

Skills Development in the Built Environment

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Abstract — In South Africa, skills development, knowledge transfer and Radical Economic Transformation lies at the heart of infrastructure development, and consequently economic growth. The crux of this paper will present the mentorship of the engineering graduate from tertiary education into the built environment, transfer of skills within the Road Asset Management System (RAMS) Academy programme and the Contractor Development Program within the roads sector.

The shortage of skilled engineers has been recognized in this paper as a long-standing problem. While ECSA has highlighted the requirements and operational levels for candidate engineers to achieve professional stature, it is ultimately the effectiveness of mentorship programs, that prepare and equip the candidate for the built environment.

This paper explores The National Department of Transport's need to facilitate a learner ship program or Academy in Road Asset Management Systems (RAMS) which is initiated to train individuals to be equipped to accurately implement RAMS within their organization.

This paper also covers the Contractor Development Program that is an intervention designed to develop and educate emerging and historically disadvantaged contractors. The program assists contractors to build capacity and move into a higher CIDB grading designation, thus enabling them to tender for a higher grade of construction work.

Finally, this paper addresses the initiatives and interventions mentioned above that form a platform to empower individuals that make up the built environment, by providing sustainable knowledge and skills to the industry.

Keywords—Skills development; Mentorship program; Road Asset Management Systems Academy; Contractor Development Program (key words)

I. INTRODUCTION

Civil engineering is an ever-growing industry within South Africa. Infrastructure development and economic growth is vastly dependent on the caliber of personnel that are conceptualizing, implementing, designing and constructing

new developments. The motivation behind this paper lies with the need to ensure continuous development of skills in the civil engineering industry. The development of skills lies in mentorship and candidate programs and transferring of knowledge through courses. Most organizations have developed such programs to enhance their employee's skills in order to improve the quality and accuracy of work that is produced. This paper illustrates three initiatives that focus on the following; graduates entering the industry; transfer of knowledge in a governmental organization and a contractor development program. The paper describes a one-year mentorship program broken up into five parts. The second initiative introduces the Road Asset Management System Academy. The academy has been initiated by the National Department of Transport to equip the organization with skills to manage the road network more efficiently and successfully. Lastly, the paper describes a contractor development program that was introduced in the Free State for the Department of Transport to provide mentorship and guidance to emerging contractors.

II. DESIGNED MENTORSHIP PROGRAM

The transition between tertiary education and the working world is mammoth for most. Ultimately, the effectiveness of mentorship programs remains key in preparing and equipping a candidate for the built environment. Therefore, candidates progressing from tertiary education into the built environment need to be developed and trained through mentorship and mentorship programs administrated and designed by professionals in the industry.

Engineering Council South Africa (ECSA) has provided comprehensive literature on candidacy programs that will equip a candidate with a skill set to apply for professional status at the successful completion of the program. However, a candidate requires further training beyond this program in the field that the individual is working in.

According to an article published by the University Of North Carolina (UNC) adapted from the research undertaken by the UNC Kenan-Flagler Business School [2], mentoring should include six key components: purpose, communication, trust, process, progress and feedback.

Adopting and modifying these principals, VNA Consulting had orchestrated a one-year mentorship program for graduates entering into the work place.

The mentorship program comprises of five parts.

Part one: Two months

- Recapping on knowledge absorbed in tertiary education.
- Understanding each component of the task given (which is in line with the job description) and the final output.
- Researching each component in the task.
- Creating flow charts and spreadsheets that will assist in the execution of the task.
- A summary of what has been learnt.

Part two: Four months

- Executing the task given using the tools adopted during period one. This was done from first principals without computer-aided software.
- Recap and summarise the period.

Part three: One month

- Receive training on the company procedures and methods of completing tasks using computer-aided software adopted and used by the company.
- A summary of the period.

Part four: Five month

- Execute the given task using the company standards, methods and tools.
- Recap training during this period.

Part five:

- Evaluation of the training received during the one-year mentorship program.

The programme was put to the test with a graduate operating in the Geometric Design office.

During the first period of training, the graduate undertook research and recapping of geometric design principals. The graduate was exposed to literature such as the TRH 17 manual (Technical Recommendations for Highways 17: Geometric design of rural roads), the SANRAL Geometric Design Guidelines and the SANRAL Drainage Manual. Each component was broken up to understand what makes up a full geometric design. The graduate there after developed spreadsheets on how to calculate horizontal and vertical alignment, road cross-falls and drainage systems for the road.

The graduate was then given 1.5 kilometers of an existing gravel surfaced road to improve the alignment and drainage systems of the road that will be upgraded to a blacktop standard. This task was performed using first principals and spreadsheets earlier developed.

The task issued to the graduate in the last period was reviewed and the graduate was assessed on the technical accuracy and time taken to complete the task. In the third period, the graduate was introduced and trained on a computer package for geometric design called Civil Designer by Knowledge Base Software.

Using the package and the section of road used in the graduates second period, the graduate was tasked with designing the road using the package.

Lastly, the graduate was evaluated based on technical accuracy, completion of the task within the timeframe stipulated and understanding in completing all components of the task provided.

III. ROAD ASSET MANAGEMENT SYSTEMS (RAMS)

Road networks are deemed to be an organizations asset. The sustainability, longevity and wellness of it depends on maintenance of the network. In order for effective maintenance to be executed, an organization would have to create a system that measures the extent and severity of the network. Road asset management systems is a tool that helps an organization prioritize which roads require maintenance and what type of maintenance is required. This is based on the severity of the failure. Many companies and organizations have developed methods, techniques and programs that assist in managing road networks. However, the effectiveness of these programs and methods depends largely on individuals or teams operating them. The need then arises to ensure that an organizations team is well equipped to ensure that RAMS is implemented effectively and accurately.

VNA Consulting, together with the National Department of Transport has engaged in an initiative to design an academy that will mentor and train an organizations road asset management team to ensure that the system is administrated effectively and accurately. The objective of the RAMS Academy is imparting knowledge and skills to successfully manage a road network.

It is proposed that the RAMS Academy be a virtual institutional-line delivery of course material and examinations.

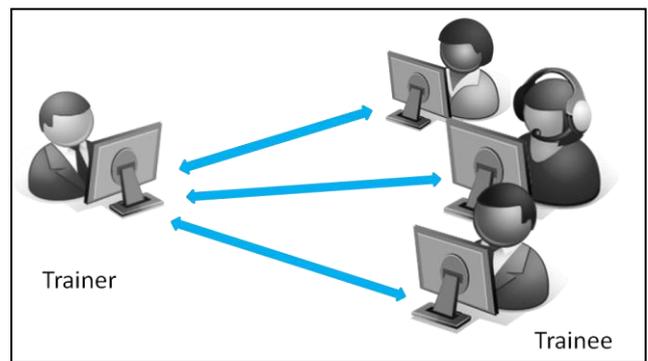


Fig. 1: Figure showing virtual institutional-line delivery

The RAMS Academy is made up of courses or training pertaining to an organizations road network and the functionality. Trainees need to be trained in following courses derived from key areas of TMH22:

- Road network characterization.
- Introduction to GIS.
- Collection and storage of road inventory data.
- Valuation of road assets.

- Condition assessment of flexible pavements.
- Condition assessment of concrete pavements.
- Condition assessment of unpaved roads.
- Condition assessment of block paving pavements.
- Condition assessment of bridges and major culverts.
- Condition assessment of road assets.
- Instrumented surveillance methods.
- Determination of condition indices.
- Introduction to Pavement Management Systems.
- Pavement maintenance needs analysis.
- Introduction to HDM4.
- Preparation of asset management plans

The implementation of these courses would equip an individual with the tools and knowledge to implement RAMS within their organization.

Based on the skills need and level of responsibility, the organization would identify trainees for the programme. Each trainee needs to have attended pre requisite courses in order to be registered with the academy.

The program can only become a success if each element of the course is evaluated. Trainees will be evaluated on results of assignments and examinations. Facilities will be evaluated on their ability to effectively communicate with trainees. Feedback from trainees will provide an indication on facilitator's communication skills. Lastly, the content needs to be in line with new, approved and accredited research and new technologies that effect road management systems.

IV. CONTRACTOR DEVELOPMENT PROGRAM (CDP)

Many organisations have developed programs over time to enhance a contractor's ability to produce quality construction, improve business management and technical skills. The Construction Industry Development Board (CIDB) has developed a construction development program, which develops contractors with a CIDB grading between grade 2 and grade 6 contractors but excludes emerging grade 1 contractors [1]. In light of this, a programme was designed with the Free State Department of Public Works to alleviate unemployment, poverty and mentor contractors to grow within the industry.

The format of the mentorship aspect of the programme is as follows:

The contractors that formed part of the programme were actively registered with CIDB and had a grading between one and seven CE. The basis of the mentorship programme was introduced at three levels based on the contractor's CIDB grading.

The technical on-site and classroom mentorship, management support, general site planning, organising and resourcing utilizes a tri-level mentorship support method that

saw contractors receive support based on grading and therefore their developmental needs. Details of the mentorship method are:

- Level 1 CIDB Grade 1-3 are assigned to a Managing Contractor (MC)

Managing Contractors are contractors of CIDB 6-7 grading. MCs support the programme by executing selected works contracts using CIDB Grade one to three from the Contractor Development Programme (CDP).

As a Mentor, the MC are responsible for the execution of work on time, cost and quality. The MC further facilitates or provide material and plant for the sub-contractors including supporting each sub-contractor on Contract Management (planning, organising, and execution).

- Level 2 CIDB Grade 4-5 are assigned to a Construction Manager (CM)

The Construction Manager supports the appointed Grade 4 and 5 contractors in each of the designated Maintenance districts. As a Mentor, the CM is responsible for supporting the Contractors to deliver their contracts and provides guidance on Contract Administration, Quality Management and Progress Management.

- Level 3 CIDB Grade 6-7 are assigned to a Project Management Consultant (PMC)

Project Management Consultants support contractors in each of the Districts. The PMCs mentor contractors in Grade 6 and 7 from the Contractor Development Programme (CDP). As a Mentor, the PMC are responsible for providing guidance and advice to contractors in order to meet the contract requirements and to close identified skills gaps.

The program has been implemented on four projects namely:

- P81 connecting Harrismith to Bergville via Sterkfontein Dam
- Thaba Nchu Transport Route
- Monontsha Border Pass
- Kroonstad Through Route

Given the current economic climate within South Africa, many of these projects were marred with protests. These issues were alleviated by discussion with the parties involved to come to a common ground. Part of this was ensuring that labourers within these programs and the project at large were employed from the community in which the project was located. This was done on a fixed term and the labourer was provided with skills development during their term. From this not only did local emerging businesses benefit but also the people within that area.

V. DISCUSSION

The graduate that was assigned onto the mentorship program was measured by their understanding on what needed to be done, their technical ability in completing the task accurately and completing the task given in the specified period. This was adjudicated and examined by a professional engineer who deemed the graduate to have met the goals outlined.

The RAMS Academy has not been implemented yet and therefore cannot be measured to any other similar program. However, the structure or framework has been accepted by government organizations. The objective of the academy is to develop individuals to be able to manage an organizations road network as well as make valued and technically accurate decisions on how to maintain the network.

The Contractor Development Program implemented in the Free State was successful through contractors moving up the CIDB grading. 36 grade 1 contractors were put on the programme for 3 years. 15% of these contractors are now Grade 6, 5% are Grade 5, 45% are Grade 4 and 35% are now Grade 2 contractors.

VI. CONCLUSION

This paper illustrated three types of mentorship interventions and programs. Through the transfer of skills and knowledge, it is evident that an individual may improve their capability in the engineering and built environment. However, the success of each program depends on the willingness of an individual to learn and absorb what is being mentored. It further lies in the accuracy and diligence that it is being mentored in. By adopting a willing attitude, passion and dedication; skills development in this industry will continue to grow and thrive. Therefore, the need for skills development in the built environment is to transfer knowledge and preserve the industry.

ACKNOWLEDGEMENT

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