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THE EFFECTS OF ARCHITECTURAL DESIGN ON SOUTH AFRICAN EXPANDED PUBLIC WORKS PROGRAMME GOALS.

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Abstract
Increasingly in South Africa, architects are requested to design buildings that meet the job-creation and training goals of the Expanded Public Works Programme (EPWP). In so doing, architects have a mandate to both design buildings and to design work for the poorest of the poor. This purpose of this study is to develop a useful framework for the assessment of measurable EPWP outcomes within architectural projects in this context. Based on Case Study research that utilized semi-structured interviews and data collection, this paper seeks to link data to the popular narratives of two reportedly successful projects, the Mapungubwe Interpretive Centre in Limpopo and the Ocean View/Mountain View Housing Development in Cape Town (Constable, 2013; Fagan, 2010). This paper proposes labour-intensity and certified training outcomes as key areas of measurement and presents data for each project. Findings from the two cases reveal great variability in the intensity of EPWP usage and the nature of the relevance of worker training for future employment prospects. The paper concludes with key areas for future projects to consider regarding labour-intensive construction and worker training goals, including identifying the challenges in aligning architectural innovation with certification standards for construction skills. Recommendations include careful selection of building technology to maximize labour-intensity and worker training outcomes. With the continued growth of the EPWP anticipated in coming decades, this paper takes initial steps to identify unique architectural strategies and establishes a quantitative baseline from which to compare future projects. (National Planning Commission, 2012).

Keyworks: Architecture, EPWP, Labour-intensive construction, South Africa

1 Introduction

With the advent of the nation-wide EPWP in 2005, a methodology of labour-intensive construction was adopted by all public bodies in South Africa, prioritizing job creation and training in the delivery of infrastructure and new buildings (DPW, 2015). There are three primary EPWP goals: to provide income distribution through employment opportunities, to provide training and skills development to beneficiaries, and to build cost-effective and quality assets (DPW, 2015). This requires finding a balance between short-term employment goals and long-term building construction quality goals.

A review of the existing literature revealed no existing research specifically focused on architectural projects and the EPWP. This paper is an initial attempt to fill this gap by investigating the links between architectural design and EPWP outcomes through a pair of project level investigations.

Architects in this context are challenged to design economically empowering processes, not simply to design beautiful buildings. Most architectural design precedes the tender for building contractors. Therefore, architects must anticipate work outcomes even though it is at the discretion of building contractors to execute the work and manage workers on site. "*Architectural design "at the drawing board" is never neutral. It predetermines a set of relations around production."* (Low, 1998). As this paper will reveal, *"imagination is certainly required in order to find ways to create employment*." (McCutcheon, 2001)

The aim of this study was to explore the potential for architects to contribute to empowering others to work, to earn, and to grow in skills and independence.

2 Literature Review

2.1 Public Works Programmes

Anna McCord (2008) defines Public Works Programmes (PWP's) as: "all activities which entail the payment of a wage (in cash or in kind) by the state, or by an agent acting on behalf of the state, in return for the provision of labour, in order to i) enhance employment and ii) produce an asset (either physical or social), with the overall objective of promoting social protection." PWP's are most commonly implemented in conditions of extreme poverty or seismic shifts in a nation's economy prompted by war, famine, market collapse or conditions of structural unemployment (del Ninno, Subbarao, and Milazzo, May 2009). It is widely held that the first large-scale PWP to be established was the New Deal programme in the United States in the 1930's (Auer & Leschke, 2005). During the period from 1935 to 1943 this programme produced 40,000 new and 85,000 improved buildings including an array of public buildings ranging from park houses and schools to libraries (Leighninger Jr, 1996). While elements of the New Deal included a modicum of training for workers, these programs primarily focused on employing already skilled people through economic stimulus (Ermentrout, 1982; Leighninger Jr, 1996). Globally a vast range of PWP's operate with various programme designs and goals ranging from short term employment and job-counseling for the temporarily unemployed to income guarantee schemes that provide seasonal employment for participants. (McCord, 2008).

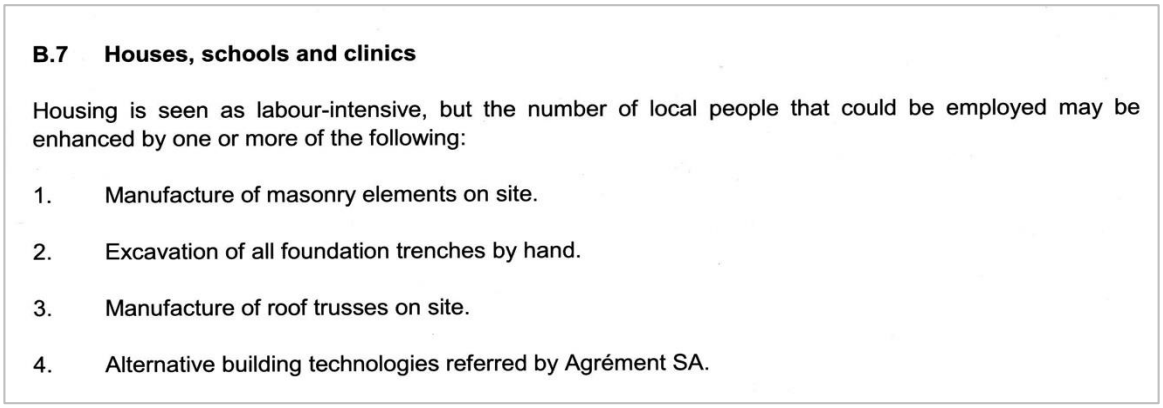
The EPWP is characterized as offering a single short-term episode of employment with an emphasis on skills training (McCord, 2008). Since its inception, a range of criticisms have been brought against the program, including critique of the fitness of the programme's design to the context of South Africa's economy. In 2008 the EPWP had only reached 11 percent of the officially unemployed, leading researcher Charles Meth (2011) to suggest that the program in South Africa is nowhere near sufficient in scale to address the need. Meth (2011) also evaluates the individual work opportunity, which averaged 4-6 months and involved 8-12 days of training, a very brief tenure to expect significant up-skilling. McCord (2005) echoes this concern; "The implicit assumption is that workers will metamorphosize from unskilled workers to skilled workers for whom there is unmet demand." This lack of demand for low skilled workers is linked to the core problem of structural inequality present in South Africa (Philip, 2010).

The up-skilling of beneficiaries is central to the EPWP emphasis on certified trainings aligned with National Qualification Framework (NQF). Exiting the EPWP with an NQF recognized training certificate represent a best-case outcome of the program.

2.2 Labour Intensive Construction

McCutcheon (2008) explains that "labour-intensive construction results in the generation of a significant increase in employment opportunities per unit of expenditure by comparison with conventional capital-intensive methods." Much of the literature related to labour intensive

construction focuses on the work of civil engineers and particularly road-construction as a labour-intensive output for beneficiaries**.** This is largely due to the potential to increase labour-intensity in this area through the selection of appropriate road-buildings methods. By contrast building construction, "is regarded as being inherently labour-intensive" due to the nature of the task work, which is by convention largely dependent on manual labour versus machines (A. Fitchett, 2009). While building construction has room for increasing labour it is seen to have less potential than many other areas such as roads. CIDB outlines a series of tactics for labour-intensification of building construction including recommended building technologies (CIDB, 2005). In Figure 1 EPWP identifies key areas with potential to increase labour-intensity within infrastructure projects involving building construction:



B.7 Houses, schools and clinics

Housing is seen as labour-intensive, but the number of local people that could be employed may be enhanced by one or more of the following:

1. Manufacture of masonry elements on site.
2. Excavation of all foundation trenches by hand.
3. Manufacture of roof trusses on site.
4. Alternative building technologies referred by Agrément SA.

Figure 1. Excerpt from: Guidelines for the Implementation of Labour-Intensive Infrastructure Projects under the EPWP (2015)

2.3 Labour Intensive Architecture

Within the field of architecture less rigorous assessment of labour-intensive building technologies exists. Fitchett's PhD (2009) contributes to an emerging knowledge in the South African context of building technologies and resultant labour-intensity. This builds on the work of Egyptian architect Hassan Fathy's in the development of New Gourna in the 1970's, an important precedent involving extensive local production of building materials and training of local people for construction. Fathy meticulously documented the strategies and decision within these labour-intensive construction projects (Fathy, 1973).

The recent publication of Afritecture (Lepik, 2014) popularized the narrative of job-creation and training goals within architectural projects across the African continent, including recent high-profile work by Mass Design Group in Rwanda. For the 6040m² Butaro Hospital in rural Rwanda, a reported 12,000 short term unskilled jobs were created while nearly 3900 skilled craftspeople were reported to be employed and received training on the job. (Murphy & Ricks, 2012) Here labour-intensive materials development and construction work was enabled through a design extensively using locally plentiful lava rock.

3 Research Methodology

The Case Study method was selected as appropriate to study this contemporary phenomenon in context. Given the enormous range of EPWP projects, two cases were selected to represent a divergent pair, rural and urban, once off and replicable. This research relied heavily on semi-structured interviews with key project participants. Interview protocol includedtenstandardized for each intervieweeselect customized questions24The method of analysis involved making notes on the key content of each interview in order to construct a project narrative informed by the perspective of different participants. Following these

interviews, formal letters were submitted requesting official data for each of the two projects in addition to a database of all current EPWP projects. Data collected from the two projects was then amalgamated into a spreadsheet to generate new comparison between the two projects to assess how architectural design decisions affected EPWP outcomes.

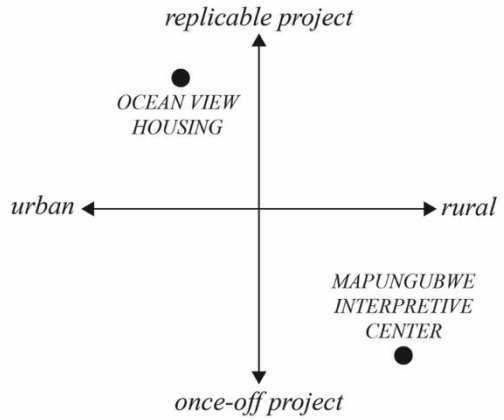


Figure 2. Project selection diagram

4 Findings and Discussion

4.1 Abbreviated Case Histories

The interviews revealed within each project unique forms of material and architectural innovation in pursuit of achieving the EPWP goals of labour-intensive construction.

4.2 CASE #1. Mapungubwe Interpretive Centre

4.2.1 Background

In 2005 South African National Parks (SANParks), a public agency within the Department of Environmental Affairs, embarked on the development of the Mapungubwe Interpretive Centre (MIC). They formed a competition brief to solicit design ideas from architects for a *"World-class Interpretive Centre to orientate all audiences regarding the Mapungubwe Landscape (cultural and natural)"* with a key mandate: *"The design of the building should be such that the construction methods should maximize the use of labour, job creation and skills development."*(SANParks, 2005).

4.2.2 Architectural Design

From this competition Lerotholi/Rich Architects from Johannesburg lead by Peter Rich was selected as the winning design. Previously Rich had done extensive research of the Ndebele culture and had a unique understanding of the regional vernacular. In addition, he had worked in several community-based projects involving local production of material, primarily through the use of Hydraform pressed blocks. (Joubert, 2011) Uniquely with this project the design was conceived in conjunction with two MIT based engineers who had worked together at to develop a tile vaulting construction system used at the Pines Calyx in England to. The key innovation in this project was found in the use of high-tech engineering to create a dramatic structure built using low-tech site-made tiles. To achieve this intensive research and development was required.

4.2.3 From Design to Labour-intensive Construction.

Despite the identification of regionally available industrial made tiles, the team chose to build them on site using local unemployed people to both minimize environmental impact and maximize job-creation (Rich, 2015). In May 2005, a research team formed between MIT and the University of the Witwatersrand to develop an earthen tile that could be created on-site using a modified cinva-ram style hand-operated block press (Ramage et. al., 2010). To minimize the building's environmental impact, the team opted to design for only 5% cement content, creating the weakest tile that could safely support the structural loads (P. Rich, personal communication, April 6, 2015). Following a two-week demonstration-based on-site training (M. Hodge, personal communication, June 16, 2015), the tile manufacturing commenced in the production of 200,000 tiles.

To manage the tile production six Small, Medium and Micro Enterprises (SMME's) were developed. SMME development involved NQF Level 2 business training of individuals leading to registration with the CIDB. Each SMME was then responsible to manage a tile making team, typically comprised of eleven EPWP workers. The overall construction was managed by a local building contractor, who was charged with maximizing EPWP work opportunities for all aspects of labour within the construction.

4.3 CASE #2: Ocean View/Mountain View Housing

4.3.1 Background

Since 1994 over 2.8 million RDP houses have been built in South Africa with scores of currently ongoing projects throughout the country (EPWP, 2015; SA News, 2014). This sector of EPWP has high potential for scalable strategies for labour-intensive construction and is recognized within the National Housing Code. Ocean View/Mountain View Housing (OV) is a People's Housing Process driven RDP housing scheme of 543 houses located forty kilometers south of Cape Town. A community board selected Mellon Housing Initiatives to lead the construction and project management with over site from the City of Cape Town's Department of Human Settlements, who issued a tender for architectural services.

The rocky mountainous site had for years delayed development on this land earmarked for housing. However in 2006 civil site work commenced, grading the land for sites and roads and stockpiling the quarried stone (Constable, 2013). A breakthrough in the project occurred when the City of Cape Town approached the Provincial Department of Human Settlements with a proposal to approve funding to develop a stonemason training programme and retain the stone for housing construction instead of removing the stone to a landfill site (P. Houniet, personal communication, July 15, 2015). In addition, the project accessed the Mayor of Cape Town's Special Job-Creation Fund to support the stonemasonry training.

4.3.2 Architectural Design

In March 2012 the City of Cape Town advertised a Request for Services seeking architects experienced with stone masonry design. This tender did not specifically indicate the presence of EPWP within the project nor the necessity to design for labour-intensive construction but did solicit architects with stone construction experience. Cape Town based Two Think Architects and Greenhaus Architects formed a joint venture to respond to the unique context of the project and were awarded the tender.

4.3.3 From Design to Labour-intensive Construction.

Early house designs featured up to 80% stone facades (A. Spies, personal communication, May 12, 2015). Along with an expert stonemason one of the two project architects co-lead the design and implementation of the 6-month stone-masonry training, involving 30 trainees in both

classroom and site-based learning. By working with engineers to develop a load bearing stone wall that utilized both dressed stones for the façade and rubble infill, the architects were able to maximize the use of the available site material while generating additional work for the stone mason team. Uniquely, this involvement both in the design and training of stonemasons had a direct effect on the housing design, encouraging increased variety in the stone facades to provide useful training experiences for the stonemasons and visual intrigue to the neighborhood. Here goals for a diverse site plan aligned with goals to broaden the experience of the stone masons in the execution of a range of structural corners, curved walls, and other challenging skills (E. Bruwer, personal communication, July 10, 2015).

At Ocean View the innovative use of the site stone belies the fact that the majority of the construction method was more conventional and much of this also utilized EPWP trainees. While stone collection, refinement and installation increased the opportunities for EPWP beneficiaries, an abundance of conventional building elements including concrete block, cement tile for roofing, and gang-nailed wooden trusses were purchased and delivered to site from regional industrial producers. These too offer possible opportunities to further increase EPWP in the onsite production of buildings materials. In addition, as the project continued, plans were adjusted to decrease stone masonry and increase concrete block walls to save time and cost. Interviews revealed the challenges in managing EPWP workers and the high rate of turnover particularly in the early phases of the project.

As seen in Figure 3 in addition to this stonemason training at OV the EPWP Job Training took on a broad range of forms. With the exception of the stonemason training these were initiated by the Department of Human Settlements and Mellon Housing Initiative and independent of the architects' involvement.

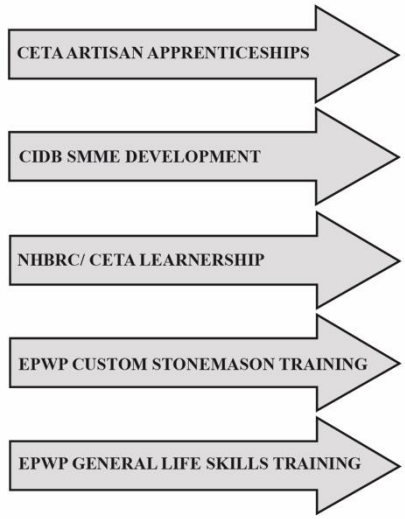


Figure 3. Training at Ocean View

4.4 Presentation of Collected Data

In this paper each of these projects is considered in relation to two key metrics; overall EPWP person-days and construction skills training deliverables. EPWP person-days (1 person day=8 hours of work) correlate to the goal of income relief through financial support transferred to participants. MIC generated 47,867 person days whilst OV (80% complete at time of data collection, including 2591 person/days of initial civil site work) generated 40,311 person days.

Table 1. EPWP wage transfer/labour-intensity evaluation table

Project	Mapungubwe Interpretation Centre	Ocean View Housing *(Current August 2015)*	Ocean View Housing *(Projected Totals)*
% Complete	100%	80%	100%
Total EPWP Person Days Worked	47876	40311	49741
Total Area of Building m²	2753	23023	28779
EPWP Person Days/m²	17.39	1.75	1.73

Table 1 reveals the total EPWP person-days for each project, and the ratio of EPWP person-day to the size of the constructed buildings. The purpose of this table is to isolate the use of EPWP as this programme aligns with particular government objectives for poverty relief and training distinct from the general labour market. This table does not refer to the total labour utilized in the completion of each project, which in both projects also featured the work of sub-contractors independent of the EPWP programme.

This study suggests a metric particularly relevant to understanding intensity of EPWP usage in architectural projects is EPWP Person Days/m². MIC featured EPWP usage of approximately 17 EPWP Person Days/m². The major contributor to this labour effort was in the production of 200,000 tiles for the vaults that totalled 28, 512 of the 47, 876 overall EPWP person-days. (SanParks 2015). The productivity of tile production at Mapungubwe and the efficiency of on-site materials production emerges as a key area in need of further investigation. Initial estimates for the expected output per tile-press were significantly higher than actual output, although the low wages associated with EPWP workers meant the overall costs for material production remained relatively low. (Fitchett, 2009a; Ramage et. al., 2010) Interviews revealed high levels of breakage in the transportation of the fragile tiles across the site as well as challenges in on-site vs. laboratory conditions of the tile production. (A. Fitchett, personal communication, March 28, 2015, F. Prinsloo, personal communication, July 12, 2015).

Based on the reported average of other RDP housing developments, the comparatively high level of EPWP hours at OV is apparent (EPWP, 2015)**.** However, at OV the overall level amounts to 1.75 EPWP Person Days/m², much lower than MIC. Areas of potential increase to the EPWP Person Days/m² at OV include decreased purchasing of industrially produced materials in favor of on-site material production using EPWP beneficiaries.

The second measure of significance for this paper is "Construction Skill Training Deliverables" that emerge as outcomes that potentially enable workers to have improved job prospects beyond the time of the project.

Table 2. Construction Skill Training Deliverables

Project	Mapungubwe Interpretation Centre	Ocean View Housing *(Current Aug. 2015)*	Ocean View Housing *(Projected Totals)*
% Complete	100%	80%	100%
# CETA Construction Skill Certificates	0	24	48
# Non-Accredited Construction Certificates	0	32	32
% Workers Earning Construction Certificates	0.00%	2.15%	5.78%
Total SMME's Developed	6	2	2

Table 2 seeks to categorize key measurable training outcomes and SMME's development for each project. As indicated in Figure 3, a range of possible outcomes exists within the training

of EPWP workers. Here CETA certified trainings are prioritized as specific evidence of construction skill development, with additional non-certified Construction Certificates also accounted for. This table shows that MIC generated 6 SMME's but no reported construction certificates. During the MIC project, accredited training was the responsibility of the Department of Environmental Affairs and information was not made available for this study. However, based on interviews with MIC project leaders, while general life skills training were facilitated throughout the project no reports of formalized construction skills trainings emerged.

Ocean View generated 24 CETA certificates for trainees in Painting and Carpentry/Joinery and 32 informal non-accredited certificates for the Stonemasons. It is projected that among the current Plumbing and Electrical trainees an estimated 24 will likely be certified by project completion. However, while many of these trainees were selected from the pool of EPWP workers, once entering the CETA 3-year apprenticeship programme they are no longer EPWP beneficiaries. This creates some ambiguity in assessing outcomes.

Architectural design had no apparent effect on these opportunities. Despite the best efforts of the project team, the stonemasonry trainings at OV failed to be recognized by CETA and to achieve an NQF Unit Standard. Ultimately participants were given a non-accredited certificate from the trainers in order to have tangible proof of their dedication and newly developed skills.

To construct the vaults at MIC, workers received on-site training in specific vault building techniques but this was not associated with any certifiable skill. Similarly the tile-making training, though useful to the production of tiles required for the construction was not associated with any NQF validated training to substantiate the workers efforts beyond the project. Beyond the SMME trainees, no MIC participants were reported to have received any form of skills training certificates.

The relevance of taught skills with respect to regional employment opportunities is an important consideration when architects select building technologies. While MIC generated high levels of EPWP person/days this was largely based in the production of tiles for a construction system anomalous to the region. By contrast, at Ocean View the stone masonry training shows initial signs of enabling future work opportunities, with the City of Cape Town and others in discussion concerning employment potential in the maintenance of historic stone structures, and stone walls on public roads. In addition, there are many stone buildings in the neighbouring suburbs that may allow for work opportunities in the open market.

Nonetheless, the SANParks brief called for a world-class building, and in 2010 MIC was selected as the World Building of the Year (Fagan, 2010). There can be little doubt this design has achieved this goal in addition to achieving high levels of EPWP wage transfer.

5 Conclusion and Further Research

A primary lesson from this research has been that architects should recognize, from the outset of projects, that material production on site offers the single greatest potential to increase EPWP labour opportunities (A. Fitchett, personal communication, March 28 2015). Additionally, it is important to anticipate the areas within the domain of architects to affect EPWP outcomes and those areas outside of their control. Finally, given the option, architects should choose building technologies and designs that align with certifiable skills, regionally useful techniques, and encourage management structures that develop local SMME's.

This research process has also revealed the challenges of utilizing data collected by agencies for EPWP reporting requirements to trace the specific impacts of architectural design on EPWP outcomes. In the future, focused researcher-lead data collection would assist in more precisely evaluating labour-increasing strategies and their connection to the work of architectural design.

5.1 Recommended Areas for Future Research

This study has identified the following areas for further research:

5.1.1 Project Level Studies of Training within EPWP

Further project level studies of training and certification processes within EPWP architectural projects are warranted. These should include understanding the duration, training costs and management structures within training programmes. Additionally, both projects of this paper raise questions concerning how "unit standards" can more flexibly align with innovative building technologies to validate training efforts.

5.1.2 Tracer Study of Ocean View Stonemasons

With Ocean View's construction completion anticipated in early 2016, a follow up study on the work outcomes for this stonemason-training group may yield important understandings of the transition from EPWP work opportunities to finding employment in the labour market. This case appears to represent a real application of the EPWP ideals of "a better equipped work seeker" with potential for self-employment and a newly marketable skill.

5.1.3 RDP Housing and Local Material Production

The use of site based stone at Ocean View while defaulting to factory based materials for the majority of building components raises important questions about site-based material development and the inherent limits in terms of cost and management. Further exploration of this area could lead to a more defined position in future RDP developments.

5.2 Closing Thoughts

The EPWP presents a challenge and an opportunity for South African architects. Continued assessment and innovation within EPWP architectural projects can yield a South African architecture well suited to its cultural and economic context and expand the social and economic impact of architectural design.

6 Acknowledgement

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