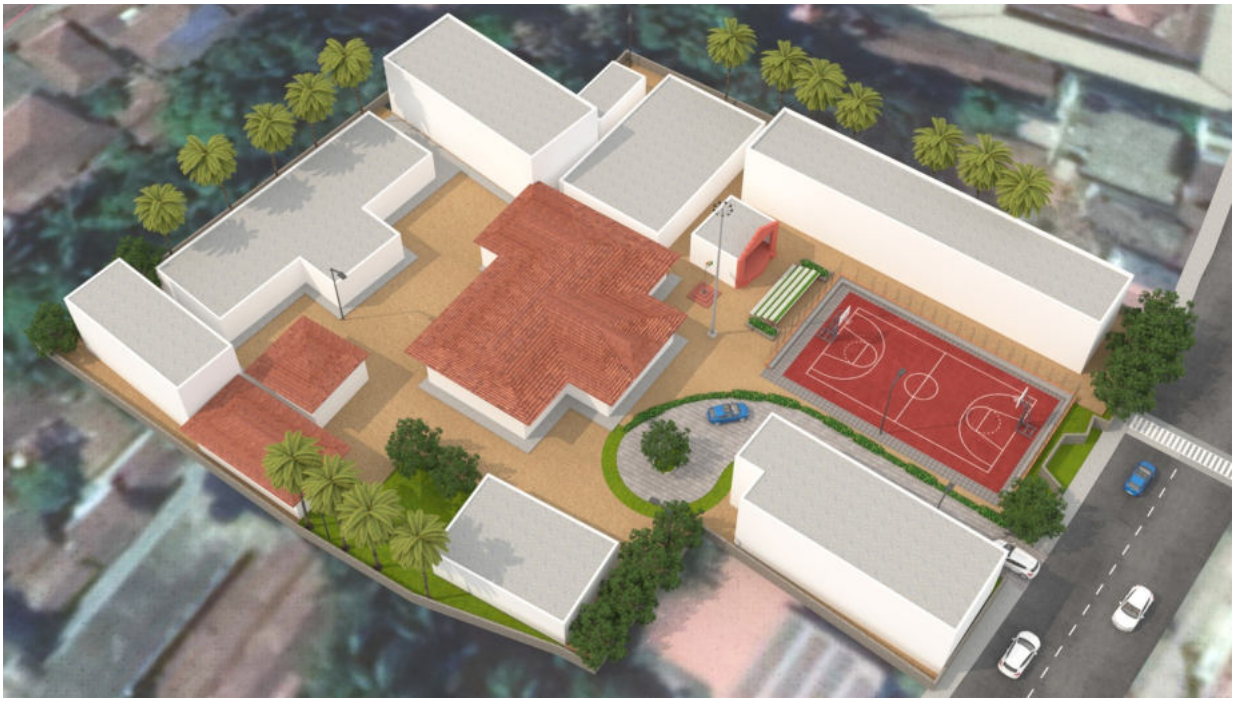
After- Main Ground

Before- Classroom With Stage

After- Classroom With Stage

5.3.10 S.No. 13- Govt. Womens Pre-university college Rathabeedi, Carstreet Ward No-43

CAR STREET PLAN



CAR STREET 3D VIEW

Key Recommendation For Car Street School:

- Redevelopment of entry & exit road.
- Improvements to toilet facilities by providing sanitary utilities and electrification.
- Pathway to toilets to be improved by providing interlocks being high school section.
- Upgradation of existing stages with amphitheater concept.
- Providing of outdoor sports ground.
- Permanent solution for water logging problem inside the campus.
- Beautification through landscaping and plantation.
- Compound wall improvements.
- Drinking water facilities.

Before- Entry Side

After- Entry Side

Before- Front Of Admin Block & Stage

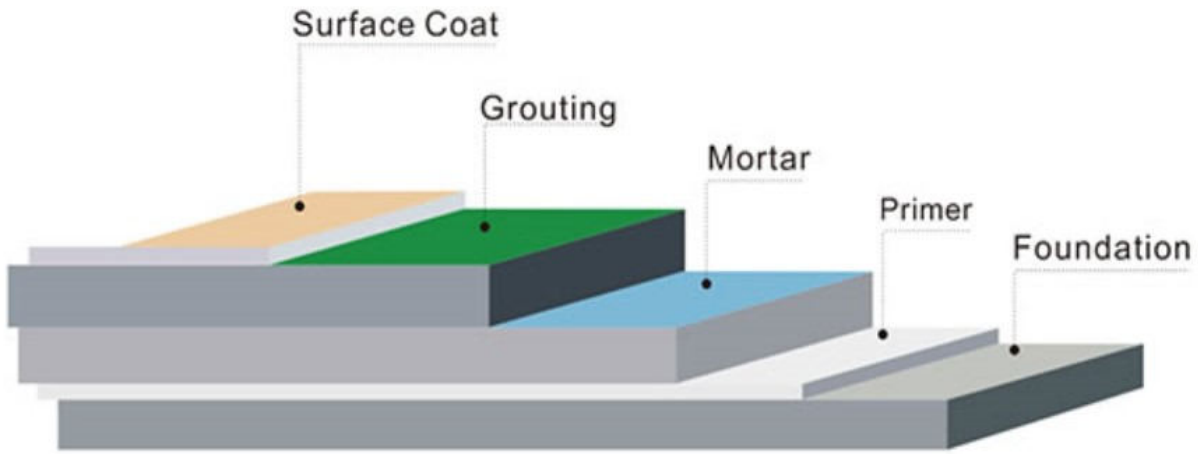
After- Front of Admin Block & Stage

Before- Facade

After- Facade

6. SPECIFICATIONS WORKS NON SOR WORK:

System Solution For Surfaced Sports Facility – PU-COATING System:- Green Label certified, low VOC as per ISO, solvent free, flexible polyurethane coating system providing a colourful watertight, hardwearing surface for exterior and other trafficable floors consisting of 3 component, solvent free, Polyurethane based primer/body coat/binding agent having solid content of approximately 100% which accepts silica aggregate scatter to produce an anti skid surface as well as 2 component, coloured, flexible polurethane coating of having 100% solid contents to seal the aggregate layer where UV light staibility chemical resistance property to Petrol, Diesel, Antifreeze, Hydraulic Fluids, Chlorides & Battery Acids etc. Technical profile having Fire resistance, Slip Resistance, Abrasion Resistance. HDPE Sheet below the VDF flooring/foundation in order to avoid floor coating damage due to negative hydrostatic pressure. It Has zero fading life of almost 10 years.



Vendor Visit for Site Inspection

Water Proofing

Flooring Tile

Paints work

7. GENERAL INSTRUCTION

7.1 Contractor's Superintendence

- The Contractor shall submit a Staff Organisation Plan in accordance with the Client. This plan shall be updated and resubmitted whenever there are changes to the staff. The plan shall show the management structure and state clearly the duties, responsibilities and authority of each staff member.
- The site agent and his associates/supervisors shall have experience and qualification appropriate to the type and magnitude of the Works. Full details shall be submitted of the qualifications and experience of all proposed staff to the Engineer for his approval.

7.2 Checking of the Contractor's Temporary Works Design

The Contractor shall, prior to commencing the construction of the Temporary Works, submit a certificate to the Engineer signed by him certifying that the Temporary Works have been properly and safely designed and checked and that the Contractor has checked the effect of the Temporary Works on the Permanent Works and has found this to be satisfactory.

7.3 The Site

- Works Areas are those areas identified are to these Employer's Requirements and on the Drawings.

Use of the Site

- The Site or Contractor's Equipment shall not be used by the Contractor for any purpose other than for carrying out the Works in the scope of this contract, except that, with the consent in writing of the Engineer, the Site or Contractor's Equipment such as batching/mixing plants for concrete and bituminous materials may be used for the work in connection with other contracts under the Employer.
- Rock crushing plant shall not be used on the Site.
- The location and size of each stockpile of materials, including excavated materials, within the Site shall be as permitted by the Engineer. Stockpiles shall be maintained at all times in a stable condition.
- Entry to and exit from the Site shall be controlled and shall be only available at the locations for which the Engineer has given his consent.

Access to the Site

- The Contractor shall make its own arrangements, subject to the consent of the

Engineer, for any further access required to the Site.

- In addition, the Contractor shall ensure that access to every portion of the Site is continually available to the Employer and Engineer.

Access to Outside the Site

- The Contractor shall be responsible for ensuring that any access or egress through the Site boundaries are controlled such that no disturbance to residents or damage to public or private property occur as a result of the use of such access or egress by its employees and sub contractors.

Survey of the Site

- A survey shall be carried out of the Site to establish its precise boundaries and the existing ground levels within it. This survey shall include a photographic survey sufficient to provide a full record of the state of the Site before commencing the work with particular attention paid to those areas where reinstatement will be carried out later on. The survey shall be carried out before the site clearance wherever possible and in any case prior to the commencement of work in any Works Area. The survey shall be carried out by the Contractor and agreed with the Engineer.

Barricades and Signboards

- The Contractor shall erect barricades as per Tender Drawing and gates around its areas of operations to prevent entry by unauthorised persons to his Works Areas and necessary identity cards /permits should be issued to workers and staff by the contractor. The Contractor shall submit proposal for barricades of the complete perimeter of all works areas to the Engineer. Painting of the barricades shall be carried out to the design and colours as directed by the Engineer and the Contractor shall carry out re-painting of the entire barricades on an regular basis. No work shall be commenced in any Works Area until the Engineer has been satisfied that the barricades installed by the Contractor are sufficient to prevent, within reason, unauthorised entry. The cost of all this barricade is included in quoted price.
- The types, sizes and locations of project signboards shall be agreed with the Engineer before manufacture and erection. Other advertising signs shall not be erected on the Site.
- The consent of the Engineer shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in positions after the completion of the Works shall be repaired and repainted as instructed by the Engineer.
- Hoardings, barricades, gates and signs shall be maintained in clean and good order

by the Contractor until the completion of the Works, whether such hoardings, fences, gates and signs have been installed by the Contractor or by others and transferred to the Contractor during the period of the Works. All the fencing, hoardings, gates and signs etc. shall be mopped minimum one in a **week** and washed **monthly.**

- All hoardings, barricades, gates and signs installed by the Contractor shall be removed by the Contractor upon the completion of the Works, unless otherwise directed by the Engineer.

Clearance of the Site

All Temporary Works which are not to remain on the Site after the completion of the Works shall be removed prior to completion of the Works or at other times instructed by the Engineer. The Site shall be cleared and reinstated to the lines and levels and to the same condition as existed before the Works started except as otherwise stated in the Contract.

7.4 Survey

- The Contractor shall relate the construction of the Works to the Site Grid. To facilitate this, survey reference points have been established and the Engineer will provide benchmarks in the vicinity of the Site. .
- Before the Contractor commences the setting out of the Works, the Engineer will provide a drawing showing the position of each survey reference point and bench mark, together with the co-ordinates and/or level assigned to each point. The Contractor shall satisfy itself that there are no conflicts between the data given and shall establish and provide all subsidiary setting out points which may be necessary for the proper and accurate setting out and checking of the Works.
- The Contractor shall carefully protect all the survey reference points, bench marks, setting out points, monuments, towers and the like from any damages and shall maintain them and promptly repair or replace any points damaged from any causes whatsoever. The Contractor shall regularly recheck the position of all setting out points, bench marks and the like to the satisfaction of the Engineer.
- Upon handover to the Contractor, the survey reference points will become the responsibility of the Contractor. The Contractor shall frequently review, ensure that these survey points continue to remain consistent with the bench marks.

7.5 Safety, Health and Environmental Requirements

The Contractor shall comply with in the conditions stipulated in the Conditions of contracts on Safety, Health & Environment (SHE).

Training of Contractor's Employees/Staff/Workers:-

Contractor shall provide a training/workshop on safety, Health & Environment (SHE) to all its workers/staff/employees/subcontractors of at least 2 weeks (96hrs.) at the time of induction .Before postings of any his workers / staff / employees / subcontractors, the contractor shall give a certificate that the said person had undergone the requisite SHE training. Non-compliance of the above will invoke penalties as per condition of contract.

In case of any mishap/ accident causing death/injury to public or damage to public/private property or damage to public/private vehicles or damage to railway property, the employer, will impose a penalty to the contractor as deemed fit and appropriate in addition to the cost of damage caused due to the mishap/accident.

7.6 Other Safety Measures

Site Safety, Health & Environment Plan

- The Contractor shall, within **7 days** of the date of Notice to Proceed, prepare and submit to the Engineer for review his proposed safety, Health and Environment plan which shall contain as a minimum those items set out in Conditions of Contract on Safety, Health & Environment Plan.

Fire Regulations and Safety

- The Contractor shall provide and maintain all necessary temporary fire protection and fire fighting facilities on the Site during the construction of the Works, and shall comply with all requirements of the Manglore Fire Services Department. These facilities may include, without limitation, sprinkler systems and fire hose reels in temporary site buildings, raw water storage tanks and portable fire extinguishers suitable for the conditions on the Site and potential hazards.
- The Contractor shall submit details of these facilities to the Engineer for review prior to commencement of work on the Site.
- If, in the Engineer's opinion, the use of naked lights may cause a fire hazard, the Contractor shall take such additional precautions and provide such additional fire fighting equipment (including breathing apparatus) as the Engineer considers necessary. The term "naked light" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.
- Oxyacetylene burning equipment will not be permitted in any confined space. Burning equipment of the oxypropane type shall be used.

Hazard and Risk Assessments

- The Contractor shall, prior to the commencement of any operation carry out a

detailed hazard and risk assessment. The results of such assessments shall be recorded and the records kept for inspection by the Engineer.

- The Contractor shall produce detailed method statements for all medium and high risk operations and shall submit them to the Engineer for his consent prior to commencement of any task to which they relate.
- The Contractor shall produce and implement a Permit to Work system for all high risk operations. The Permit to Work system shall be submitted to the Engineer for consent before application.

Roofing tile work

- The Contractor shall prepare a detailed specification for the operation, installation, removal of staging and submit it to the Engineer for review in advance before start of work.
- Always ensure that you are inspecting scaffolding thoroughly before using it. Check to make sure the base is secured, and that it is level and adjusted for any lean in the building. Make sure that every single guardrail and plank is installed safely and securely, and also look out for elevation changes, obstructions (such as wires), and weather conditions.
- During the design stages of scaffolding, one of the main mistakes that is made is failing to consider all of the different types of load that the material will be under during construction and setup. In order to maximize the safety of everyone involved, do not attempt to overload the scaffolding with more workers than it is rated for in order to save time. Also take care to ensure that it is not overloaded by equipment, and that nothing is pushing against any guardrails.
- Everyone working on height should be trained and experienced in such kind of job and always work in good mental and health condition.
- Scaffolding is designed to be braced by or entirely attached to a building. If bracing isn't properly secured, scaffold movement may dislodge an end, which will reduce the stability of the scaffold. There are a few types of brace retention or locking systems on scaffolds. These systems need to operate freely during assembly and dismantling, and also be able to lock in order to prevent the brace from dislodging. You shouldn't try and replace the proper parts supplied by the manufacturer with nails or other miscellaneous substitutions.
- When taking the design of a scaffold into consideration, a construction company must ensure that any scaffolding over 10 feet high has guardrails on the three sides facing away from the building, at the very least. The side facing the building is still a danger, so it is recommended to have them there as well. Guardrails should not be

viewed as a replacement for true fall protection gear, which should be worn at all times while on the scaffolding.

- Scaffolding structures need to be constantly maintained and inspected in order to retain their structural integrity and safety. Someone knowledgeable about the construction of the scaffolds themselves needs to inspect the structure to ensure that it is still functional and safe, making sure that boards are all still intact and that all of the components are still in good shape. Failure to keep these crucial components regularly maintained could lead to extremely hazardous conditions
- **Use protection, or PPE** This can include things like head protection, fall prevention gear, and non-slip footwear. It is essential to wear these measures at all times in order to maximize your safety, and the safety of all who are around you.

Standby Equipment

- The Contractor shall provide adequate stand-by equipment to ensure the safety of personnel, the Works and the public. These measures shall include as a minimum the following:-
  - stand-by pumping and generating equipment for the control of water;
  - stand-by equipment and spares for illumination of the Works; and
  - Stand-by generating equipment and equipment for the lighting for the works.

Co-operation

- The Contractor shall provide full co-operation and assistance in all safety surveillance carried out by the Engineer or the Employer. Any breaches of the Site Safety Plan or the statutory regulations or others disregard for the safety of any persons may be the reason for the Engineer to exercise his authority to require the site agent's removal from the Site.

7.7 Care of the Works

- Unless otherwise permitted by the Engineer all work shall be carried out in dry conditions.
- The Works, including materials for use in the Works, shall be protected from damage due to water. Water on the Site and water entering the Site shall be promptly removed by temporary drainage or pumping systems or by other methods capable of keeping the Works free of water. Silt and debris shall be removed by traps before the water is discharged and shall be disposed of at a location or locations to which the Engineer has given his consent.
- The discharge points of the temporary systems shall be as per the consent of the Engineer. The Contractor shall make all arrangements with and obtain the

necessary approval from the relevant authorities for discharging water to drains, watercourses etc. The relevant work shall not be commenced until the approved arrangements for disposal of the water have been implemented.

- The methods used for keeping the Works free of water shall be such that settlement of, or damage to, new and existing structures do not occur.
- Measures shall be taken to prevent flotation of new and existing structures.

Protection of the Works from Weather

- Work shall not be carried out in weather conditions that may adversely affect the Works unless proper protection is provided to the satisfaction of the Engineer.
- Permanent Works, including materials for such Works, shall be protected from exposures of weather conditions that may adversely affect such Permanent Works or materials.
- During construction of the Works storm restraint systems shall be provided where appropriate. These systems shall ensure the security of the partially completed and on going stages of construction and in all weather conditions. Such storm restraint systems shall be installed as soon as practicable and shall be compatible with the right of way, or other access around or through- out the Site.
- The Contractor shall at all times programme and order progress of the work and make all protective arrangements such that the Works can be made safe in the event of storms.

Protection of the Work

- The finished works shall be protected from any damage that could arise from any activities on the adjacent site/ works.

7.8 Damage and Interference

- Work shall be carried out in such a manner that there is no damage to or interference with:
  - watercourses or drainage systems;
  - utilities;
  - structures (including foundations), roads, including street furniture, or other properties;
  - public or private vehicular or pedestrian access;
  - Monuments trees, graves or burial grounds other than to the extent that is necessary for them to be removed or diverted to permit the execution of the Works. Heritage structures shall not be damaged or disfigured on any account.

The Contractor shall inform the Engineer as soon as practicable of any items which are not stated in the Contract to be removed or diverted but which the Contractor considers need to be removed or diverted to enable the Works to be carried out. Such items shall not be removed or diverted until the consent of the Engineer to such removal or diversion has been obtained.

- Items which are damaged or interfered with as a result of the Works and items which are removed to enable work to be carried out shall be reinstated to the satisfaction of the Engineer and to at least the same condition as existed before the work started. Any claims by Utility Agencies due to damage of utilities by the Contractor shall be borne by the Contractor.

Utilities

- Please refer Employer's Requirement - Functional

Structures, Roads and other Properties

- The Contractor shall immediately inform the Engineer of any damage to structures, roads or other properties.

Access

- Alternative access shall be provided to all premises if interference with the existing access, public or private, is necessary to enable the Works to be carried out. The arrangements for the alternative access shall be as agreed by the Engineer and the concerned agency. Unless agreed otherwise, the permanent access shall be reinstated as soon as practicable after the work is complete and the alternative access shall be removed immediately as it is no longer required, and the ground surfaces reinstated to the satisfaction of the Engineer. Proper signage and guidance shall be provided for the traffic / users regarding diversions.

Removal of Graves and other Obstructions

- If any graves and other obstructions are required to be removed in order to execute the Works and such removal has not already been arranged for, the Contractor shall draw the Engineer's attention to them in good time to allow all necessary arrangements and authorisations for such removal, and it shall not itself remove them unless the Engineer has given consent.

Protection of the Adjacent Structures and Works

- The Contractor shall take all necessary precautions to protect the structures or works being carried out by others adjacent to and, for the time being, within the Site from the effects of vibrations, undermining and any other earth movements or the diversion of water flow arising from its work.

7.9 Work on Roads

(1) Traffic Management Plan

The Contractor shall develop a detailed Traffic Management Plan for the work under the contract. The purpose is to develop a Traffic Management Plan to cope with the traffic disruption as a result of construction activities by identifying strategies for traffic management on the roads and neighbourhoods impacted by the construction activities. The Contractor shall implement the Traffic Management Plan throughout the whole period of the Contract.

Principles for Traffic Management

The basis for the Plan shall take into consideration four principles:

- to minimise the inconvenience of road users and the interruption to surface traffic through the area impacted by the construction activities;
- to ensure the safety of road users in the impacted area;
- to facilitate access to the construction site, and to maintain reasonable construction progress.
- to ensure traffic safety at each construction site.

7.10 Site Establishment

Site Laboratories

- The Contractor shall provide, erect and maintain in a clean, stable and secure condition a laboratory, equipped for the routine testing of concrete, soil and rock samples and for the storage and curing of concrete cubes or cylinders only. This laboratory shall be located at the Contractor's principal work site or at a location agreed to by the Engineer. Detailed requirements for this laboratory are set out in to Employer's Requirements.

Contractor's Site Accommodation

- The Contractor shall provide and maintain its own site accommodation at locations consented to by the Engineer. Offices, sheds, stores, mess rooms, garages, workshops, toilet and other accommodation on the Site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the Site. The Contractor shall comply with the requirements of Appendix 8 to the Employer's Requirement.

Toilet and Wash places

- The Contractor shall provide toilet and wash places for the use of its personnel and all persons who will be on the Site. The size and disposition of toilet and wash places

shall accord with the numbers and dispositions of persons entitled to be on the Site, which may necessitate their location on structures and, where necessary there shall be separate facilities for males and females. The capacities and layout shall be subject to approval of the Engineer. The Contractor shall arrange regular disposal of effluent and sludge in a manner that shall be in accordance with local laws/ regulations.

The Contractor shall be responsible for maintaining all toilets and wash places on the Site in a clean and sanitary condition and for ensuring that they do not pose a nuisance or a health threat. The Contractor shall also take such steps and make such provisions as may be necessary or directed by the Engineer to ensure that vermin, mosquito breeding etc. are at all times controlled.

Site Utilities and Access

- The Contractor shall be responsible for providing water, electricity, telephone, sewerage and drainage facilities for contractors site offices, structures and buildings and for all site laboratories in accordance to the Employer's Requirements and all such services that are necessary for satisfactory performance of the Works. The Contractor shall make all arrangements with and obtain the necessary approval from the relevant civil and utility authorities for the facilities.

The contractor shall be responsible for provision of power supply for his works including for launching girder and the like .The Employer can not guaranty provision of adequate, continuous power supply however assistance will be given in obtaining the necessary permissions for site generators and the like.

- Access roads and parking areas shall be provided within the Site as required and shall be maintained in a clean, acceptable and stable condition. .

Submission of Particulars

- The following particulars shall be submitted to the Engineer for his consent not more than ten days after the date of commencement of the Works:
  - drawings showing the formation works and the layout within earmarked area for the Contractor's offices, project signboards, principal access and other major facilities required early in the Contract, together with all service utilities;
  - drawings showing the details to be included on the project signboards and diversion boards.
- Drawings showing location of stores, storage areas, concrete batching plants and other major facilities +and their access roads/paths shall be submitted to the Engineer for his consent as early as possible.

7.11 Security

The Contractor shall be responsible for the security of the Site for the full time the Site is in its possession, except for the specific case. The Contractor shall maintain all site boundary fences in first class condition, and shall so arrange site boundary fences at all access drainage points of work areas that it's use of such access points etc., are not restricted by the system or method of achieving the required security measures. Notices shall be displayed at intervals around the Site to warn the public of the dangers of entering the Site.

7.12 Testing

General

- The Contractor shall provide and perform all forms of testing procedures applicable to the Works and various components and the interfacing of the Works with the other Contract works and shall conduct all necessary factory, site and acceptance tests.
- All testing procedures shall be submitted at asap prior to conducting any Test. The Testing procedures shall show unambiguously the extent of testing covered by each submission, the method of testing, the Acceptance Criteria, the relevant drawing (or modification) status and the location.
- The testing Procedures shall be submitted, as required, by the Contractor during the duration of the contract to reflect changes for the identification of additional testing requirements.
- The Engineer shall have the facilities for monitoring all tests and have access to all testing records. Ample time shall be allowed within the testing programmes for necessary alterations to equipment, systems to be undertaken, together with re-testing prior to final commissioning.
- The Contractor is reminded that at some point, the High Voltage Power Supply system will be energised and the additional precautions for the safety of staff and co-ordination of activities after power-on shall be anticipated in its testing and commissioning programmes.
- All costs associated with the Testing shall be borne by the Contractor, unless otherwise specified, including the services of any specialised personnel or independent assessors. The Contractor shall also bear any expenses incurred due to resetting caused by defects or failure of equipment to meet the requirements of the Contract in the first instance.
- Unless agreed in writing by the Engineer, the personnel engaged on testing shall be independent of those directly engaged for installation of the same equipment.

- All testing equipment shall carry an appropriate and valid calibration labels.

Batches, Samples and Specimens

- A batch of material is a specified quantity of the material that satisfies the specified conditions. If one of the specified conditions is that the material is delivered to the Site at the same time, then material delivered to the Site over a period of a few days may be considered as part of the same batch if in the opinion of the Engineer there is sufficient proof that the other specified conditions applying to the batch apply to all of the material delivered over the period.
- A sample is a specified quantity of material that is taken from a batch for testing and which consists of a specified amount, or a specified number of pieces or units, of the material.
- A specimen is the portion of a sample that is to be tested.

Samples for Testing

- Samples shall be of sufficient size and in accordance with relevant Standards to carry out all specified tests.
- Samples taken on the Site shall be selected by, and taken in the presence of, the Engineer and shall be suitably marked for their identification. An identification marking system should be evolved at the start of works in consultation with the Engineer.
- Samples shall be protected, handled and stored in such a manner that they are not damaged or contaminated and such that the properties of the sample do not change.
- Samples shall be delivered by the Contractor, under the supervision of the Engineer, to the specified place of testing. Samples on which non-destructive tests have been carried out shall be collected from the place of testing after testing and delivered to the Site or other locations instructed by the Engineer.
- Samples which have been tested may be incorporated in the Permanent Works provided that:
  - the sample complies with the specified requirements;
  - the sample is not damaged; and
  - the sample is not required to be retained under any other provision of the Contract.
- Additional samples shall be provided for testing if in the opinion of the Engineer :
  - material previously tested no longer complies with the specified requirements;

or

- material has been handled or stored in such a manner that it may not comply with the specified requirements.

Testing

- The Contractor shall be responsible for all on-site and off-site testing and for all in-situ testing. All appropriate laboratory tests shall be carried out in the Contractor's laboratory, unless otherwise permitted or required by the Engineer. Where the laboratory is not appropriately equipped and/or staffed for some tests, or if agreed to by the Engineer, tests may be carried out in other laboratories provided that:
  - they are accredited for the relevant work to a standard acceptable to the Engineer ; and
  - particulars of the proposed laboratory are submitted to the Engineer for his consent.
- In-situ tests shall be done in the presence of the Engineer.
- Equipment, apparatus and materials for in-situ tests and laboratory compliance tests carried out by the Contractor shall be provided by the Contractor. The equipment and apparatus shall be maintained by the Contractor and shall be calibrated before the testing starts and at regular intervals as permitted by the Engineer. The equipment, apparatus and materials for in-the situ tests shall be removed by the Contractor as soon as practicable after the testing is complete.
- The Contractor shall be entitled in all cases to attend the testing carried out in the Employer's or other laboratories, to inspect the calibration certificates of the testing machines and to undertake the testing on counterpart samples.
- Attendance on tests, including that by the Engineer, Contractor, shall be as laid down in the Quality Assurance procedures.

7.13 Records

Drawings Produced By the Contractor

Drawings produced by the Contractor including drawings of site layouts, Temporary Works, etc. for submission to the Engineer shall generally be to ISO A1 size. They shall display a title block with the information as detailed to these Employer's Requirements. The number of copies to be submitted to the Engineer shall be as stated in the Contract, or as required by Engineer.

Progress Photographs

The Contractor shall provide weekly progress photographs which have been properly

recorded to show the progress of the works to the Engineer.

The Contractor shall ensure that no photography is permitted on the Site without the agreement of the Engineer. Contractor should be aware of the local regulations and conditions with regard to Photography in some "RESTRICTED AREA' in Manglore.

Records of Wage Rates

The Contractor shall keep monthly records of the average, high and low wage rates for each trade/tradesman employed on the Site and records shall be made available to the Engineer during inspection.

7.14 Provision and Disposal of Earthworks Material

The Contractor shall be responsible for the provision of all classes of earthworks material required for the Works, whether sourced from the excavations within the Contract or obtained from any other sources, which are located outside the Site, for which the Engineer has given the consent.

For fill or dumping sites, the Contractor shall prepare a land plan with details of surface drainage requirements, final formation levels, spreading and compaction of the fill during dumping acceptable to the Engineer. The Contractor shall also provide security for such sites. The dumping sites to be used by the Contractor shall be as directed by the Engineer.

All excavated material, excluding waste material, bentonite fluid and bentonite contaminated material shall be disposed of at the appointed site only. This material shall be placed and compacted in accordance with the Construction Specification for Earth Works or as otherwise directed by the Engineer's Representative. The disposal of waste material, bentonite fluid and material contaminated with bentonite shall be the full responsibility of the Contractor and these materials shall be disposed of by the Contractor at an approved location. The dumping sites provided by the Employer shall not be used for disposal of waste material, bentonite fluid or material contaminated with bentonite.

Rock deposited as fill material at the dumpsites shall be capable of compaction with single pieces no larger than 300mm.

7.15 Restoration of Areas Disturbed By Construction.

Unless otherwise directed by the Engineer, any areas disturbed by the construction activity, either inside or outside the Project Right of Way, shall be reinstated as follows:

All areas affected by the construction work shall be reinstated to their original condition, with new materials, including but not necessarily limited to, sidewalks, parking lots, access roads, adjacent roads properties and landscaping. Grass cover shall

be provided for any bare earth surface areas, along with proper provisions for surface drainage.

7.16 Landscaping

Landscaping must be submitted to the relevant authorities and match the remaining areas. In addition the Contractor shall carry out the construction of landscaping for all works areas and will submit his proposals to the relevant authorities for approval before commencement of landscaping works.

7.17 Specifications

When the Specification has received a Notice of No Objection from the Engineer it shall become the Particular Specifications and shall take precedence over the other Specifications for construction purposes.

7.18 Specifications in Metric and Imperial Units

- The Contract shall utilise the SI system of units. Codes and Standards in imperial units shall not be used unless the Engineer has given his consent.
- Conversion between metric units and imperial units shall be in accordance with the relevant Indian Standards.

7.19 Works Programme

- The Contractor shall prepare and submit its Works Programme and three month rolling programmes and the detailed requirements to these Work Requirements and the project calendar mentioned.
- However successful bidder has to obtain all statutory permission NOC, clearance pertain to their plant, yards, other temporary works/structures, establishments, hutments and others allied work of their own use.

7.20 Monitoring of Progress

- The Contractor shall submit to the Engineer **three** copies of a Weekly Progress Report (WPR), as described to these Employer's Requirements, describing the progress and current status of the Works. The WPR shall address the matters set out in the Works Programme.
- The WPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from sixth day of the last week and up to sixth day of the current week
- The WPR shall be divided into two sections. The first section shall cover progress and current status relating to design (not applicable) and the second section shall

cover progress and current status relating to construction.

- A weekly meeting to monitor & review the progress of the project shall be convened by the Engineer. Contractor's site Representative of Contractor and site agent of all interfacing contractor shall also attend the meeting. The Employer may also be present in the meeting.
- The Engineer or Employer may also conduct progress review meetings on weekly /bi-weekly intervals depending upon the requirements or urgency of works. In these review meetings Engineer may call Contractor's Supplier/Sub-Contractor etc. as per the requirements.

7.21 Quality Assurance

The Contractor shall establish and maintain a Quality Assurance System in accordance with to these Employer's Requirements for construction procedures and the interfaces between them. This Quality Assurance system shall be applied without prejudice to, or without in any way limiting, any Quality Assurance Systems that the Contractor already maintains.

7.22 Co-Ordination with Designated and other Contractors

General

- The Contractor is responsible for detailed co-ordination of his construction activities with those of the Designated Contractors, Civil Contractors, Utility Agencies, Statutory Authorities, Private Service Providers, Developers, Consultants and other Contractors whether or not specifically mentioned in the contract, that may be working on or adjacent to the site for the purpose of the Project. For the purpose of this Specification, all of the above parties shall be referred to as Interfacing Contractors. The Contractor shall note that there are other contractors, consultants, etc. which the Employer will engage from time to time with whom the Contractor shall have to similarly co-ordinate.
- The Contractor, shall in carrying out his co-ordination responsibilities, raise in good time and provide sufficient information for the Engineer to decide on any disagreement between the Contractor and the Interfacing Contractors as to the extent of services or information required to pass between them. If such disagreement cannot be resolved by the Contractor despite having taken all reasonable efforts, then the decision of the Engineer shall be final and binding on the Contractor.
- The Contractor shall co-ordinate with the Engineer on all matters relating to works that may affect the Operation & Maintenance of the already operational Section corridor of the Employer in general. Such work shall be subject to the rules and

regulations imposed by the Employer.

Dedicated co-ordination team

- The Contractor shall establish a dedicated co-ordination team, led by a Chief Co-ordinator
- The complexity of the Project and the importance of ensuring that work is executed within time limitations require detailed programming and monitoring of progress so that early programme adjustments can be made in order to minimise the effects of potential delays.
- Auto CAD Operator :- The contractor shall provide one experienced Auto CAD operator exclusively for the Office of the Engineer till 3 months beyond the date of completion of project for As-build.

7.23 Survey and Site Investigations

- The datum used for the Contract shall be Mean Sea Level Datum
- The Contractor shall carry out all further site investigations necessary for the design of the Permanent Works and to enable the determination of the methods of construction and the nature, extent and design of the Temporary Works.

7.24 Climatic Conditions

Manglore experiences coastal climatic conditions and tenderers must acquaint themselves about the same before submitting the tender. The Employer shall in no way be responsible on this account.

7.25 Contractor's Project Organisation

- The Contractor shall have a competent team of Managers, Engineers, Technical staff etc so as to complete the work satisfactory as per various requirements of the contract.
- A office room with round the clock radio communication or telephone switch board links with all safety offices, works sites, site offices, batching plants, casting yards, workshops, fabrication yard, off site offices, Engineers site office, Resident Engineer's office, testing labs etc shall be maintained and manned round the clock. Residences of all senior project team members shall also be linked with the office room. Vehicles for emergency use should be on stand-by at the office room around the clock.
- The designations of the various project organisations team members shall be got approved by the Engineer before adoption so as to avoid any duplication of the designations with those of the Employer or the Engineer.

7.26 Technology Transfer

- The Contractor shall ensure that all local contractors and sub-contractors engaged in the works are given training, guidance and the necessary opportunity for transfer of technology in various areas of construction such as instrumentation, safety, quality assurance, etc.

7.27 Maintenance Report

- The Maintenance Report shall be submitted as part of the long term inspection and maintenance operations for each major component of water supply, sewerage system, water treatment, STP plants etc.
- The Contractor shall provide inspection and maintenance manuals for the civil, structural and building works covering all areas.
- For each area an inspection checklist shall be supplied giving inspection frequency, items to be inspected, criteria for acceptance, criteria for remedial works and details of the remedial works, including proposed materials and method statements. The recommended regular maintenance regime of each area shall also be given including cleaning methods and frequency for different surfaces; removal of leakage borne salts from concrete surfaces; cleaning of drainage channels, sumps and pipes; repainting of metallic items;
- A long term monitoring regime shall also be included covering items such as
  - Roofing & waterproofing work
  - ICT work
- All instruments necessary to carry out the inspections and monitoring that are identified in the report shall be provided by the Contractor.

8. DRAWINGS

The Following Drawings prepared for Each Schools are enclosed in Volume 2 of the DPR:

4) Existing Plans Prepared based on Building Measurement done
5) Proposed Plans
6) 3D Views: Before and After

9. BUDGET & COST ESTIMATES

9.1 Budget as per SCP

Smart City Component ID	Smart City Component Name	Budget Estimated in the Smart City Proposal in INR
KAR-MAN-141	:Implementation of E-smart schools in all government schools - Package 1 – Infrastructure	**11 Crore**
KAR-MAN-142:	Implementation of E-smart schools in all government schools - Package 2 - ICT	**5 Crores**

9.2 Project Cost (Part A: Infrastructure Upliftment)

Sr.No.	School List	Amount in Rs.
1	Dakshina Kannada Zilla Prathamikta Hera School, Pandeshwara, Ward-46	9,823,545
2	Govt. High School, Urdu, Bunder, Ward 46	9,385,062
3	Govt. Higher Secondary School, Hoigebazar ward-57	5,808,677
4	Lower Primary School, Hoigebazar, Ward-57	4,980,811
5	Gov. Upper Primary School, Neereshwalya, Ward-45	3,084,924
6	Block Education Office and Govt High School, Bolar	15,064,948
7	Govt.primary and secondary school and College, Balmatta, Ward-40	19,866,738
8	Govt. Practicing School, Opp. Maidan Road near Railway Station	11,261,875
9	Govt.Primary School, Bastigarden, Ward-41	5,670,004
10	Govt. Women's Pre-university College, Rathabeedi, Car Street	11,297,024
	Total Cost	**96,243,608**
	Add Tender Premium @ 5%	4,812,180
	Add Contingency @ 3%	2,887,308
	GST @ 12% on SOR & Non SOR	8,368,178
	GST @ 18% on Market Rate	3,907,362
	Adminstrative charges, Miscellaneous and rounding off (LS)	11,364
	Grand Total	**116,230,000**

Infrastructure Upliftment Cost Under Each Sub Head Of Infra Work						
Infra Components	**Building works In Cr**	**Electrical Works In Cr**	**Plumbing Works In Cr**	**External Development In Cr**	**Sports Equipments In Cr**	**Total Amount in Rs. Cr**
Total Cost - A	**6.96**	**0.45**	**0.21**	**1.99**	**0.022**	**9.62**
Other Cost - B						
(i)Add Tender Premium @ 5%	0.35	0.02	0.01	0.10	0.0011	**0.48**
(ii)Add Contingency @ 3%	0.21	0.01	0.01	0.06	0.0006	**0.29**
(iii)GST @ 12% on SOR & Non SOR						**0.84**
(iv)GST @ 18% on Market Rate						**0.39**
(iv) Adminstrative charges, Miscellaneous and rounding off (LS)						0.0011
Total Cost - B	**0.80**	**0.28**	**0.26**	**0.40**	**0.247**	**2.00**
Grand Total (A + B)	**7.76**	**0.73**	**0.48**	**2.39**	**0.27**	**11.62**

The Detailed Cost Estimates are enclosed as Volume 3 of the DPR

10. CONCLUSION & RECOMMENDATION

Conclusion:

Schools, being the second home, serve a number of purposes in a child's life. From boosting their confidence to making them learn the importance of team work and socialization, schools do it all. Away from home, schools become the place for children to spend their maximum time. Kids are sent to school considering the fact that there is an experienced hand to guide them and also a safe environment promoting growth. We also accept the fact that infrastructure plays a budding hand in creating a favorable environment for a child's growth.

- Sending children to a school where the building looks rundown and playgrounds need work can never be a good idea. Can parents feel safe sending their child to an environment like that? Well, even children won't feel satisfied in a place that lacks physical comfort and other basic facilities. Let's read between the lines to understand the impact of a school's infrastructure on the overall growth of students. However, there are times when irrespective of poor infrastructure, students perform meritoriously. People may argue that physical space is secondary and concentration is what matters but researchers and psychologists suggest that environmental factors can increase the academic performance and motivate attendance.
- It's proven that overcrowded and stressful environment can affect the learning capabilities of children. The site for educational institutions like schools is a crucial concern as noise and temperature levels are said to affect the understanding levels in students. Physical conditions can leave both positive and negative effects on the students' all-inclusive development. School buildings, classrooms, playgrounds and libraries are the most important aspect of school infrastructure. Spacious and refurbished buildings and well- ventilated classrooms are a must in schools. Well-equipped labs enable them to perform lab activities more effectively. Facilities like extracurricular workshops, libraries, halls, games equipment, assembly area and proper sanitation facilities are some of the infrastructure essentials that every school should provide to its students. Properly planned school infrastructure is an out-and-out key factor in effective teaching and learning. This can also be an encouragement for the school faculty.
- The quality of nation’s political, social and economic future will depend on the capabilities of their young generation. Smart schools have been proposed as a solution to increase the capabilities of the new generation in the era of ICT. Recently, many smart schools have been established in India. The aim of this

study is to compare smart training method and traditional training method in learning-retention processes. A Smart School is an educational establishment that adopts instructional processes and educational management practices that foster systemic changes that are intended to enable learners to surmount the challenges posed by the information technology era. Smart schools have been systemically reinvented in terms of teaching and learning practice and school management in order to prepare students for the Information Age. In the Information Age, a Smart School will evolve over time continuously developing its professional staff, educational resources and its administrative capabilities to adapt to changing condition, while continuing to prepare student for his/her future life. Smart schools will seek to make learning more interesting, motivating, stimulating and meaningful. Smart schools are using an appropriate mix of learning strategies to ensure mastery of basic competencies and promote holistic development, accommodate individual different learning styles, to boost performance and foster a classroom atmosphere that is compatible with different teaching-learning strategies. Smart School pedagogy will seek to make learning more interesting, motivating, stimulating and meaningful for students. It is also involve students mind, spirit and bodies in the learning process

In the modern era of rapid changes of information and technology, the process of teaching and learning is changing. Using ICT in education has been proposed to be led to increase in education quality, expansion of learning chances and accessibility of education beyond the classroom.

Smart training has led not only to higher learning scores, but the higher retention of the learned materials. It could be proposed that teachers in smart schools could be able to make the inappropriate and inflexible content of textbooks more attractive for students. Also, the teacher's role as the sole speaker is changed into a director where the former is resulted in presenting educational materials by emphasizing the memory and speed which is boring for students.

Recommendation

Yes, smart schooling is the answer to making learning interesting, purposeful and giving a direction to a dream and pathways to achieve the same, Undoubtedly most schools recognize this need and are working towards it. The advent of digital boards, online tools, and programmes, the media links and modules are some of the basic smart school tools. But the need is far greater and below listed are some ways of changing the game.

- Design spaces in school buildings for flexibility and adaptability of use – for example, classrooms that can be converted to auditoriums. Consider new ways of organizing the classroom to facilitate collaboration and creativity (eg ‘didactic

corners' or round tables and circular seating instead of fixed desks and chairs) while also ensuring space for privacy and reflection when needed.

- Use the school as a multi-purpose, cultural utility that provides resources and services to the wider community such as libraries, internet access, performance/arts spaces, playgrounds, gardens, etc.
- Consider building designs with shared spaces and central patios/courtyards surrounded by classrooms. The central patio can serve as a meeting point, auditorium and play area.
- Consider the furniture, finishings, floors, ceilings, toilets, sanitary, safe drinking water and plantings as a 'third teacher'
- Understand how students, teachers and parents commute to schools and ensure safe, multi-modal options are available to all families. Ensure pedestrian safety and accessibility in the vicinity of schools (traffic calming, reduced speed limits, crosswalks and crossing guards) Provide safe drop offs and circulation inside/outside school compound
- App-based Learning: This tool is immensely useful when one needs access to mobile learning resources. Whilst you are on the move, you can access the app and revisit concepts taught in various disciplines namely maths, sciences, social studies etc. Besides being easily available it also provides a learner-friendly atmosphere and could be helpful as it also addresses the need for differential learning strategies.
- Video-based Learning: Giving a face to the name, helps remember someone. Same is with teaching and learning today. Instead of written theory, a very easy and impactful way to reach the child's mind is the use of video-based lessons. Adopting the digital learning way to impart education makes understanding easy, especially so for a visual learner. Today the tools available in this medium are so vast that you can use it to enhance any learning activity. Right from using it in class, to showing virtual experiments which don't require learners to use labs, teaching art through this medium and many more. Teachers lectures can be recorded too, which can be used to help students who can't attend school due to various reasons or students who don't understand can revisit lectures at a later date.
- Use of Artificial Intelligence in Schools: Digital content is created using AI with the same proficiency as that of humans and is extremely popular given the short period of time that they are created in. Digital textbooks or digital learning interfaces are user-friendly and child-friendly. Digital lectures, video conferences

help better the understanding of a child. Artificial Intelligence helps here by automating the grading methodology which also makes it more accurate.

- Virtual Lecturers: The virtual facilitator is a new phenomenon that responds just like the same actual teacher. Although one can never replace a teacher-learner interaction in class this definitely is a great substitute for various contingencies like teacher absenteeism, illness etc. Once fine-tuned, these will be very popular in the classrooms.

Some of the above-mentioned methods are already in practice across many schools, the integration of all of them will truly translate to the advent of smart schools. And with the pace at which these are being developed and tested, the education segment will see a major breakthrough in the coming years with teaching made fun and within easy reach to many.

Annexure

Annexure- A Stack-holders' attendance sheet

Annexure- B Stack-holders' representation