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Think, Transform & Transcend

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North-East COREN Regional Steering Committee Inauguration

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Courtesy Visit by COREN Leadership

ENGR. A. A. RABIU, FNSE, RECEIVED SYMBOLIC HANDOVER AS THE 35TH PRESIDENT OF NSE FROM THE OUTGOING PRESIDENT.



NIHTE IMMEDIATE PAST CHAIRMAN, ENGR. SAIDU HASSAN, FNSE, FNIHTE, ATTENDED AND CHAIRED A ONE-DAY TRAINING WORKSHOP ON EMPOWER LEADERSHIP FOR SUSTAINABLE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT, ORGANIZED BY THE FEDERAL MINISTRY OF ENVIRONMENT (FMEv) - EA DEPARTMENT ON 10TH DECEMBER, 2025



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Development
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OUR VISION

- ! To transform the nation's highway & transport sector that is centered on road safety, compliance, intervention, monitoring, assets management, reform, financing and capacity building for the nation's highway and transportation professionals.

OUR MISSION

- ! To think, transform and transcend the nation's highway & transport practice to that of global best practices.
 To provide forum for members and partners of the highway & transport industry that foster education, innovation, research, fellowship, promoting a safe, sustainable and efficient highway & transport system.
 To bring radical changes into the highway & transport practice in design, construction, maintenance, sustainability and management of highway & transport infrastructures.
 To engage highway and transportation stakeholders.
 To hold research, conference, seminar, technical publication, workshops, lectures in line with global best practices.
 To provide professional leadership while developing and sharing knowledge, capacity building and technology acquisition.
 To develop the nation's highway design and construction standards.
 To net-work and engage with highway industry leaders from different countries of the world.
 To have unparalleled professional and business development opportunities around the globe.

Core Values

Education and Innovation.
 Diversity, Inclusiveness and Ethics.
 Quality life
 Fellowship.

Goals

Increase visibility.
 Maintain membership and extend market diversity.
 Promote education.
 Educating highway & transport decision makers.

Aims & Scope

As an academic journal, the *Journal of the Nigerian Institution of Highway and Transportation Engineers (NIHTE)*, provides a platform for the exchange and discussion of novel and creative ideas, on theoretical and experimental research in the field of Highway and Transportation. This journal publishes high-quality peer-reviewed papers on engineering, planning, management, and information technology for highway transportation. The journal is committed to rapid peer review and publication.

The scope of the *Journal of the Nigerian Institution of Highway and Transportation Engineers*, includes: -

- Road engineering, railway engineering, environmental engineering, ITS and traffic engineering and bridge and tunnel engineering
- Automotive engineering, design, manufacture, and operation of vehicles
- Air transportation, maritime transportation, road transportation, and railway transportation
- Analysis, operation, optimization, and planning of highway and transportation systems and networks
- Travel behaviour, information technology, traffic control, and traffic flow theory
- Economics, health, safety, security, environmental and management of highway and transportation
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A NOTE FROM THE LEAD EDITOR'S PEN

Dear colleagues and friends,

As we conclude a year marked by significant achievements and progress, I wish to extend my deepest gratitude to each and every one of us, we have been source of motivation with our optimistic attitude and creative spirit. We have navigated numerous challenges, contested against enormous difficulties and fought across all frontiers, nevertheless, we propelled to new heights, because of efforts of all of us – our 4th position in the NSE Group Dynamics. The future is filled with opportunities and I am confident that together, we will continue to excel and shape a future that is not only successful, but also sustainable.

I intend to set more ambitious tasks, targets and goals that will deliver strategic advantages for the Journals and we also achieve milestones or excellent scorecards with our supports.

I thank all of us for always exceeding my expectations. We elevated the meaning of teamwork to a new level. I am truly grateful for our professionalism and focus on excellence.

Kindly find time and peruse the Journal with so many exciting news, articles, etc. Wishing all of us a Joyful Season and a Happy New Year in advance!

We wish to stay connected during this time, so please, find time to send your articles/papers or email us at: -
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japavisca@yahoo.com

Or call 08032630023, 08035146679, 08023549515, 07038064059, 08065668058, 08066898981, for any submission.

Welcome again to NIHTE quarterly Journal.

Sincerely,



Jones Nwadike
Lead Editor

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About NIHTE

NIHTE – the Nigerian Institution of Highway and Transportation Engineers – is a non-profit, non-partisan institution representing highway and transportation in the Nigerian Society of Engineers (NSE), in Nigeria. It represents all highway and transportation modes, including air, highways, public transportation, active transportation, rail, and water. Its primary goal is to foster the development, operation, and maintenance of an integrated national highway and transportation systems.

NIHTE works to educate the public and key decision-makers about the critical role that highway and transportation play in securing a good quality of life and sound economy for our nation. NIHTE supposed to serves as a liaison between national, state and local government departments of highway and transportation and the Federal government and is supposed to be an international leader in setting technical standards for all phases of highway and transportation systems development. Standards are supposed to be issued for design, construction of highways and bridges, materials, and many other technical areas.

Construction workers are often at risk of exposure to many infectious diseases, such as coccidioidomycosis, histoplasmosis, hypersensitivity pneumonitis, disseminated histoplasmosis, dengue, asbestos-related illnesses, silicosis, legionellosis, tuberculosis, blood-borne pathogens, and COVID-19. Due to severe working conditions and possible accidents, construction fields are high-risk zones by nature. It is very important to recognize and control the preventable health and safety hazards within these environments. The need for identification and prevention of these diseases is urgent, according to NIHTE. We can be nimble and quick in illustrating to those who are exposed to theses hazards, how to spot them and, hopefully, eradicate them, with help from health workers.

DESIGN AND CONSTRUCTION CHALLENGES OF RIVER BRIDGES: A CASE STUDY OF RIVER WONDERFUL BRIDGE

BY

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ABSTRACT

The day to day developments in computer software coupled with the recent emergence of the Artificial Intelligence otherwise known as 'AI', have made things that may otherwise be regarded as an ingenuity of young engineers to be more or less nothing really surprising. The preliminary design of the River Wonderful Bridge from first principles by young engineers of the Federal Ministry of Works, Kaduna State Field Office, is one of the innovative designs in 1998, at a time when computer software was just developing and Artificial Intelligence is yet to be introduced into the practice of engineering. With critical study of the bridge location in relation to the geotechnical, hydraulically, economical, serviceability and other relevant parameters, the in-house preliminary design of River Wonderful Bridge was made to consist of three spans of beam and slab deck type. The implementation of the final design which retained almost all features of the initial preliminary design was awarded to Setraco Nigeria Limited. The construction of the bridge, which is the main subject of this paper, is what can be said to be a manifestation of the name of the river it crossed. The workmanship employed during the construction was not really special when compared with other bridge constructions in civil engineering field works. However, the abstruse incidences witnessed during the construction that spanned from early 2000 to December, 2001 made the work events a series of subjects to be remembered continuously.

KEY WORDS: Wonderful River and Bridge, Pad and Pile Foundations, Abstruse Incidences.

1.0 INTRODUCTION

In the world, there are natural phenomena that occurs in places with incidences that are purely inexplicable. In the science world, there exist some places that have proved the law of gravity to be wrong. Places among many others that have proved the known force of gravity as ineffective are 'Naneghat Reverse' in India, 'Hoover Dam' in Nevada, USA, The 'Oregon Vortex' also in USA, 'Rua Do Amendoim' in Brazil, 'Gravity Hill' in Armenia and 'Hudson Bay Area' in Canada. Related places

among others that have created an illusion of zero gravity include Ado Awaye in Nigeria where there exist a 'Suspended Lake' that makes gravitational force law abnormal; figure 1, 'Mystery Spot' in California, USA where water appears to flow uphill with people and objects seemingly to change size, and Magnetic Hill in Ladakh where vehicles appears moving uphill.

Places in the world similar to the subject of this paper are where names given to them are manifestation of the wonders of nature occurring there. Some of this places among many others are; 'Blood Falls' in Antarctica where iron-rich hyper-saline water from Taylor Glacier makes a fall; figure 1, 'Crooked Forest' in Poland where J-Shaped tree trunks produced a dancing forest, 'Sailing Stones' in Death Valley National Park, USA where rocks move on their own with no external force, and 'Lake Natron in Tanzania where blood red waters is so alkaline that animals that die and fall into it becomes stone-like and don't decompose. In this category is the River Wonderful in Nigeria where incidences witnessed during the construction of a bridge over it was indeed a manifestation of the name ascribed to it.

FIGURE 1: SOME INEXPLICABLE NATURAL OCCURENCES IN THE WORLD



This paper is an overview of the design and implementation challenges of bridges over river, with the 'Construction of Approach Roads and Bridge over River Wonderful' near Kafanchan in Kaduna State, Nigeria as a case study. After a careful study of all the site physical and sub-soil investigations, identification of all the locally available materials, and all other design parameters, the preliminary design of the project was made in-house using the first principles by young engineers in the Kaduna State Field Office of the Federal Ministry of Works. The final design was made by a consultant; Dave Design Group, Abuja. The implementation / construction was awarded to Messrs. Setraco Nigeria Limited, though her sister company

curbed, climate change will still occur. However, until recently, most adaptation efforts have been top-down, and little attention has been paid to communities' experiences of climate change and their efforts to cope with their changing environments. This special issue of *Participatory Learning and Action* focuses on recent approaches to adaptation to climate change which are community-based and participatory, building on the priorities, knowledge, and capacities of local people. Community-based adaptation draws on participatory approaches and methods developed in both disaster risk reduction (DRR) and community development work, as well as sectoral-specific approaches such as farmer participatory research (Berger *et al.*, this issue) and Farmer Field Schools (Sherwood and Bentley, this issue). Innovative participatory methods are also emerging to help communities analyze the causes and effects of climate change, to integrate scientific and community knowledge of climate change, and to plan adaptation measures. In this overview paper to the issue, we describe how community-based approaches to climate change have emerged, and the similarities and differences between community-led adaptation and other participatory development and disaster risk reduction approaches. Whilst community-led adaptation is a relatively new field, some lessons and challenges are beginning to emerge, and we analyze these, drawing on the experiences contained in the collection of articles for this issue. Many of the articles are concerned with natural resources, reflecting the preponderance of submissions we received in this area. However, climate change will affect many other aspects of communities' lives, and we would urge practitioners working in other sectors, such as human health and urban areas, to share their experiences of community-based adaptation.

Climate change and its impacts

Climate change refers to short-, medium- and long-term changes in weather patterns and temperature that are predicted to happen, or are already happening as a result of anthropogenic emissions of greenhouse gases such as carbon dioxide. These changes include a higher frequency of extreme weather events such as drought and floods, as well as greater unpredictability and variability in the seasons and in rainfall. Overlying this increased variability are expected longer-term changes, such as temperature and sea-level rises, and lower (or in some cases higher) rainfall.

Why are people vulnerable to climate change?

Countries and communities are more vulnerable to climate change because they tend to be located in geographically vulnerable areas, such as flood-prone, drought-prone or cyclone-prone and in more vulnerable locations. For example, the slums and informal settlements surrounding many developing country cities are usually sited on land prone to landslips or to flooding and river bank erosion. Wealthy people, commerce and industry can afford to situate themselves on safer land. Many poor communities are heavily dependent on natural resources for their livelihoods. Smallholder farmers have much experience of adapting to their complex, diverse and risk-prone environments. However, farming is now becoming even more difficult and risky because of greater unpredictability in the timing of rainy seasons and the pattern of rain within seasons, making it more difficult to decide when to cultivate, sow, harvest and needing more resources to seize the right time for planting and to maintain crops and animals through dry spells. Heat stress, lack of water at crucial times, and pests and diseases are serious problems that climate change appears to be exacerbating. These all interact with ongoing pressures on land, soils and water resources that would exist regardless of climate change (Jennings and McGrath, 2009). Vulnerability to climate change is not just a function of geography or dependence on natural resources; it also has social, economic and political dimensions, which influence how climate change affects different groups (Action Aid, 2005). People rarely have insurance to cover loss of property due to storms or cyclones. They cannot pay for the healthcare required when climate change induced outbreaks of malaria and other diseases occur. They have few alternative livelihood options when their only cow drowns in a flood or drought kills their maize crop for the year – and they do not have the political clout to ask why their country's early warning system did not warn them of likely flooding. Climate change will also have psychological and cultural effects, for example beliefs and traditions associated with the seasons being undermined by climate change (Jenning and McCrath, 2009). Communities already struggle to cope with the existing challenges of poverty and climate shocks, but climate change could push many beyond their ability to cope or even survive. It is vital that these communities are helped to adapt.

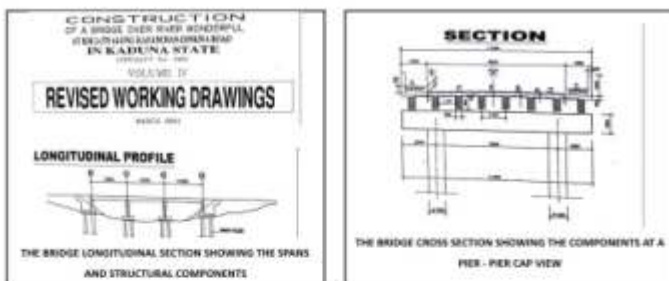
made the discovery very amazing and unexpected.

Reports on this discovery were immediately written to the authorities. A consultant; Dave Design Group was promptly engaged for the review of the working drawings. All necessary comprehensive subsoil investigations which includes drilling of boreholes at all the abutment and pier locations were carried out. The revised working drawings which tackled and corrected all the envisaged problems were made by the consultant for the ministry's consideration.

3.4 THE REVISED WORKING DRAWINGS

The revised design retained almost all the features of the substructure and superstructure as per the initial and final designs. The main revision is the foundation which is made to be of reinforced concrete bearing piles of varying length depending on the basement complex depths. The relatively short piles which were designed to be 800 millimeters diameter bored are of 'Type D. That is, Cast-In-Place Reinforced Concrete Bearing Piles formed by driving a steel pipe casing which is filled with concrete and then withdrawn during or after'. They were strictly designed in line with the relevant clauses of the Federal Ministry of Works' 'General Specification; Road and Bridges'¹² Main features of the revised design of the bridge are as shown in figure 3.

FIGURE 3: DETAILS OF THE FINAL DESIGN OF RIVER WONDERFUL BRIDGE¹



1.0 THE CONSTRUCTION

The need to have the design revised stalled the progress of the bridge's field works after award. Comprehensive subsoil investigations, collations of data, actual design of the pile foundation coupled with the necessary authority approvals made serious field works to be delayed for few months. During this period of delay, the contractor concentrated on the production of the bridge's main beams and fabrications of the pre-slabs also known as false formworks. The curtailment (bending and cutting) of the reinforcements, especially for the sub-structural members, were also done during this period.

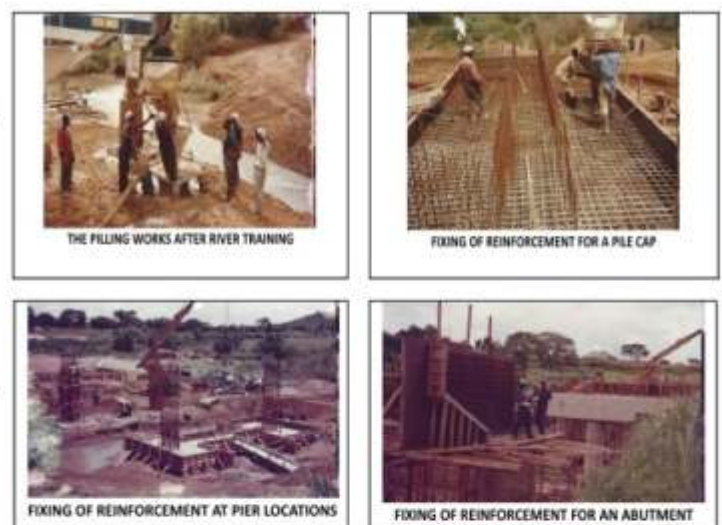
4.1 THE FOUNDATION WORKS

The contractor commenced the construction works almost immediately after the revised working drawings were approved. The piling works which commenced on completion of the necessary survey and river training works continued non stop until all the piles for the bridge's foundation were completed. Figure 4 shows the pile works then in progress with river training already done for ease of construction..

4.2 THE CURTAILMENT AND FIXING OF REINFORCEMENT

The curtailment (bending and cutting) of the already tested and passed reinforcement and subsequent fixing of same for the substructures and superstructures were carefully done bearing in mind the details in the revised working drawings. Having started the works during the delay period made a remarkable progress to be promptly achieved as works gets to the stage of making use of them. Presented in table 4 are the reinforcement works for basic members of the project.

FIGURE 4: PILE AND REINFORCEMENT CURTAILMENT & FIXING WORKS^{3,4}



4.3 THE CONCRETE MIX DESIGN

Concrete have the ability to resist structural compression in civil engineering structures while the reinforcement resist structural tension in same. The two combined provides the requisite concrete quality to carry the design loads. Since reinforcement is factory made and laboratory tested, concrete was the main site supervision focus. The concrete mix design was carefully done by the contractor using the Department of Environment (DOE) method. With diligent checking of the computations by the supervising team, the control mix design proportions were

determined. Trial mix was carried out and the satisfactory results from the mix are as presented in figure 5.

FIGURE 5: THE CONCRETE MIX DESIGN FEATURES⁵

SETRACO NIGERIA LTD. CONSTRUCTION OF APPROACH ROAD BRIDGE OVER RIVER WONDERFUL AT KAZANCIAN IN KADUNA STATE. CONTRACT NO. 1980-A MIX DESIGN FOR CONCRETE GRADE 30	
Design strength 30 N/mm ²	Mean strength for preliminary test 40 N/mm ²
The required mix proportions are:	
- Cement content	= 380 kg/m ³
- Water content	= 190 kg/m ³
- Fine aggregate	= 740 kg/m ³
- Coarse aggregate	= 1223 kg/m ³
CONCRETE DESIGN STRENGTH & MIX PROPORTIONS	

CONCLUSION	
From the above mentioned trial mix, the following results were obtained:	
1. Slump test	25mm
2. Average compressive strength at 7 days	31.5 N/mm ²
3. Average compressive strength at 28 days	42.5 N/mm ²
4. The volume of compacted concrete obtained (from the quantity used for trial mix was 8 cubic ft. 0.227 m ³)	
Therefore the ratio of cement physically used for each m ³ of concrete is	
$\frac{380 \text{ kg}}{0.227 \text{ m}^3}$	= 1674 kg/m ³
CONCRETE MIX DESIGN RESULTS	

4.4 THE CONCRETE WORKS

The major works of a bridge construction apart from the reinforcement bending, cutting and fixing is concrete batching and placement. Bearing this in mind, the supervising team ensures all the workmanship procedures were fully complied with. Strict adherence to all the necessary specifications as per the Contract Documents Volumes I – III, the project's revised working drawings, standard technical books relevant to the project, and all other relevant documents were readily made use of on site. In figure 6 are the completed concrete works for the bridges sub-structural members ready for work on the superstructures.

4.5 THE ROAD WORKS

The road works commenced immediately with back-filling of the abutment after the concrete has achieved the 28 days minimum strength in line with the specifications. Great care was exercised in the achievement of the 100% compaction of the abutment backfill since this is often times difficult to achieve. The roadworks, which were completed within the scheduled period, were executed with compliance to all requisite workmanship specifications after all necessary tests on the material like grain size analysis, atterberg limits, consolidation and other tests have been carried out and the results found satisfactory.

4.6 THE QUALITY CONTROL

Quality control is a major aspect of construction works that guarantee the quality, safety, serviceability as well as the durability of the completed project. As such, quality control aspect of the bridge works together with the approach roads were handled with great care. The supervising team always ensure the workmanship employed by the contractor were strictly complied with. The head of the supervising team directly supervised important material testing and concrete cube crushing including all necessary computations therein to ensure compliance with the requisite specifications, while the Principal Resident Engineer was always monitoring all aspects of the workmanship employed by the contractor. Figure 6 shows illustration of a quality control test and the direct supervision of the computations therein by the supervising head.

FIGURE 6: THE WORKS' QUALITY CONTROL^{3,4}



1.0 THE CONSTRUCTION CHALLENGES

The experienced challenges during the project's implementation apart from the technical one already discussed under the design (section 3.3) are incidences that relates to the project's overall cost and the ones that are very inexplicable. The costing challenge and the incidences which were very abstruse and seems very difficult to believe in this modern world are as follows:-

a. The Overall Project Cost: The change made to the foundation type from pad footing to pile supposed to result in an increase in the overall project cost. However, the Federal Ministry Works management didn't want this to happen. A team of well experienced engineers were directed to visit the site, with a mandate to physically study the project's revised scope of works, make a review of the Bill of Engineering Measurement and Evaluation (BEME) to be within the cost with which the project was initially awarded, and ensure the specifications of all aspects of the works are not compromised as a result of the review. Since the bridge works were mainly concrete with members being with specified dimensions, no change could be effected on them. Attention was hence shifted to the road works. With the revised drawings now with pile foundation, the locations of the pile works can be at any transverse line along the river. It was hence concluded that moving the new bridge as close as possible to the existing bailey bridge is the thing. With this conclusion, the surveyors swung into action and the bridge's position was made to be very close, less than five meters, to the existing one such that the total length of the approach roads both sides was made to be about one kilometer including the asphaltic concrete surfacing. With this changes, the BEME was prepared with the overall project cost made to be the same as the initial cost. Though, major part of the funds initially provisionally earmarked for the project's contingency and administrative expenses were made use of.

b. The River Wonderful and the Name: The name of the river is a major thing that makes almost everybody involves in the project execution to be curious. A waterfall about fifty meters from the existing Bailey Bridges are named 'Matsirga Waterfall'. Matsirga is the name of a village closest to the waterfall. Inquiries I personally made on why the river was named wonderful and not after

Matsirga village reveals it was a nickname given to it by non-indigence that visits the waterfall. Further investigations yield no positive result, I hence made the issue a forgotten one.

c. The River That Flows Backward:

Prior the supervising team's movement to site, various sayings were heard about the river due to the name ascribed to it. One of such sayings is the popular one that river wonderful is a river that flows backward. However, on getting to site, we discovered that the water in the river was flowing normal like any other river. Also, we couldn't see any form of fetish things in the vicinity of the site, a man was even sent by the community to the project site to ensure no one perform any form of ritual by the river banks. This observation made all the members of the teams involved in the construction works to regard as false all the information already heard about the river. I still have this believe in mind until one day when the dry season was at its peak, I was standing at a stone trow to the waterfall and I observed a dry leave that falls into the river moving slowly in opposite direction to the river flow. Curious, I went to the waterfall and saw a group of boys swimming in a depressed area used as swimming pool by the foot of the water fall. Still curious, I squeezed a small piece of paper into the river near the 'swimming pool' and the paper seems to be stagnant with little movement back and forth. My attention shifted to the swimming boys who have started to move out of the water one by one to prepare for another jumping into the water again. As the 'swimming pool' became empty, I observed a momentary movement of the paper earlier thrown into the river moving against the river flow. On a close observation of the waterfall environment, I realized that as the boys moved out of the very small 'swimming pool', water level in it dropped. Since the period is at the peak of the dry season and the volume of water in the fall is at the lowest, dropping water doesn't make up the reduced water level immediately and the river flow together with the wind direction, which most of the time is in the opposite direction, makes the river to flow backward so as to make up the water level in the depressed area. With this observation and finding, I, in my mind, debunk the most popular saying about the river.

d. The Site Abstruse and the

Trepidation: At the commencement of the full construction works, youths from Kafanchan and the environs trooped into the site looking for work. However, we noticed that youths from vicinity of the project neither came to site seeking for work nor made any attempt through the community chiefs for same. This action to me was not normal and I became very worried. Shortly after commencement of the piling works, I and a senior staff of the contractor made a private investigation on the observation. The investigation reveals that sometimes when the project's working drawing were been worked upon, a revelation was made in the

communities adjacent to the project that the river shall take two people during the course of the bridge construction. We privately discussed this with other senior members of the contractor and the supervising team. A conclusion was made that everybody involved in the project execution should be sensitized on being extra careful during the execution of the works. Thereafter, the construction works witness rapid progress until

e. The Inexplicable Incidences - After completion of the foundation works in the second quarter of year 2001 and pier formworks were being put in place, I travelled to to see my family to receive news of numerous visions concerning me already revealed. At the time, communications were not readily available, even to make a call to loved ones from site, we have to travel to Jos due the breakdown of telecommunication (NITEL) services in Kafanchan. On arrival and listened to all that have been revealed in my absence, the family concluded that I should limit my travelings up and down the country till possibly the end of the project being supervised as well as not to relent on prayers. Third day of my arrival and while preparing to go back the following day, I went out to see somebody and on coming back within a short time met my son dead in a very sudden and abstruse circumstance. The incidence, which occurred without any form of sickness, devastated the family and nearly caused depression of some members. Still having very painful feeling, I summoned courage and went back to site a week after the incidence. The construction works continued and rapid progress was recorded. Toward the end of the same year, while all the major works on the project were already completed with only ancillary ones outstanding, embankment fill protection of the bridge abutment commenced. To prevent scouring, the abutment protection was designed to have a retaining wall by the toe. As the excavation of one of the abutment's retaining wall bases was being dug, suddenly and without any warning sign, the embankment earth fill shifted and within twinkle of an eye collapsed on two of the contractor's staff putting finishing touches to the trench being excavated. Closest excavator and everyone on site swung into action, the first person was retrieved within five minutes motionless while the second was brought out moments later. The two were immediately moved to the Kafanchan general hospital where they were confirmed dead. Paragraph 5(d) above we have all completely forgotten about hence comes to pass. ***"When you read about the fact that he survived and others didn't, it's almost like there was some divine hand in what was happening"*** - Norman Schwarzkopf (Koch, 2006).

2.0 CONCLUSION

As a Principal Engineer at the time, the opportunity of being the most senior engineer in the supervising team who was resident on site twenty four seven on a pure bridge project made me a fulfil engineer in bridge construction, negative experiences

encountered notwithstanding. The achievement of the completion of the bridge from inception within the record time together with the adjudged standard and aesthetically beautiful structure achieved was a yardstick for my next project assignment in Gombe State with two bigger / longer bridges in the scope of works. However, sitting down and ruminating about the revelations prior to the occurrence of the negative incidences during the implementation of the project, I **concluded that there is an iota of truth in the advance revelations of things to come and traditional beliefs of people about a place especially the ones relating to rivers.**

3.0 ACKNOWLEDGEMENTS

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This paper cannot be concluded without dedicating it to the following people: [1]. Olakunle Fadire, my son, whose sudden demise without any form

of illness remains inexplicable and mastery till now, [2]. The two staff of the contractor who were accidentally buried alive, and [3]. All others who experienced one loss or the other while the construction was on. May the souls of all the departed continue to rest in peace.

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Engr. Olumuyiwa Alade Ajibola, FNSE, NSE Past President, delivering his Goodwill Message.



Engr. Ifedayo Akintunde, FNSE, FAEng, NSE Past President, delivering his Goodwill Message.

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COMMUNITY-LED CLIMATE CHANGE ADAPTATION IN INFORMAL SETTLEMENTS AS A SINE-QUA-NON FOR URBANIZATION.

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Abstract

Within the last few decades, there has been a great upsurge of interest by the authors, *to identify and assess socio-economic factors affecting communities that are in informal settlements globally*. Over one billion people in the world live in informal settlements, where they face difficulties are vulnerable to climate change due to geographical, socioeconomic and environmental factors. Due to the deep effects of poverty, poor-quality living conditions, etc., people in informal settlements lack the resources or ability to adapt to changing climates. Efforts must focus on implementing inclusive, resilience and sustainable community-led development policies and practices that prioritize access to basic services, affordable housing, efficient transportation, etc., for all. This paper focuses on empowering people to address climate change impacts in communities to achieve sustainable formal settlements. The paper is thematic, chronological as well as analytical in presentation.

Keywords: Community-led adaptation, climate change adaptation, challenges, opportunities, settlements

Introduction

There is an urgent need to focus climate adaptation on the local level to target investment at the people and places that are most affected by adverse weather patterns. With informal settlements forming the bulk of residential development across the Global South, governments must see communities as part of the solution to climate challenges. They need to upgrade, integrate, and adapt environments and housing and extend the provision of services to include informal settlements as part of the 'formal' city. Increasing pressure from population growth and vulnerability of settlements in at-risk areas means that urban resilience can only be achieved through

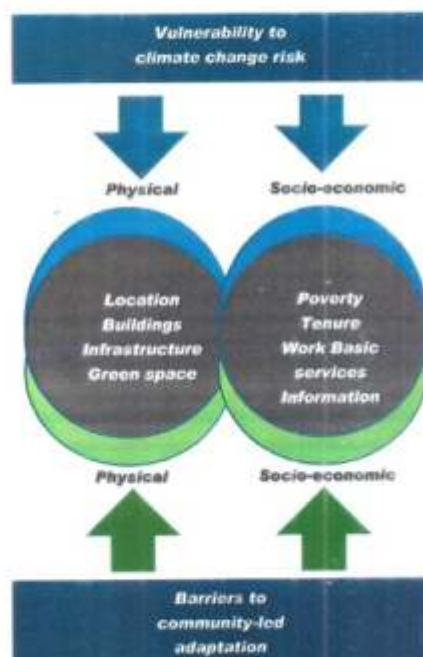
partnerships championed by governments that create the institutional and finance frameworks to enable local leadership.

What is community and community-led?

Community is a social unit or group of people living in the same place or having a particular or shared socially significant characteristic in common, such as place, set of norms, culture, religion, values, customs or identity. Community-led means that a group of people, usually a community are in charge of and responsible for their own development and decision-making processes. It involves local residents working together to identify their needs, create plans and implement solutions, with the goal of improving their community. This approach emphasizes community ownership, participation and leadership in driving positive change. The challenges facing community-led became increasingly urgent and brought to the surface long-standing underlying and unresolved factors such as climate change, urbanization and informality, global and local inequalities. Often when we think of the term community, we think in geographic terms. Community is the location, that is, city, town or village, where we live. When community is defined through physical location, it can be defined by precise boundaries that are readily understood and accepted by others. Defining communities in terms of geography, however, is only one way of looking at them. Communities can also be defined by common cultural heritage, language and beliefs or shared interests. These are sometimes called communities of interest. By involving residents in design and implementation of solutions, more cost effective and impactful adaptation strategies can be achieved more and finally, by fostering local ownership and leveraging existing knowledge and resources, community-led adaptation can lead to more effective,

sustainable and inclusive community-led climate resilience.

Figure 1: Drivers of vulnerability are also barriers to Climate Change Adaptation in Informal Settlements.



Even when community does refer to a geographic location, it does not always include everyone within the area. For example, many Aboriginal communities are part of a larger non-Aboriginal geography. In larger urban centres, communities are often defined in terms of particular neighborhoods. Most of us belong to more than one community, whether we are aware of it or not. For example, an individual can be part of a neighborhood community, a religious community and a community of shared interests all at the same time. Relationships, whether with people or the land, define a community for each individual. Climate variability significantly impacts agricultural practices, real estate development, health, community well-being, available financing practices, etc. in the world.

Social drivers of vulnerability

Access to basic services: Households without access to electricity, water and sanitation and waste management services are more impacted by climate extremes.

Type of dwelling: Houses that are poorly built, are poorly located, or lack flood and lightning protection, efficient water systems, cool spaces, heat-reflective surfaces or damp-proofing are a source of climate vulnerability. Informal housing (shacks) is particularly vulnerable.

Health: Climate resilience is dependent on baseline health and age. Children and the elderly are more susceptible to illness, heat stress, food insecurity and malnutrition, all of which are projected climate hazards.

Economic factors: Poverty and unemployment link to many of the abovementioned factors and reduce the ability of households to recover from climate shocks. Land tenure status is another important factor; households with insecure tenure such as squatters are less likely or able to invest in adaptation.

Demographic factors including age and gender: In addition to age-related vulnerabilities to health impacts, asymmetrical power relations may increase the vulnerability of women. Communities with a smaller than average proportion of working age adults are particularly vulnerable.

Urban, rural and coastal human settlements face particular environmental and social challenges in relation to climate change. South Africa is experiencing a long term urbanization trend which places infrastructural stresses on urban resources and results in a "hollowing out" of the productive potential of rural areas due to an exodus of working-age adults.

What is community-led climate change adaptation?

Community-led climate change adaptation, also known as community-based adaptation is a participatory approach where communities are at the forefront of planning and implementing strategies to cope with the impact of climate change. It is also a community-led process, based on communities' priorities, needs, knowledge, and capacities, which should empower people to plan for and cope with the impacts of climate change. It emphasizes the involvement of communities in decision-making processes, ensuring that adaptation solutions align with their needs and priorities. Climate change is only one of a range of natural, social, and economic problems that may face people (such as unemployment, the prices of food and other essentials, commodity prices, drugs, gambling, community conflict, and health), etc. So it is unlikely that interventions focusing only on climate-related risks will reflect community priorities. Community-led adaptation needs to start with communities' expressed needs and perceptions and to have poverty reduction and livelihood benefits, as well as reducing vulnerability to climate change and disasters. In practice, community-led adaptation projects look very like 'development as usual' and it is difficult to distinguish the additional 'adaptation components'.

For example, in a drought year, we cannot divide water storage measures undertaken by local communities into those initiated as a response to 'normal' climate variability, and those initiated as a response to climate change. However, the difference is that community-led adaptation work attempts to factor in the potential impact of climate change on livelihoods and vulnerability to disasters by using local and scientific knowledge of climate change and its likely effects. Community-led adaptation may start by identifying communities in countries that are most vulnerable to climate change or these communities may themselves ask for assistance (Kelman *et al.*, this issue). It may also follow on from work with communities to cope with a disaster, such as severe flooding. International development NGOs and donors funding community-led adaptation usually work through local partners, such as local NGOs or community groups which already have the trust of local communities. Incorporating climate change information community-led adaptation work needs to incorporate information on climate change and its impacts into planning processes. This includes:

- scientific information (e.g. long-term predictions from climate change models, seasonal forecasts, information on trends based on data collected at nearby weather stations); as well as

- local knowledge about trends and changes experienced by communities at a local level and strategies these communities have used in the past to cope with similar shocks or gradual climatic changes.

Both these sources contribute to an understanding of risk. Climate change science cannot say for certain, for example, how much rainfall a particular area will receive over any given time – but it can give some guidance on the probability that rainfall will increase or decrease and to what extent. Community-led adaptation builds in this notion of risk and uncertainty into activities, with the aim of building communities' resilience to both current climate variability and future climate change.

Objective and Structure

This report contributes to ongoing discussions on climate change adaptation, focusing on the urgent need to encourage community leadership in informal settlements and use the full palate of available climate and development resources. It is aimed at governments, donors, NGOs, and World Bank staff working on urban climate adaptation, development, and disaster risk management. The objective of the paper is to examine the role of community-led climate change

adaptation in enhancing the inclusiveness, resilience, and sustainability of cities, focusing on rapidly growing informal settlements. The report is intended to inform the thinking of governments, donors, and World Bank staff in shaping urban program design. The evidence and case studies included in this report show how more inclusive approaches to urban adaptation are possible. By connecting strategic investment in infrastructure, driven by national and city governments, with mobilized grassroots action, more cost-effective and impactful urban climate adaptation can be achieved. But this will only be realized through a step change in policy, project design and implementation. Inclusive approaches, such as community-led data collection and the co-design of locally-led climate adaptation solutions with organized communities, embedded in project design, are essential. When deployed with innovative climate financing, such as Results-based Finance, inclusive approaches can help bridge a significant climate financing gap for the most vulnerable underserved areas, strengthening institutions, and incentivizing and enabling new patterns of collaborative working.

The paper is structured in a way that it provides background analysis on cities and climate change, focusing on the vulnerabilities of informal settlements with focus on how community-led approaches can be put into practice to drive impactful and lasting change in informal settlements, followed by a conclusion.

Methodology

The conceptual framework for understanding vulnerability of human settlements used in this study is informed by the perception that vulnerability is an outcome of the interaction between social vulnerabilities and the environmental risk and stresses arising from climate change. A widely used representation of these relationships is presented in the diagram below.



Figure 2: Vulnerability to climate change.

In this approach, the interaction between climate change impacts and hazard exposure, based on climate change projections, and sensitivity, based on an analysis of the responses of living systems, can be understood as encompassing the environmental risks posed by climate change. Vulnerability is therefore a product of the extent to which these risks are mitigated or exacerbated by the presence or absence of adaptive capacity, as well as the particular sensitivities of communities to the impacts of climate change – agricultural communities, for instance, have different sensitivities to urban communities. Adaptive capacity represents the ability of communities to respond to the environmental risks presented by climate change. Therefore, where adaptive capacity is high, social vulnerability is low and vice versa. As a concept, adaptive capacity combines subjective qualities, such as levels of organization and institutional capacity, which are difficult to measure directly, with characteristics of communities that influence social vulnerability which can be and are measured, such as income levels and access to basic services. This study seeks to identify climate change adaptation responses for human settlements that:-

1. *Respond to particular environmental risks posed by climate change.*
2. *Build particular adaptive capacities or reduce particular social vulnerabilities to the environmental risks posed by climate change.*
3. *Have ancillary developmental benefits associated with national priorities such as job creation and the reduction of poverty and inequality.*

While vulnerability to climate change is location specific, and adaptation responses need ultimately to be defined at local level, there are inevitably certain features that human settlements either have in common, or that differentiate them. An important challenge for this study was therefore to arrive at a meaningful typology of human settlements to assist in identifying climate change vulnerabilities.

What is community-led informal settlement?

A community-led informal settlement refers to a process where residents of informal settlements, also known as slums, actively participate in planning, designing, and implementing projects to improve their living conditions, infrastructure, and overall neighborhood. This approach emphasizes

resident empowerment, inclusivity, and collaboration, ensuring that improvements align with the community's needs and priorities. Here is a more detailed explanation with key characteristics like:-

- **Resident involvement:** Community members are at the heart of the process, not just as beneficiaries but as active participants in decision-making and project implementation.
- **Bottom-up approach:** Instead of top-down development, the process starts from the needs and ideas of the community.
- **Holistic approach:** Community-led initiatives often address social, economic, and environmental aspects of the settlement, aiming for comprehensive and sustainable improvements.
- **Emphasis on empowerment:** The goal is to empower residents with the skills, knowledge, and resources to improve their living conditions and advocate for their rights.
- **Inclusive practices:** Community-led approaches strive to include all members of the community, including marginalized groups, in the decision-making process.
- **Community knowledge:** Community members possess valuable knowledge about their settlement, its challenges, and potential solutions, which is crucial for effective and sustainable improvements.
- **Building resilience:** Community-led initiatives contribute to building resilience in informal settlements, making them more capable of withstanding climate change impacts and other challenges.
- **Collaboration and partnerships:** While community-led, these initiatives often involve collaboration with local governments, NGOs, and other organizations to secure resources and technical support.

The implications of climate change for human settlements will be profound, and human settlements therefore represent a crucial vector for adaptation strategies. Scientists are clear that climate change is happening, and that it is due to emissions of greenhouse gases produced largely by industrialized countries (IPCC, 2007). Those likely to be worst affected are the world's poorest countries, especially poor and marginalized communities within these countries. Ironically it is these poor countries and people who have contributed least to the problem of climate change, because of their very low greenhouse gas emissions, but who will suffer most from its consequences. Even if emissions are severely

curbed, climate change will still occur. However, until recently, most adaptation efforts have been top-down, and little attention has been paid to communities' experiences of climate change and their efforts to cope with their changing environments. This special issue of *Participatory Learning and Action* focuses on recent approaches to adaptation to climate change which are community-based and participatory, building on the priorities, knowledge, and capacities of local people. Community-based adaptation draws on participatory approaches and methods developed in both disaster risk reduction (DRR) and community development work, as well as sectoral-specific approaches such as farmer participatory research (Berger *et al.*, this issue) and Farmer Field Schools (Sherwood and Bentley, this issue). Innovative participatory methods are also emerging to help communities analyze the causes and effects of climate change, to integrate scientific and community knowledge of climate change, and to plan adaptation measures. In this overview paper to the issue, we describe how community-based approaches to climate change have emerged, and the similarities and differences between community-led adaptation and other participatory development and disaster risk reduction approaches. Whilst community-led adaptation is a relatively new field, some lessons and challenges are beginning to emerge, and we analyze these, drawing on the experiences contained in the collection of articles for this issue. Many of the articles are concerned with natural resources, reflecting the preponderance of submissions we received in this area. However, climate change will affect many other aspects of communities' lives, and we would urge practitioners working in other sectors, such as human health and urban areas, to share their experiences of community-based adaptation.

Climate change and its impacts

Climate change refers to short-, medium- and long-term changes in weather patterns and temperature that are predicted to happen, or are already happening as a result of anthropogenic emissions of greenhouse gases such as carbon dioxide. These changes include a higher frequency of extreme weather events such as drought and floods, as well as greater unpredictability and variability in the seasons and in rainfall. Overlying this increased variability are expected longer-term changes, such as temperature and sea-level rises, and lower (or in some cases higher) rainfall.

Why are people vulnerable to climate change?

Countries and communities are more vulnerable to climate change because they tend to be located in geographically vulnerable areas, such as flood-prone, drought-prone or cyclone-prone and in more vulnerable locations. For example, the slums and informal settlements surrounding many developing country cities are usually sited on land prone to landslips or to flooding and river bank erosion. Wealthy people, commerce and industry can afford to situate themselves on safer land. Many poor communities are heavily dependent on natural resources for their livelihoods. Smallholder farmers have much experience of adapting to their complex, diverse and risk-prone environments. However, farming is now becoming even more difficult and risky because of greater unpredictability in the timing of rainy seasons and the pattern of rain within seasons, making it more difficult to decide when to cultivate, sow, harvest and needing more resources to seize the right time for planting and to maintain crops and animals through dry spells. Heat stress, lack of water at crucial times, and pests and diseases are serious problems that climate change appears to be exacerbating. These all interact with ongoing pressures on land, soils and water resources that would exist regardless of climate change (Jennings and McGrath, 2009). Vulnerability to climate change is not just a function of geography or dependence on natural resources; it also has social, economic and political dimensions, which influence how climate change affects different groups (Action Aid, 2005). People rarely have insurance to cover loss of property due to storms or cyclones. They cannot pay for the healthcare required when climate change induced outbreaks of malaria and other diseases occur. They have few alternative livelihood options when their only cow drowns in a flood or drought kills their maize crop for the year – and they do not have the political clout to ask why their country's early warning system did not warn them of likely flooding. Climate change will also have psychological and cultural effects, for example beliefs and traditions associated with the seasons being undermined by climate change (Jenning and McCrath, 2009). Communities already struggle to cope with the existing challenges of poverty and climate shocks, but climate change could push many beyond their ability to cope or even survive. It is vital that these communities are helped to adapt.

Why Community-Led Climate Change Adaptation Matters?

- i. **Community knowledge:** Residents of informal settlements possess a deep understanding of the specific challenges and vulnerabilities they face, as well as the community context and resources available, which are often overlooked in top-down approaches.
- ii. **Ownership and sustainability:** When communities are actively involved in the adaptation process, they are more likely to take ownership of the solutions, ensuring their long-term sustainability.
- iii. **Cost-Effectiveness:** Community-led initiatives can be more cost-effective than top-down approaches, as they leverage local resources and expertise, and can be tailored to specific needs and contexts.
- iv. **Empowerment and Social Inclusion:** Community-led adaptation empowers residents, giving them a voice in decision-making processes and fostering social inclusion.
- v. **Effective and Targeted Solutions:** Community-led initiatives can lead to more effective and tailored solutions that address the specific needs and priorities of the residents.

Climate change impacts on Informal settlements

The vulnerability of Informal settlements to climate change is understood as an outcome of their exposure to environmental risks and changes resulting from climate change, and the extent to which the adaptive capacity of affected communities and households is reduced by social vulnerability. Many of these factors are location specific, related to particular local climate, topography and informal settlement patterns, while others are related to socio-economic factors. Environmental factors driving vulnerability and their potential consequence for informal settlements due to climate change include: -

Increased temperatures: heat stress impacts on human health exacerbated by urban heat islands, loss of productivity, declining air quality in cities and increased demand for cooling.

Extreme weather – heat waves and droughts: increased water demand, water quality problems, heat-related deaths and reduced quality of life, food insecurity.

Extreme weather – heavy rainfall and violent

storms: water quality problems, deaths and injuries, infections and waterborne disease, damage to infrastructure and economy, loss of property.

Sea level rise and coastal storm surges: salt water intrusion on fresh water reservoirs, deaths and injuries, forced relocations, property losses, erosion and submersion of land, damage to infrastructure and services.

Adaptation responses

Residents of informal settlements are exposed to a variety of overlapping climate risks, but they are not passive in responding to challenges. At a household level, people cope with climate shocks the best way they can, balancing recovery costs with meeting everyday needs. Collective action at a community level, through savings groups and local networks, is used to improve housing and reduce exposure to climate risks. People can spend as much as one-third of their annual income on responding to climate conditions, long-term risk reduction requires complementary government investment in infrastructure, service improvements and tenure security. Including organized communities in planning and delivering adaptation would encourage households to shift spending away from short-term coping and recovery to longer-term risk reduction. Redirecting household expenditure to complement public investment could help accelerate the positive impacts of climate adaptations, increase the resilience of settlements and reduce repeated short-term expenditure on recovery. While levels of global climate finance are increasing, there remains a major gap in resources, with insufficient funds directed at informal settlements. The value and flow of climate finance needs to better reflect the scale and complexity of the climate challenge in Global South cities.

In relation to the planning of human settlements infrastructure, downscaling of climate change projections, needs to inform the identification of water constraints, revised flood and coastal setback lines, and engineering parameters for future temperature tolerances of infrastructure at local level. National and provincial government need to support local authorities with research and guidelines to assist them in incorporating these implications of climate change into service delivery, planning processes and land use decisions. Adaptation to climate change needs to be viewed as an integral part of the broader developmental challenges facing South Africa's human settlements. Addressing existing deficits in the provision of water, sanitation, drainage, electricity,

tenure, healthcare, emergency services, schools, and public transport backlogs is fundamental to building climate resilience in vulnerable human settlements, Absalom, E. *et al.*, 1995.

The housing backlog is a particular source of vulnerability in relation to human settlements and we need to learn from past mistakes in the provision of low cost housing: -

Informal settlement upgrades and relocations need to be fully accepted as an integral part of the housing strategy at all levels of government, and environmental risks relating to climate change need to be considered in these processes. Local authorities need to support community driven re-blocking projects and integrate them into strategies for the delivery of basic services to these communities. The planning skills needed for these projects do not revolve around technology so much as the facilitation of community processes.

Policies and programmes that improve tenure security and safely provide basic services to backyard tenants need to be developed.

Formal planning of low cost and social housing needs to prioritize urban densification and where possible the state should intervene to ensure market values do not dictate property development to the detriment of social equity. In relation to existing low cost housing developments, deficits in the structural design of individual units need to be addressed, as well as deficits in urban design in the form of inadequate community facilities, public services and infrastructure.

Ecological infrastructure and ecosystem based adaptation needs to be mainstreamed into human settlement planning. For instance, measures to improve and maintain the health of catchments support downstream service delivery. National and local government should identify and implement supporting incentives – such as water pricing and water use charges – that encourage landowners to restore degraded catchments and maintain healthy ones.

Urban development strategies that leverage adaptation opportunities in mixed settlements, (such as urban agriculture) and mitigate vulnerabilities, such as inadequate access to basic services, need to be pursued.

Adaptation Strategies

Informal settlement has been the dominant form of urban growth across the Global South during the last 30 years. As city populations have expanded and people have migrated to urban areas, driven by a search for economic opportunity or refuge, informal settlements have provided the entry point to a home in the city. However, the lack

of planning, basic service infrastructure, tenure security, and construction standards in these communities has created a legacy of vulnerability to climate change. This chapter provides an outline of the characteristics of informal settlements to highlight the implications of changing climate conditions for urban populations across the Global South.

1.Participatory mapping and risk assessments: Communities can work together to map out their neighborhoods, identify vulnerabilities, and assess potential climate-related hazards.

2.Community-based early warning systems: Developing and implementing systems that provide timely and relevant information about impending climate-related events.

3.Sustainable livelihoods and income diversification: Supporting community members in developing alternative income sources and building resilience to climate-related economic shocks.

4.Nature-based solutions: Utilizing natural resources, such as urban green spaces, to mitigate the impacts of climate change.

5.Promoting community knowledge and skills: Encouraging the use of traditional knowledge and practices in adaptation planning and implementation.

6.Participatory upgrading of informal settlements: This involves working with residents to improve infrastructure, sanitation, and housing conditions in a way that is sensitive to their needs and priorities.

7.Community-based disaster risk reduction: This includes training residents in disaster preparedness, establishing early warning systems, developing evacuation plans and emergency response mechanisms.

8.Climate-resilient livelihoods: This involves supporting communities in developing income-generating activities that are adapted to changing climate conditions, such as sustainable agriculture or eco-tourism, developing climate-smart agricultural practices and accessing climate information services.

9.Community-based water and sanitation management: This includes empowering communities to manage their own water resources and sanitation systems, ensuring access to clean and safe water and sanitation services.

10. **Retrofitting housing:** Strengthening homes to withstand extreme weather events, such as reinforcing roofs or raising foundations.
11. **Access to water and sanitation:** Developing community-managed water and sanitation systems.
12. **Promoting climate-resilient livelihoods:** Supporting alternative income-generating activities that are less vulnerable to climate impacts.
13. **Disaster preparedness and response:** Developing community-based early warning systems and emergency response plans.
14. **Infrastructure improvements:** Building drainage systems, flood walls, and other infrastructure to mitigate the impacts of flooding and other extreme weather events.
15. **Nature-based solutions:** Planting trees, creating green spaces, and restoring wetlands to improve drainage, reduce the urban heat island effect, and enhance biodiversity.
16. **Waste management and sanitation:** Implementing waste reduction, recycling, and composting programs to improve sanitation and reduce greenhouse gas emissions.
17. **The role of governments and other stakeholders:**
- 18.1 **Supportive policies and regulations:** Creating an enabling environment for community-led adaptation by streamlining regulations, providing access to land and resources, and promoting inclusive urban planning.
- 18.2 **Strategic investments:** Directing public and private investments towards infrastructure, services, and technologies that support community-led adaptation efforts.
- 18.3 **Technical assistance and capacity building:** Providing communities with the technical expertise and training needed to design, implement, and manage adaptation initiatives.
- 18.4 **Partnerships and collaboration:** Fostering partnerships between communities, local authorities, NGOs, and other stakeholders to ensure that adaptation efforts are coordinated and effective.

Promoting urban densification to build climate

resilient infrastructure improving climate resilience of low-cost housing

encouraging water-sensitive urban design incorporating down-scaling of climate projections, and effective information and assessment tools to inform land-use planning and urban design that is climate resilient.

Support to small-scale farmers in the adoption of agricultural practices that conserve underlying ecosystems, thereby strengthening resilience to climate change.

Researching and developing appropriate agricultural technologies that promote soil and water conservation and developing and introducing drought resistant crops and livestock species.

Empowering local communities (and particularly women) and diversifying rural livelihoods.

By embracing community-led approaches, cities can enhance the resilience of informal settlements, build more inclusive and sustainable urban environments, and achieve more cost-effective and impactful climate adaptation.

By embracing community-led approaches, cities can build more resilient, inclusive, and sustainable informal settlements, ultimately contributing to a more just and equitable future for all.

Community-led climate change adaptation in informal settlements is a crucial approach to building resilience in the face of climate change impacts. It recognizes the knowledge, agency, and needs of residents in these areas, fostering locally tailored solutions and promoting a more inclusive and sustainable urban development.

Drawing on participatory disaster risk reduction approaches

The lessons from disaster risk reduction (DRR) work are of tremendous value for climate change adaptation, because climate change is likely to change the magnitude, frequency, and timing of extreme events such as flooding, landslides, and storms, as well as generate new disaster events. Disaster risk reduction is likely to be the entry point for communities suffering from severe shocks as a result of short-term climate variability (Christian Aid, 2009). Many of the papers in this issue use a participatory DRR framework (e.g. Tanner *et al.*, Warrick, and Gaillard and Maceda). Although different approaches and frameworks for participatory DRR exist, all involve working with local people to understand the types of hazards they face (e.g., earthquakes, droughts, floods, pests and diseases, human diseases), the factors which make them vulnerable to these hazards, and

their causes. These together give an indication of how 'at risk' communities are and which groups are most vulnerable. They also help communities consider what capacities they have for reducing vulnerability, and aim to empower communities to take action themselves to reduce the risks they face. Many organizations working with local communities to reduce poverty and disaster risks are now trying to incorporate the effects of climate change into their work with communities. Kelman and Mercer (this issue), for example, describe a disaster risk reduction framework developed with communities to facilitate DRR planning in small island developing states (SIDS), such as Papua New Guinea. They then show how the framework can be adapted to take into account the likely effects of climate change by drawing on external scientific information such as downscaled climate projections and satellite images, as well as local knowledge of hazards and vulnerabilities. Taking into account these longer-term impacts is one of the key differences between DRR and climate change adaptation. This points towards the need to find practical ways of integrating DRR, livelihoods, and climate change adaptation. Christian Aid, for example, has developed a climate risk cycle management approach to development planning which builds on the expertise and experience of existing DRR and livelihoods programmes, using existing tools wherever possible. In the model, predictable risks are anticipated, long- and short-term risk reduction activities are integrated into livelihood development, and the time spent in emergency or rehabilitation is minimized, Figure 3.

Figure 3: Climate risk cycle management



Community-led climate adaptation in informal settlements involves empowering residents to identify, plan, and implement solutions to address the impacts of climate change, such as extreme weather events and resource scarcity. This approach recognizes that communities living in informal settlements are often disproportionately affected by climate change but also possess valuable knowledge and agency to drive effective adaptation strategies. By fostering participation, strengthening local capacity, and promoting collaboration between communities and other stakeholders, community-led adaptation can lead to more inclusive, sustainable, and impactful climate action.

Make cities and human settlements inclusive, safe, resilient and sustainable

Over half of the global population currently resides in urban areas, a rate projected to reach 70 per cent by 2050. Approximately 1.1 billion people currently live in slums or slum-like conditions in cities, with 2 billion more expected in the next 30 years.

In 2022, only half of the world's urban population had convenient access to public transportation. Urban sprawl, air pollution and limited open public spaces persist in cities.

Since 2015, the number of countries with national and local disaster risk reduction strategies has doubled.

To achieve Goal 11, efforts must focus on implementing inclusive, resilience and sustainable urban development policies and practices that prioritize access to basic services, affordable housing, efficient transportation and green spaces for all.

The Challenge of Climate Change

Rising global temperatures pose a major threat to the lives and well-being of populations across the world. With between 3.3 billion and 3.6 billion people currently living in contexts that are highly vulnerable to climate change, (IPCC, 2022), global warming to 1.5°C above pre-industrial levels by 2030 could expose almost half the world's population to extreme climate hazards (McKinsey, 2024). There is clear evidence that low- and middle-income countries (LMICs) will be disproportionately affected by climate change. People in Sub-Saharan Africa and South Asia are most at risk because of lower income levels, a lack of access to risk reducing basic infrastructure, such as drainage and energy, and essential social services, such as health

care, needed to cope with and recover from, shocks (World Bank, 2024). The density of informal settlements, the reduction in green environments, and poorly insulated and ventilated housing exposes urban dwellers to rising temperatures. Growing cities will be significantly impacted by climate change. The share of global populations in urban areas is expected to rise from 56 percent to 68 percent (UN Habitat, 2022) over the next three decades, with an additional 2.2 billion people living in cities by 2050. About 90 percent of this growth will take place in Asia and Africa. Approximately half the growth in urban populations will result from regional and internal migration. Growing populations will increase pressure on urban land use and access to services in cities already unable to respond or raise revenue to get ahead of demand. Higher population density is likely to increase unplanned development, with a lack of infrastructure deepening the vulnerability of low-income communities. Patterns of urban growth over the last 30 years have resulted in large-scale informal settlements across the Global South. The occupation and unplanned development of marginal land, along coasts, floodplains on steep slopes, urban dump sites and other sensitive areas has placed populations at great risk from changing climate conditions. The process of informal settlement has degraded natural ecosystems, such as mangroves, and the absence of infrastructure to protect communities has substantially increased exposure to adverse weather events (IPCC, 2022).

The density of informal settlements, the reduction in green environments, and poorly insulated and ventilated housing exposes urban dwellers to rising temperatures. Evidence from the Intergovernmental Panel on Climate Change (IPCC) indicates that the number of cities with summertime temperatures of 35°C and above will triple by 2050 creating significant risks to the well-being of people. Poor urban design has led to the creation of heat islands in cities that disproportionately affect the health of young children, the elderly, and people with disabilities (World Health Organization).

Resource Constraints: Community-led adaptation may face challenges related to limited access to financial and technical resources.

Power Imbalances: Addressing power dynamics and ensuring equitable participation from all community members.

Coordination and Collaboration: Ensuring

effective coordination between different community groups and other stakeholders.

Sustainability: Developing strategies to ensure the long-term sustainability of community-led initiatives.

A continued trend of urbanization, particularly involving the rural poor.

The rapid growth of a demographic of young, unemployed urban residents driving discontent.

The apartheid legacy of fragmented urban communities, coupled with the urgent need to leverage transport networks to achieve spatial transformation.

Ecological and resource limits facing cities, including water stress, food security and power shortages

Weaknesses in institutional capacity to respond to these challenges

Moving Forward

Mainstreaming Community-Led Approaches: Integrating community-led adaptation into broader urban planning and development strategies.

Investing in Community Capacity: Providing adequate resources and support for community-based adaptation initiatives.

Strengthening Partnerships: Fostering collaboration and knowledge exchange between communities, local governments, and other stakeholders.

Monitoring and Evaluation: Developing robust monitoring and evaluation frameworks to assess the effectiveness of community-led adaptation efforts.

Key Elements of Community-Led Climate Change Adaptation

Community Participation: Actively involving residents in all stages of the adaptation process, from assessment to implementation and monitoring, is crucial.

Local Knowledge: Recognizing and utilizing the wealth of knowledge and experience that residents possess about their environment and vulnerabilities is essential.

Resource Mobilization: Identifying and mobilizing local resources, including financial, human, and material assets, to support adaptation efforts.

Partnerships: Establishing strong partnerships between community groups, local governments, NGOs, and other relevant actors to facilitate collaboration and resource sharing.

Capacity Building: Strengthening the capacity of community members to understand climate risks, develop adaptation strategies, and implement

projects through training and other support.

Inclusive Approaches: Ensuring that all members of the community, including women, youth, and marginalized groups, have a voice and are actively involved in decision-making.

Long-term Planning: Developing long-term adaptation plans that address both immediate and future climate risks, integrating them into broader urban planning processes.

Community Engagement and Mobilization: This involves building trust, fostering dialogue, and creating spaces for community members to participate in decision-making processes.

Participatory Data Collection: Engaging communities in gathering information about climate risks, vulnerabilities, and local resources can provide valuable insights for developing appropriate adaptation strategies.

Capacity Building: Providing communities with the necessary skills, knowledge, and resources to effectively plan, implement, and manage adaptation initiatives.

Collaborative Decision-Making: Establishing platforms for collaboration between communities, local authorities, and other stakeholders to ensure that adaptation efforts are integrated and aligned with broader urban development plans.

Access to Funding and Resources: Ensuring that communities have access to adequate financial resources and technical support to implement their adaptation plans.

Strengthening community Governance: Establishing or strengthening local decision-making structures and mechanisms that facilitate community participation and collaboration.

Community-led climate adaptation in informal settlements focuses on empowering residents to address climate change impacts. By involving communities in the planning and implementation of adaptation strategies, these initiatives aim to build resilience, enhance inclusivity, and foster a sense of ownership and sustainability within the settlement.

Key Principles

Inclusivity: Community-led adaptation emphasizes the participation of all residents, regardless of their background or social status, in decision-making processes.

Local Knowledge: It recognizes and utilizes the valuable knowledge and experience that residents possess about their environment and the specific challenges they face.

Empowerment: By giving communities agency in shaping their adaptation strategies, these initiatives

foster a sense of ownership and responsibility for their own well-being.

Collaborative Approach: Community-led adaptation promotes partnerships between residents, local governments, and other stakeholders to ensure that solutions are tailored to local needs and contexts.

Benefits of Community-Led Adaptation

- a. **Improved living conditions:** Directly addresses the needs and priorities of residents, leading to tangible improvements in their quality of life.
- b. **Increased community ownership:** When residents are involved in the process, they are more likely to take ownership of the improvements and ensure their sustainability.
- c. **Strengthened social fabric:** Community-led initiatives foster collaboration, trust, and social cohesion within the settlement.
- d. **Empowered communities:** Residents gain confidence, skills, and the ability to advocate for their rights and participate in decision-making processes.
- e. **More effective and sustainable solutions:** Community-led approaches ensure that solutions are tailored to the specific context and needs of the settlement, making them more effective and sustainable.
- f. **Enhanced Resilience:** By actively participating in adaptation efforts, communities can better prepare for and respond to climate-related risks, such as floods, droughts and extreme heat.
- g. **Improved Inclusivity:** Community-led approaches ensure that the voices and needs of all residents are heard and addressed, leading to more equitable and sustainable outcomes.
- h. **Cost-Effectiveness:** When communities are involved in the design and implementation of adaptation measures, they are more likely to be sustainable and cost-effective.
- i. **Social Cohesion and enhanced social equity:** Community-led adaptation can strengthen social bonds and foster a sense of collective responsibility within the settlement. When communities are involved in decision-making, adaptation efforts are more likely to address the specific needs and priorities of all residents, promoting social equity.

- j. Catalyzing Action:** Community-led initiatives can serve as a catalyst for broader change, inspiring other communities and stakeholders to take action on climate change.
- k. Reduced vulnerability:** Community-led adaptation can help to reduce the vulnerability of informal settlements to climate-related hazards, improving the lives of residents.
- l. Improved governance:** Community-led adaptation can strengthen local governance structures and improve collaboration between communities and local authorities.
- m. Sustainable development:** By integrating climate adaptation into broader urban planning and development processes, community-led adaptation can contribute to more sustainable and resilient cities.

Conclusion

Community-led climate change adaptation in informal settlements is crucial for building resilience and addressing the disproportionate impacts of climate change on vulnerable populations. These settlements, often excluded from traditional planning, require locally tailored solutions that leverage community knowledge and resources. Effective adaptation requires a combination of bottom-up and top-down approaches, with community involvement in planning and decision-making processes, alongside government investment in infrastructure and services. The theory and practice of community-led adaptation are still in their infancy. Both are likely to grow very rapidly, however, as needs increase as a result of intensifying climate change impacts and as interest in and support for adaptation grows at national and international levels. Although funding is increasingly available for adaptation activities, simply providing poor country governments with more money does not mean that it will reach the poor and those who are most vulnerable to climate change, let alone increase their ability to adapt. Such communities are often marginalized, remote, and receive limited services and little support from their governments even when they are able to articulate what support they need. Reaching these hundreds of millions of people and supporting their genuine participation in any decision-making about resource allocation for community-led adaptation will be an immense challenge for any international or national programme or funding mechanism focusing on

adaptation. Whilst community-led adaptation initiatives are increasing in number and information sharing on these activities is developing, translating these activities and documentation into improved policy responses and scaled up community-led adaptation initiatives worldwide remains a challenge. Power structures are at the heart of climate change vulnerability and it is important to find ways to allow poor vulnerable people to influence policy and be heard in key policy arenas. To be successful, community-based adaptation programmes will need to ensure that communities are able to participate in identifying priorities, both local and regional and in planning, implementing, monitoring and reviewing adaptation. Such programmes should provide support and link communities to relevant decision-making institutions. They will also need to build the capacity of local organizations and local governments to enable them to effectively take part in decision-making processes.

Community-led adaptation draws on a number of different fields, including disaster relief work, community development work, and climate science. These different areas of knowledge and expertise often employ different languages and concepts, and there is still much work to be done in developing a common understanding and language and sharing experiences and good practice. Continuing to document community-led adaptation processes in an honest and critical way is very important, both to improve practice and to share experience in little-documented areas, such as incorporating climate change adaptation into health policy.

Key take away

Community knowledge and participation are essential: Residents of informal settlements possess valuable local knowledge about their environment and the specific challenges they face. Integrating this knowledge into adaptation planning leads to more effective and sustainable solutions.

Bottom-up and top-down approaches must be integrated: While community-led initiatives are vital, they need to be complemented by supportive policies, infrastructure development, and financial investments from governments and other stakeholders.

Addressing the financial burden on residents: Coping with climate impacts can place a significant financial strain on households in informal settlements. Targeted financial support and innovative financing mechanisms can help alleviate this burden and empower communities to

invest in adaptation measures.

Promoting inclusivity and shared ownership:

When communities are actively involved in shaping adaptation strategies, they are more likely to be invested in their success. This can be achieved through collaborative decision-making structures and inclusive planning processes.

Recognizing the role of informal settlements in adaptation solutions:

Governments need to recognize that communities in informal settlements are not just recipients of aid, but active participants in building resilience to climate change. This includes incorporating their needs and priorities into broader urban development plans.

The need for scale: While community-led initiatives are effective at the local level, they need to be scaled up to address the needs of the growing urban population in informal settlements. This requires bridging the gap between grassroots action and larger-scale planning and investment.

Climate adaptation is not just an environmental issue, it's a development issue:

Addressing climate change in informal settlements requires a holistic approach that considers social, economic, and environmental factors. Effective adaptation can contribute to poverty reduction, improved livelihoods, and more equitable and resilient urban environments.

We face increasing pressure to meet the myriad challenges that a changing climate presents. As this new community of practice emerges and matures, the ethics and quality of participatory processes will be central to the success of community-based adaptation to climate change – and there are both opportunities and dangers.

As we move forward with community based adaptation to climate change, we hope that this issue of *Participatory Learning and Action* will contribute to learning and experience sharing around community-led adaptation – and help to promote good participatory practice.

The opportunities are to initiate and sustain processes of change: empowering disadvantaged people and communities, transforming organizations, and reorienting individuals. The dangers come from demanding too much, in a top-down mode, too fast, with too little understanding of participatory development and its implications.

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POPULAR PARTICIPATION IN PROMOTING CONSTRUCTION SURVEYING AS AN EFFECTIVE TOOL FOR HIGHWAY DESIGN

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Abstract

The aims and objectives of this study are to evaluate the structure of construction surveying, identify the problems that are confronting construction surveying engineers, proffer solutions to the problems and highlight the contribution of construction surveying in highway design. The study evaluates the immense contribution of construction surveying methods and equipment towards stimulating highway design and all other highway economic activities to enhance socio-economic development objectives. The study concludes that without effective and efficient construction surveying in highway design, all other economic highway design activities would come to a halt. The role of construction or location surveying in the provision of quality highway and invariably improving the standard of living of the people cannot be over emphasized.

Key words: construction surveying, construction surveying engineer, highway design, reconnaissance, location survey.

Introduction

Why this paper?

- The ability to deliver quality construction surveying has been seriously eroded and that delivery of future growth opportunities will present major challenges.
- Bridge ideology, tribe, ethnicity, language in construction surveying.
- Case for technological breakthrough.

Lack of adequate construction surveying represents one of the most significance limitations to economic growth and achievement. Construction surveying investments and maintenance can be very expensive and existing civil engineers or highway engineers should be allowed to use methods available to them.

Construction or location surveying is at the heart of producing quality and effective highways. Some places and areas have difficult terrains and topography. However, with accuracy and proper equipment, quality highways are achieved. The surveys to be carried out in locating a highway are: - reconnaissance; - preliminary survey and - construction or location survey.

Reconnaissance

Details of route vis-a-vis topography of the area
Length of the road along various alternatives
Bridging requirements, number, length
Geometrics: - Gradients that are feasible; curves and hair-pin bends, etc
Existing means of communication
Right-of-way available
Terrain and soil conditions: Geology of the area; nature of the soil, drainage conditions and nature of hill slopes; road length passing through: - mountains terrain, steep terrain, rocky stretches, areas of poor soil and drainage conditions, etc.; cliffs and gorges; drainage characteristics of the area; general

elevation of the road; total number of ascents and descents in hill sections; disposition and location of sand dunes; vegetation – extent and type
Climate conditions: - Temperature, rainfall data, wind direction and velocities, water table and its variation, etc.
Facilities / resources: - labour, construction materials, availability of local consultants and contractors, etc.
Value of land
Appropriate construction costs of various alternatives
Access points
Period required for construction
Strategic considerations
Recreational potentials
Important villages, towns, and marketing centers connected
Economic factors: - population served by the alignment, agricultural and economic potentials of the area, marketing centers
Other major developmental projects
Crossing with railway lines and other existing highways
Location of existing or proposed utilities
Position of ancient monuments, burial grounds, etc.
Ecology or environmental factor

Preliminary Survey

Preliminary surveys are conducted for the following purposes: -
To collect general information about traffic, soil, drainage, etc.
To establish reference bench marks
For transverse survey
To determine levels and draw cross-sections
For map preparation

Construction or Location Survey

Construction or location survey comprises two distinct stages, namely: -

Staking or stake-out or lay-out or setting-out the centre line of the proposed road on the ground: -

- Longitudinal profile and cross-sections
- Plotting the location survey
- Surface drainage investigation
- Soil and sub-surface investigation
- Road materials investigation
- Transportation facilities
- Right-of-way investigation
- Bridge and culvert location investigation

Collecting other information required for: -

- Design of the highway
- Preparation of construction drawings
- Calculation of earthwork quantities
- Evolving suitable specifications
- Working out the cost of the project (BEME)
- Procuring right of way (Row)

Land surveying

In ordinary **land surveying**, the terrestrial or three-dimensional positions of points and the distances and angles between them is determined. These points are usually on the surface of the Earth, and they are often used to establish maps and boundaries for **ownership**, locations, such as building corners or the surface location of subsurface features, or other purposes required by government or civil law, such as property sales. A land surveying professional is called a **land surveyor**.

Statement of the Problems

The following are *some factors identified and assessed as possible* current bottle-necks or inhibitors bedeviling institutional arrangements regarding construction surveying:-

- Usage of quacks and unqualified personnel;
- Bad government policies;
- Weak and unsuitable institutions;
- Lack of qualified construction surveying engineers;
- Insufficient capital;
- High degree of foreign dependence;
- Lack of construction surveying labour;
- Political instability;
- Lack of market for construction surveying, etc.

Sadly, principles of transparency, fair play, accountability and open competition were replaced with a broken down competition system that entrenched opaqueness, inefficiency, influence peddling and inflated costs with the attendant incidences of corruption.

Aims and Objectives of the Study

The author's aims and objectives in this work are not merely to discuss construction surveying development as previous writers have been accustomed to do (If any). Rather the author's aims and objectives are to actually engage in real construction surveying to enhance development. It is to promote sustainable construction surveying planning and strengthening reconnaissance, preliminary survey and location survey.

Significance / Justification of the Study

The study aims at evaluating the immense contribution of construction surveying towards stimulating highway or location survey and involving construction surveying engineers in productivity and other socio-eco activities. In spite of the efforts of construction surveying engineers to enhance the well-being of people, wide disparities in construction surveying development outcomes persist. It is a statement of fact that without an effective and efficient construction surveying engineers' development, all other socio-eco activities would come to a halt.

Scope and Limitation of the Study

The scope of the study is limited to construction surveying development.

Research Methodology and Organization of the Study

The empirical method of research was used covering field work and specific method of articulation. The study adopts exploratory method of research to examine and discuss relevant issues of interest in construction surveying. Because of the nature of the study (macro), the writer

relies on published documents in the area of construction surveying using commissioned studies, non-commissioned studies and published works from various sources. Some of these secondary sources are narrow in view, perspective and scope, but they serve as useful materials for researchers wanting to embark on a macro-study.

Others include library books, previous works by the author, detailed investigations done on construction surveying procurement by the author, internet and articles from learned journals. During the study there was no case where anybody or scholar delved into discussing construction surveying development as a viable option for socio-eco development objectives.

The study is organized in six (6) parts apart from the introduction. These are: literature review, elements of construction survey, equipment and techniques used in construction survey, profession, conclusions and references.

Hypothesis

The hypothesis aims at determining the impact of construction surveying development as a strategic catalyst for domestic socio-eco-growth and sustainability.

H0: there is no positive relationship between numbers' of established construction surveying engineers'.

H1: there is positive relationship between numbers' of established construction surveying engineers'.

Literature Review

The advent of high speed electronic digital computers has given tremendous impetus to construction surveying method in solving engineering problems (Nwadike, 2015). The questions, "who originated the method and when did it begin?" have three different answers depending on whether one asks an applied highway engineer, a civil engineer or an engineer (Chand; Nwadike, Sharma). Each of these specialists has some justification for claiming the method as his own because each developed the essential ideas independently at different times and for different reasons. The applied highway engineers were concerned with boundary value problems of construction surveying; in particular, they wanted to find approximate upper and lower bounds for eigenvalues. The civil engineers were also interested in solving construction surveying problems, but they sought means to obtain piecewise approximate functions to represent their continuous functions. Faced with increasing complex problems in the reconnaissance or preliminary survey, the engineers were searching for a way in which to find the construction or location survey co-efficient of road-type structures for traffic, topography and alignment by software and hardware methods of chain-age and azimuth (Optical theodolite, robotic total station, RTK GPS base station, optical level, etc.).

It is physical intuition which first brought construction surveying method concept to the engineering community and later, automatic generation of chain-age, leveling and azimuth process (RTK GPS base station, optical level, etc.). To the 1930's, when a construction surveying engineer encountered a surveying problem such as the one shown in the figure below, he or she immediately knew how to solve for component surveying and levelling as well as the overall construction surveying of highway (Nwadike).

The nearly perfect squareness and north-south orientation of the Great Pyramid of Giza, built c. 2700 BC, affirm the Egyptians' command of construction surveying. A recent reassessment of Stonehenge (c.2500 BC) suggests that the monument was set out by prehistoric highway and civil engineers using peg and rope geometry. In the sixth century BC geometric based techniques were used to construct the tunnel of Eupalinoslinos on the island of Samos. As modern times come and new technology come, the more accurate and more efficient construction surveying has become. For example highway and civil engineers used to use two posts with a chain in between to measure distance, this technology could only account for the distance and not the elevation. The new technology that is used today, known as GPS can measure the distance from point A to point B as well as accounting for the elevation differences. The new technology is able to do this because it uses radar and radio frequencies. ((Bernold, L. E. (2002). Spatial Integration in Construction. Journal of Construction Engineering & Management, 128(5), 400-408.))

Elements of the construction survey

- Construction survey existing conditions of the future work site, including topography, existing roads, buildings and infrastructure and underground infrastructure whenever possible (for example, measuring invert elevations and diameters of sewers at manholes);
- Stake out lot corners, stake limit of work and stake location of construction trailer (clear of all excavation and construction)
- Stake out reference points and markers that will guide the construction of new structures
- Verify the location of structures during construction;
- Provide horizontal control on multiple floors.
- Conduct an As-Built survey: a survey conducted at the end of the construction project to verify that the work authorized was completed to the specifications set on plans.

Equipment and techniques used in construction surveying

Surveying equipment, such as levels and theodolites are used for accurate measurement of angular deviation, horizontal, vertical and slope distances. With computerization, electronic distance measurement (EDM), total stations, GPS surveying and laser scanning have supplemented (and to a large extent supplanted) the traditional optical instruments.

The builder's level measures neither horizontal nor vertical angles. It simply combines a spirit level and telescope to allow the user to visually establish a line of sight along a level plane. When used together with a graduated staff it can be used to transfer elevations from one location to another. An alternative method to transfer elevation is to use water in a transparent hose as the level of the water in the hose at opposite ends will be at the same elevation. A double right angle prism verifies grid patterns, isolating layout errors.



A spirit level from the book *Carpentry and Joinery*

Equipment



optical theodolite

robotic total station

RTK GPS base station

optical level

Construction surveying techniques



A standard Brunton Geo compass, still used commonly today by engineers, geographers, geologists for field-based measurements.

Engineers determine the position of objects by measuring angles and distances. The factors that can affect the accuracy of their observations are also measured. They then use this data to create vectors, bearings, coordinates, elevations, areas, volumes, plans and maps. Measurements are often split into horizontal and vertical components to simplify calculation. GPS and astronomic measurements also need measurement of a time component.

Distance measurement



Example of modern equipment for surveying (Field-Map technology): GPS, laser range finder, and field computer allows surveying as well as cartography (Creation of map in real-time) and field data collection.



Center for Operational Oceanographic Products and Services staff member conducts tide station leveling in support of the US Army Corp of Engineers in Richmond, Maine

Profession

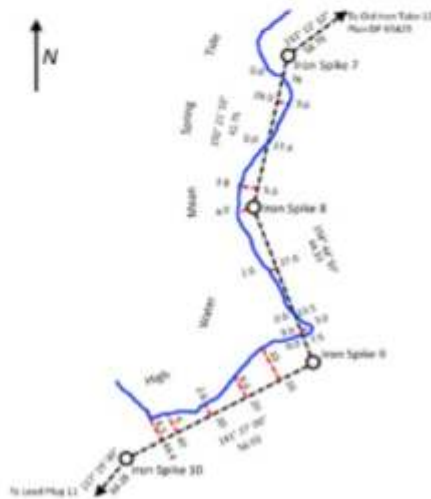
Construction Surveying Engineers emerged in the 1970s as a profession in the United Kingdom by a group of technically minded General Practice Engineers. Construction Surveying Engineering is a recognized profession within Britain and Australia. In Australia in particular, due to risk mitigation / limitation factors the employment of construction surveying engineers at all levels of the construction industry is widespread. There are still many countries where it is not widely recognized as a profession. The Services that Construction Surveying engineers undertake are broad but include: -

- Construction design and building works
- Project Management and monitoring
- CDM Co-ordinator under the Construction (Design & Management) Regulations
- Defect investigation and maintenance adviser
- Building Surveys and measured surveys
- Handling Planning applications
- Building Inspection to ensure compliance with building regulations
- Undertaking pre-acquisition surveys
- Negotiating dilapidations claims

Construction Surveying Engineers also manage and advise on many aspects of construction including: -

- design
- maintenance
- repair
- refurbishment
- restoration
- conservation

Clients of a construction surveying engineers can be the public sector, Local Authorities, Government Departments as well as private sector organizations and work closely with engineers, planners, homeowners and tenants groups. Construction Surveying Engineers may also be called to act as an expert witness. It is usual for construction surveying engineers to undertake an accredited degree qualification before undertaking structured training to become a member of a professional organization. For Chartered Construction Surveying Engineer, these courses are accredited by the Royal Institution of Chartered Construction Surveying Engineers.



A survey using traverse and offset measurements to record the location of the shoreline shown in blue. Black dashed lines are traverse measurements between reference points (black circles). The red lines are offsets measured at right angles to the traverse lines.

CONCLUSION

The paper concludes with a guideline on how to write a survey report. A construction survey without survey report is inconclusive. It is considered desirable to conclude and prepare a report about the surveys conducted for the proposed highway project. This will briefly summarize all the factors that helped in the location of the center line. It will also serve as a check for the engineer to find if he or she has missed any important information. A suggested out-line for such a report is given below: -

Survey Report

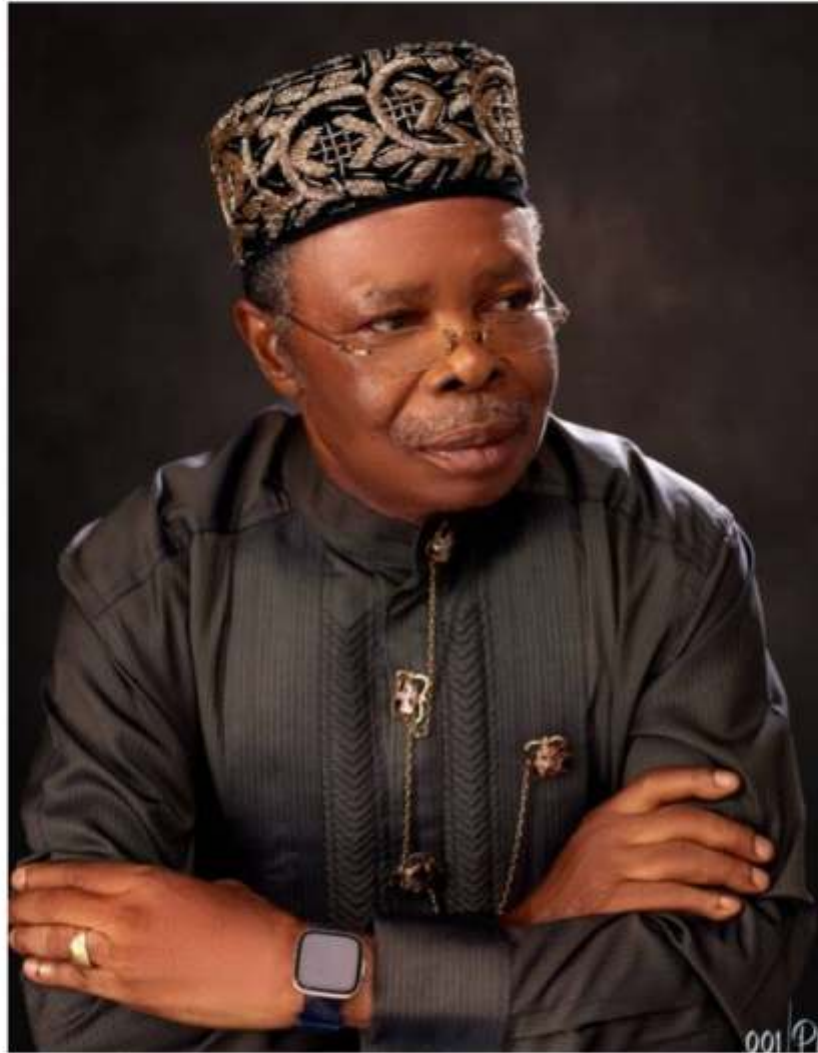
- Identification and history of survey: - Name, dates, etc.
- Traffic: - Design speed, Type and width of pavement, number of lanes, width and character of shoulder, etc.
- Topography, existing land use and utilities
- Proposed alignment and grades
- Foundation conditions
- Drainage
- Construction materials
- Right of way
- Maintenance of traffic (when required)
- Other considerations

The author hopes that the paper presented shall be a catalyst for practicing construction survey engineers, consultants, students and others, who are interested in the profession.

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INVESTITURE OF ENGR. GEORGE C. OKOROMA, FNSE, FNIHTE, JP. AS FIDIC AFRICA PRESIDENT-ELECT, MAY, 2026.



2025 NIHTE INTERNATIONAL CONFERENCE, FELLOWSHIP CONFERMENT AND AGM



2025 NIHTE INTERNATIONAL CONFERENCE, FELLOWSHIP CONFIRMATION AND AGM



POWER TRANSITION AT NSE AS ENGR. M. OGUNTALA, FNSE, HANDOVER TO ENGR. A. A. RABIU, FNSE







The Nigerian Society of Engineers
The President and Chairman-in-Council,
ENGR. MARGARET AINA OGUNTALA, FNSE
Cordially invites you

to the

Investiture Ceremony

of

ENGR. ALI ALIMASUYA RABIU, FNSE FASCE, FAEng. MFR

as the

35TH PRESIDENT

of
The Nigerian Society of Engineers

DATE: Saturday, 17th January, 2026 **TIME:** 10:00am WAT
VENUE: Banquet Hall, Aso Rock Presidential Villa, Abuja.

<i>Distinguished Guest of Honour</i> H.E. KASHIM SHETTIMA MUSTAPHA, GCON Vice President, Federal Republic of Nigeria <i>Guest of Honour</i> H.E. ENGR. ABDULLAH SULE, FNSE Governor of Nasarawa State	<i>Special Guest of Honour</i> H.E. DR. GOODLUCK E. JONATHAN, GCPR Former President, Federal Republic of Nigeria <i>Head Father of the Day</i> HRH HON. JUSTICE SIDI BAGE MOHAMMAD I, CFR, JSC RM Emir of Lafia <i>Hon.</i> BARR. EZENWO NYESOM WIKE FCT Minister
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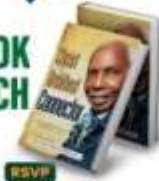
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Engr. Kashim Abdul Ali, FNSE, FAEng, mni., NSE Past President, delivering his Goodwill Message.



Engr. Amos, delivering his Lecture

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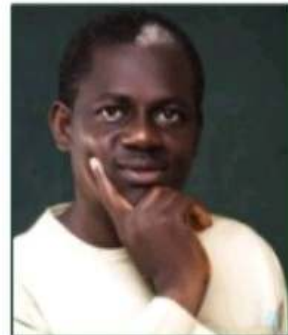
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Time: 11:00am
Venue: NSEVA, Site at Plot 11, MURUDEEN OLDWOPOPO Drive, CBO Alasara Ikaja, Behind Moris Garden (by the Lagos Chambers of Commerce & Industry building)

NSEVA
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Engr. Femi Dosumu, FNSE, Chairman NSE, Vice President
Engr. Abubakar Halilu Musa, FNSE, Executive Secretary

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AWARD: ENGR. SIR JONES NWADIKE, FNSE, FNIHTE, IN A WARM HANDSHAKE WITH NSE PRESIDENT, AS THE BEST TECHNICAL PAPER PRESENTER DURING THE 2025 NSE INTERNATIONAL CONFERENCE, FELLOWSHIP CONFIRMATION AND AGM.



2025 NSE INTERNATIONAL CONFERENCE, FELLOWSHIP CONFIRMATION & AGM IN PICTURE.



COURTESY VISIT BY COREN LEADERSHIP ON HIS EXCELLENCY, EXECUTIVE GOVERNOR OF GOMBE STATE, ALHAJI MUHAMMAD INUWA YAHAYA AT GOVERNMENT HOUSE GOMBE, ON 5TH NOVEMBER, 2025

