INTELLIGENT BUILDING DESIGN AND SUSTAINABLE ARCHITECTURAL TECHNOLOGY FOR NATIONAL TRANSFORMATION

Makama Stephen Inji

ABSTRACT: *Africans have lived intelligently for centuries and this is no less evident in their intelligent abodes which for all intent and purposes served its usefulness as shelter from the elements and functional space and also as a safe and comfortable environment for the body and by extension the mind / soul, therefore it would be wrong to see the temporary nature of many traditional buildings as epitomizing an unstable, and unsure society. For many societies, survival was dependant on preserving a delicate balance of forces and treading and re-treading a path worked out empirically over many generations. Each generation had to reassert the way and pass on the method to the next. This paper intends to lightly examine the demonstrations of intelligent building (design) by Africans in the past and attempt to show a careful selective emulation of such practices from the past can hopefully contribute toward National Transformation or at least the dawning of a National transformation agenda. This may allow us a nation an opportunity to look inward, backward and innately at the lessons of the past to enable us project to the future in order to deal with the present.*

KEYWORDS: Intelligent, Intelligent Building Design, Technology, National, Transformation

INTRODUCTION

The challenges of a National Transformation must surely be a phantom of Vision 2010 with the dawn of the 22nd century in view. The “primary objective” of the 21st Century National Development plan was to marshal plans that will put Nigeria on the threshold of being a developed country on or before the year 2010…” Momah (1999). While it may be true that the Federal Government of Nigeria may have the upgraded the Vision 2010 to 20:20:20 and a host of Millennial Development goals – the fact remains that that virtually none of the previous National Development plans, Vision 2010 inclusive, have been achieved. I stand to be corrected. Is it possible that we as a nation are not doing something right or have we missed out on something completely? Questions and possibly answers that this paper may illuminate and hopefully more expansively address in the near future.

Momah (1999) chronologises certain key points in the construction industry in Nigeria in a general over view into three major eras namely:

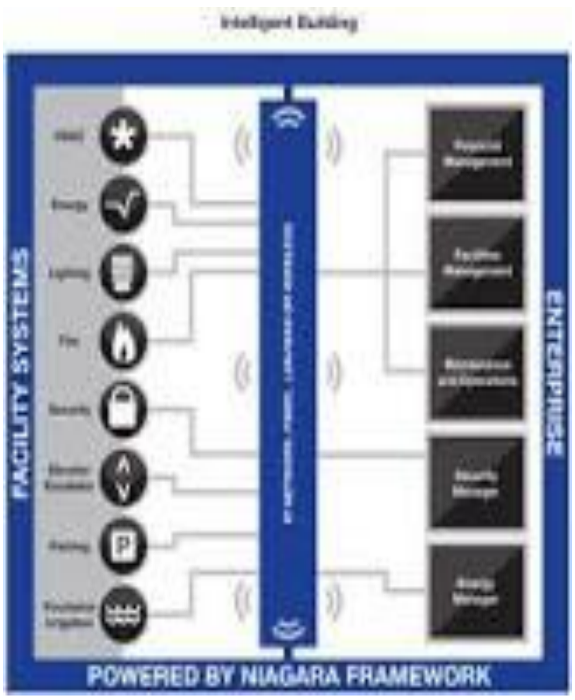
i. Pre Colonial
ii. Colonial
iii. Post Colonial

According to Momah (1999) what was required for such an objective were a qualitative educational system and an industrial revolution. He posited that it was not necessary to re-invent the wheel but to adopt -copy technology noting that it took Great Britain 58 years to double per capita income, 46 years for the United States of America, 34 years for the Japanese; Korea did it in 11 years while China achieved her feat in 10 years.

A qualitative educational system plus and industrial revolution cannot happen without a technological awakening- and technology is not easy to come by considering the costs and attendant issues of hedging by countries that are technologically advanced who will vigorously 'protect' their patents, hence the only alternative is to look inward and start from there.

Looking back at the botched 2010 vision it is easier to express or experience pessimism than optimism but we can gainfully say that considering the time it took China to raise her per capita income 10 years it would be possible for Nigeria to do the same in half that period. Only a concerted technological effort could achieve this.

Erlichman (2005) defines an 'intelligent building' as that which features incorporates- "Use of technology and process to create a building that is safer and more productive for its occupants and more operationally efficient for its owners… The results from implementing these technologies and processes are buildings that cost less to operate and worth more to their occupants".



ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

An examination of such technologies and processes are hardly the factors given consideration. This concern especially in Nigeria given that most capital projects are owner occupied by corporate, government and institutional bodies.

Higher employee productivity is the aim. For commercial developments the primary aim is for the above market rents, improved retention, higher occupancy rates and lower operating expenses- contemporary overriding needs?

Features or attributes of intelligent buildings may be summarized under the following:

A. Process

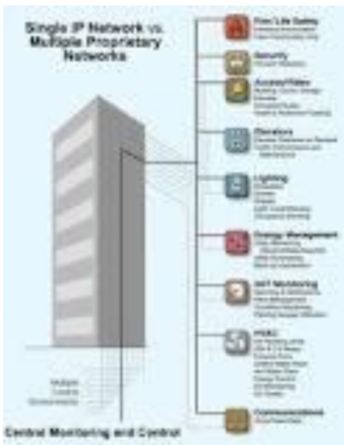
i) Design

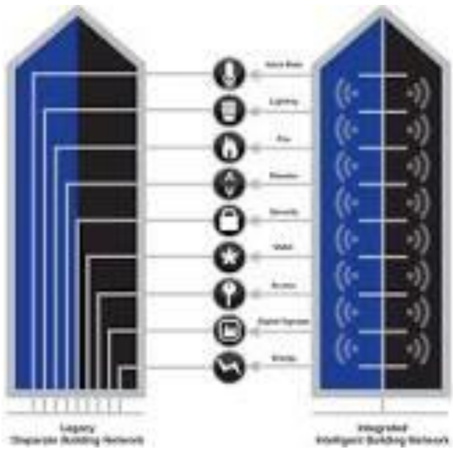
ii) Construction

iii) Operations

B .Technology

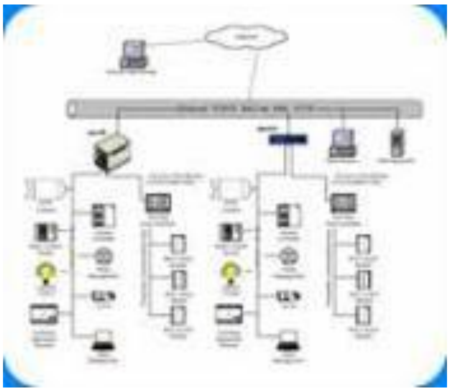
i) General





ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

ii) Networking / Communication



iii) Security/Life safety

Project and Scope

One of the first attributes of an intelligent design is to carefully evaluate current and future use of the project. This begins by clearly identifying the purpose and needs of the targeted building occupants (Erlichman, 2005).

The way of life in Africa's rural settlements determined the type of dwellings built. Settled farming societies had different requirements than herding societies which are usually nomadic.

Other rural societies in Africa are based on farming, hunting, and gathering in various combinations. A typical farming village consists of family compounds along with structures that serve the larger community.

Each family may have separate structures for cooking, eating, sleeping, storing food, and protecting animals at night.

Communal structures for holding meetings and teaching children were located in a prominent place in the village.

Towns and city states may have buildings that are larger than those in rural settlements. These buildings serve the purposes of government, trade or organized religion. In general, towns and city states have developed where trade has brought people together or where conquest has merged neighboring ethnic communities; consequently these settlements were built for diverse groups of people rather than for family units.

Concept and Budget

Creating an intelligent building does require an investment in advanced technology, processes and solutions (Erlichman, 2005) … but Africans have been practicing intelligent building design for centuries according to the definition - ("use of technology and process to create a building that is safer and more productive for its occupants and more operationally efficient for its owners")

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

The pyramids are regarded as one the most important feats of humankind and they primarily constructed to house deceased nobility and provide a safe abode as they transited to afterlife – they were built for the dead!

According to Wikipedia (Wikipedia, Free Encyclopedia, 2012) the Great Pyramid of Khufu, built around 2560BCE is 76 feet long on each side, 450feet high and composed of 2,300,000 blocks of stone, each averaging 2.5 tons. The Great Pyramid is reputed to be one of the most accurately positioned buildings known to engineering – with a base squared to only 5 seconds or 1/720 of a degree from the magnetic North …this achieved by early architects, engineers and craftsmen- Africans.

Site Selection and Integration

An intelligent design begins by looking at the site as it integrates with the community (Erlichman, 2005).

With regard to settlement plans, there were differences among the various communities. In lgboland, for example, Cole and Aniakor identified major factors that influenced settlement planning. These were population density, topography, water location social organisation, the need for defense and local traditions (Cole and Aniakor, 1984). In some other instances, related families lived in one space, or sometimes in sections of quite large houses, as in Cross River and Akwa lbom States. However, compounds as units of social organisation were emphasized in many Nigerian traditional communities and this was often reflected in their architecture

Site Integration and Site Impact

These are critical for environmental impact, and this strongly affects how the building occupants interact with the building.

At the macro scale, community integration is determined by community space planning and zoning regulations. An intelligent building should go beyond that with consideration as to how this fits in with the community‘s needs and transportation amenities (Erlichman, 2005).

In the ancient West African capital of Kanem Bornu, Birnin Gazargamu had many large streets extending from an esplanade which was connected by 600 roads.

The walls of Benin were a combination of ramparts and moats for defensive purposes and were considered the largest man made structure length wise and hailed as the largest earthworks in the world, construction of which began in 800AD and continued until the mid1400s.

Environmental Design

An intelligent building starts with an environmental friendly design (Erlichman, 2005).

Creating a project that is environmentally friendly and efficient is needful, in temperate regions the need for energy efficiency is a functional requirement- African design always took into cognizance the sweltering climatic conditions and hence deliberately selected building materials that would match the requirements for providing thermal comfort foremost. All these tie in very closely with many of the intelligent attributes.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

Intelligent buildings are designed for long term sustainability and minimal environmental impact through the selection of recycled and recyclable materials, construction, maintenance and operative procedures.

Intelligent buildings are intended to be the preferred environment for occupants. This requires focused attention to environmental factors that affect occupant's perception, comfort, and productivity. An intelligent design finds balance providing a superior indoor environment and minimizing energy usage (in terms of natural ventilation) and operations labor (.Erlichman, 2005).

All African indigenous building materials were eco friendly and possessed a high percentage of recyclabilty.

Building Circulation and Networking

Buildings exist to enable collaboration allowing occupants to be productive, efficient, and creative. Intelligent buildings provide for improved occupant circulation, interaction and collaboration. From a design perspective this means attention to how the occupants will circulate through the building. Collaboration can also be improved through the use of design elements to encourage networking in both formal and informal spaces, formal collaboration spaces are conference rooms, break rooms, classrooms, and seminar rooms. Informal collaboration spaces include niches and outdoor seating areas, and other places where building occupants can get together for brief planned or unplanned interactions (Erlichman, 2005).

At Kumbi Saleh, locals lived in domed shaped dwellings in the king's section of the city, surrounded by a great enclosure. The king was said to own several mansions, one of which was forty two feet wide, and contained seven rooms, was two stories high and had a stair case.

The rise of kingdoms in the West African coastal region produced architecture which drew on indigenous traditions, utilizing wood. The famed Benin City, destroyed by the punitive British expedition, was a large complex of homes in coursed earth material; the place had a sequence of ceremonial rooms, and was decorated with brass plaques.

CONCLUSION

Clearly poignant issues have been raised namely:

* The traditional practice of consideration for the local conditions and social preferences, and the use of locally available raw materials cannot be overlooked.
* The adverse impacts of modern architecture, including the neglect of low-cost indigenous materials, which are often treated as of inferior quality, are of concern.
* The dependence or reliance on expensive ways of housing and on jobs in urban centers to provide the means of livelihood, in contrast to use of low-cost local resources of the rural area refuses rationalization.

The goal of having an intelligent building only starts with early planning in the design stage. There are enormous benefits to be gained by creating intelligent buildings – not the least

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

because they create or allow an enabling atmosphere or ambience which will greatly enhance the well being and productivity of the occupants.

It is evident therefore that we may not need to look to far a-field to appreciate what we had was sustainable technology and that is what is needed for a National Transformation.

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ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

PRODUCTION OF AN ALTERNATIVE COMPOSITE COMPRESSED EARTH BRICK (A.CCEB) THROUGH THE UTILIZATION OF SHREDDED /DISCARDED PURE WATER SACHETS / CONSTRUCTION / CONSTRUCTION SITE WASTES

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ABSTRACT: *The primary goal of this paper is o explore the possibility and practicality of achieving a modicum degree of ' bonding ' between shredded / discarded pure water sachets and earth material (laterite) in a compressed brick format. In layman terms it will attempt to explore the theoretical possibility of achieving stabilization of compressed earth brick by materials other than cement as the primary binder or stabilizer. In the long term the goals would be to improve the initial variant of the composite material by extending this combination of possible stabilizers to other waste such as that generated from construction and construction sites.*

KEYWORDS: Alternative, Composite, Stabilization, Binder, Variant

INTRODUCTION

What is Stabilization?

Stabilization is simply the process of adding any material to laterite in the process of molding, in order to prevent disintegration or deterioration when compressed as a block or brick.

How is Soil Stabilized?

1. By increasing the density of the soil: soil pores and capillary channels are blocked.
2. By reinforcing: an all-directional barrier is formed which reduces movement of water molecules.
3. By cementation: an inert matrix is created which resists all movement of liquid molecules.
4. By bonding: technically this is the formation of stable chemical links between clay crystals.
5. By waterproofing: the coating of soil particles in an impermeable layer and blocking pores and channels.
6. By water dispersal: maximum elimination of water absorption and adsorption.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

WAYS OF STABILIZING TREATED SOILS

MEANS	PRINCIPLE	SYMBOL
INCREASING DENSITY	CREATING A DENSE ENVIRONMENT WHICH BLOCKS PORES AND CAPILLARY CHANNELS	
REINFORCING	CREATING AN OMNI-DIRECTIONAL REINFORCEMENT WHICH REDUCES MOVEMENT	
CEMENTATION	CREATING AN INERT MATRIX WHICH RESISTS ALL MOVEMENT	
BONDING	FORMING STABLE CHEMICAL LINKS BETWEEN THE CLAY CRYSTALS	
WATER-PROOFING	COATING THE SOIL PARTICLES IN AN IMPERMEBLE LAYER AND BLOCKING PORES AND CHANNELS	
WATER-DISPERSAL	MAXIMUM ELIMINATION OF WATER ABSORPTION AND ADSORPTION	

From the following above it seems not much further can done in stabilizing soils or laterite for production of earth blocks / bricks…

What if there was a way to harness key properties of one or two or more of the above methods of stabilization into one single operation and eliminating to some extent the use of any chemical process which would make the process cheap, readily accessible and most importantly widely acceptable to an average non professional in the construction industry or aspiring homeowner?

This what the Production of an Alternative Composite Compressed Earth Brick seeks to achieve- a process that will be as simple as the old traditional methods of using hand moulds and sun drying eliminating , to some extent , the cumbersome and sometimes 'frightening' prospect of hydraulic or manual machines which discourage many prospective connoisseurs of compressed brick technology.

Justification

I have had an avid interest in conventional Compressed Earth Brick technology since undergraduate study and it is my projection that this practical / theoretical work should form the ground work / referral material for a doctoral degree (having presented and successfully

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

defended a design and written thesis at masters level in 'local building materials technology') in the field of innovation of an alternative / composite compressed earth brick.

In a broader sense it is more than common knowledge that we are faces with an epidemic size problem on how to effectively and safely deal with simple everyday wastes such as pure water sachets, shopping plastic bags and a host of industry) related wastes (such as construction site and construction process) most of which are non biodegradable which emerging environmental trends preclude disposal by old methods of burning or simply dumping.

Therefore instead of dumping or burning such waste, with attendant consequences, why not explore the possibility of incorporating such material into more useful and non environmentally threatening uses.

Challenges

i) There is currently the unavailability of an alternative, cheap, readily available, easily accessible walling material in residential building construction; hopefully this proposed alternative composite material may present such an opportunity.

ii) There is a need for finding a non- environmentally polluting method of disposing non biodegradable plastic materials, specifically discarded pure water sachets, which have become hazards in their own rights.

iii) There is also the prospect of utilizing a number of construction / construction site wastes, such as leftover / cracked tiles, terrazzo slurry, P.O.P installation waste, etc in possible combinations to present a variant an alternative composite earth brick and most importantly to lessen the negative environmental impact when these wastes are summarily dumped at waste sites or haphazardly.

RESEARCH METHODOLOGY

Main Problem

This project is attempting to address the unavailability / inaccessibility of a long lasting, cheap, durable, affordable walling material in residential construction.

The objective of the project is to explore the possibility achieving an alternative composite compressed earth brick material through a ' loose' non- chemical stabilization / bonding process because currently this stabilization / bonding is achieved through the chemical process of the reaction of cement and the earth (laterite).

Intensive and extensive research has been carried out in the field of compressed earth brick technology yet surprisingly this has not translated into the goals of this paper – that is the provision of a cheap, readily accessible, durable walling material.

Therefore there is a lot of room for more research into how an alternative compressed earth material may be produced possibly one which eliminates the strain and expense associated with the conventional compressed earth brick.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

Project Activities and Output

Activity	Expected Outcome
Production	Setting up site , gathering material, preparation of material and production of bricks
Testing- Physical Testing And Chemical Testing	Integrity assurance for field simulation
Field Simulation	Testing of obtained brick samples in actual conditions
Collation And Dissemination Of Data	Peer and professional /international review, scrutiny - acceptance
Documentation	Recognition of composite material as a viable alternative walling material

Project and Activity Indicators

Activity	Indicator
Production	Stability – Non Breaking Down Of Sample Products
Testing- Physical Testing And Chemical Testing	Expected Results In Terms Of Correlation In Comparison With Test Results
Field Simulation	
Collation And Dissemination Of Data	
Documentation	

Expected Impact

i) Social impact: The environmental impact of such a project will tackle the menace of uncontrolled and haphazard disposal of discarded pure water sachets by controlling its disposal and providing an incentive for a broad swathe of pure water vendors from allowing careless disposal of the items.

ii) Economic impact: This project has its basis in the popular "waste to wealth concept".

iii) Technological impact: The use of (earth) laterite bricks has much of its indigenous roots in African and tropical architecture but due to Unagressive Research and Development (URD) the continent has lagged behind in an area of technological advancement very much a part of its culture, hopefully a breakthrough in this research will leap frog national local indigenous technological content.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

Project Management and Dissemination

Time- Line

S/No.	Description Of Activity	Duration	Year				
				Jan-March	April - Jun	July-Sept	Oct-Dec.
1	Sourcing And Preparation Of Raw Material	2-3 Weeks				*	
2	Production Of Bricks	34weeks					*
3	Curing Of Bricks	3 Weeks		*			
4	Testing Of Bricks	4 Weeks		*			
5	Construction Of Test Walls +Simulation	4-7 Weeks		*	*		
6	Collation Of Results	3 Weeks			*		
7	Dissemination	4 Weeks				*	

Management Mechanism

The project is basically and already by it s virtue a construction based or characterized activity therefore the will be a strict adherence to the basic frame work of work schedule which will ensure a predictable set of results at the expiration of the designed work period.

Evaluation Mechanisms

The mechanisms for evaluation are similarly very straight forward and almost simple- the primary task is to produce a composite brick material followed by laboratory tests and eventual field simulation tests, the criteria for a successful experimentation being the ability of the composite material to withstand and pass compression and tensional tests in laboratory situations and ability to maintain structural integrity when subjected to subsequent field simulations.

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ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

APPENDIX

Feel free to contact us at any time to discuss potential projects by clicking on the contact us section and sending us a message.

lectures

Dr. Eugene Tsui's lecture presentations at the following locations and times:

Topic: Changing our attitutdes, values and behaviors to preserve our future. Place: Lawrence Berkeley National Laboratories, One Cyclone Road, Berkeley, CA, 94720	Monday June 25, 2012 Time: 12 noon to 2:00pm

current and forthcoming projects

A list of current and forthcoming projects:

The Dave Bayer Residence	Oakland, California
The Korie Edises Residence	Hillsborough, California
The Nuno Ricardo Company and residence Buildings	Baldios, Portugal
The Telos Satellite Visitation and Demonstration Residence	Orland, California
The Telos Plaza Residence and Work Studio Building	Mount Shasta, California
The Shenzhen Tower	Shenzhen, China
The Strait of Gibraltar Floating Bridge,	Tarifa, Spain and Punta Cires, Morocco

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

internship application process

INTERNSHIPS: TSUI DESIGN AND RESEARCH, INC. (TDR,Inc.) Emeryville, California, USA

HISTORY OF INTERNSHIPS AND APPRENTICESHIPS

Since 1990, students and professionals from around the world have come to study with Dr. Eugene Tsui and the special learning environment he has created and developed. Students have come from nearly every major continent of the world; from the picturesque oceanic horizons of the Azores Islands to the dusty urban density of Gujrat, India; from the alpine forests of Kalinin, Russia to the sweltering jungles of Comayaguela, Honduras. Individuals have come from China, Japan, Korea, Canada, South America, Europe, Australia, Hawaii, Mexico and many other countries. TDR, Inc. also invites experienced professionals to engage in educational internships. These have included architects from NASA and research scientists from major American and European universities. Through the years over 350 eager designers, craftspersons, scientists and educators have come to study at TDR, Inc. Why? Because Dr. Tsui has garnered a global reputation as a pioneer of ecologic design that began in 1976, long before the terms, “ecology”, “green”, “sustainability” and “biomimicry” appeared in print. He is unique in the world for rigorously studying the workings of nature as a basis for human design and for questioning and providing solutions for the age old problems that plague humankind; problems such as overpopulation, social conformity, neglect and destruction of the natural environment, destructive consumerism and unquestioned collective religious assertion.

And his work still remains at the forefront of these issues due, in part, to the interdisciplinary approach that his designs implement, his rigorous study of nature’s organisms and processes and his integration of this knowledge in every day life. His outlook is an all encompassing paradigm that is a way of life not merely a design attitude. In addition, he consistently refuses to conform to the assumptions and expectations of architectural academia and the profession. He is a polymath that defies labeling and description.

One of Dr. Tsui’s outstanding and commendable qualities is his personableness. He is a simple man that makes everyone feel at ease and is always questioning—the trait that makes for a great educator and rebel—and that’s why individuals come; to learn, to experience and to find out how to be themselves. Exceptionally accomplished in multiple fields, i.e., music, competitive athletics, education, the sciences, oriental medicine, nature study, poetry, writing, clothing design, architecture, ecology, industrial design; Dr. Tsui is able to communicate at many different levels and immediately relate with people regardless of their background, their culture and education. The environment is one of awakening each person’s distinctiveness and strength of character; of inventing new possibilities and means. Many former apprentices visit, telephone and e-mail every year—a sure sign of affection, support and precious memories of time in one’s life when everything was an act of wonder and nothing was impossible. Come and join us!

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

WHERE

The offices of Tsui Design and Research, Inc. are located in Emeryville, California, USA, population of 8000 persons, one square mile in area, which is a small city on the waters of the San Francisco Bay nestled between Berkeley and Oakland, California. Emeryville is a dense urban city with shopping malls, movie theatres, restaurants, bookstores, schools, small parks, beaches, marina and immense number of apartments and condominiums. It is home to the renown movie making studio, Pixar, the international biotechnolgy company, Novartis, and many international companies. Walking, busing, underground train (BART) and bicycling are the preferred mode of transporation but the city is largely planned for automobile traffic. Tsui Design and Research, Inc. currently shares a three storey building with the engineering firm of Clausen Engineers.

Nearby are the renown universities of the University of California, Berkeley, The California College of the Arts, the Art Academy College, Expressions Music, Film and Digital College and Stanford University.

CURRENT OFFICE ADDRESS

Tsui Design and Research, Inc. Clausen Engineering Building 1727 64th Street, Third Floor Emeryville, California USA 94608 Telephone: 001 510 301 2105 FAX: 001 510 658 7289 E-mail: info@TDRInc.com Web Site: www.TDRInc.com

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INTERNSHIP APPLICATIONS

To apply for an internship contact Dr. Eugene Tsui at: info@TDRInc.com or telephone: 001 (USA) 510 (California) 301 2105 or write to the above mailing address.

Please forward the following documents:

1) Complete Resume/Curriculum Vitae with current contact information and description of special interests and hobbies.

2) Minimum three names, addresses, e-mail addresses and telephone numbers of academic and professional references. Recommendation letters are preferred and please e-mail directly to Dr. Eugene Tsui at: info@TDRInc.com

3) A brief essay answering the following questions: Why do you wish to intern with TDR, Inc.? What are your expectations for the internship? What do you wish to learn during your internship? What are your career plans? What are your 3, 5 and 10 year goals?

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

INTERNSHIP DESCRIPTION

All internships are full time, 5 days per week, 9am to 5pm daily with 1 hour lunch. Minimum internship is 3 months. Preferred internships are 1 to 5 years in duration. 8 years is required to complete the state and national minimum architectural licensing requirenments without university training. Apprentices are encouraged to stay as long as possible.

All interns receive 100% credit (NCARB) towards architect licensing requirements for a continuous stay of minimum 3 months, full time. Where applicable, individuals can also receive 100% State Contractor requirements for hands-on construction. In conjunction with educational institutions interns can receive 100% academic credit as an educational intern. Dr. Eugene Tsui is a licensed architect (NCARB/AIA), Licensed Contractor and City and Regional Planner (APA). Interns may receive 100% credit in all three areas simultaneously if properly prepared.

Internships are voluntary and experiential. Students and professionals must pay their own travel expenses, lodging, food and transportation expenses while they stay in the San Francisco Bay area of California, USA.

INTERNSHIP TASKS

Interns will be engaged in one or more of the following tasks:

1) Ecological and technologies research
2) Publications and promotional preparation and formatting
3) Preliminary design development
4) CAD drawings
5) Working drawings for permit application
6) Permitting research
7) Public hearings for Planning Review
8) Color renderings
9) Scale model building
10) Nature study research
11) Hands on construction
12) Materials and methods of construction research and estimation
13) Construction management/supervision
14) Business plan development
15) Public presentation development

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)