

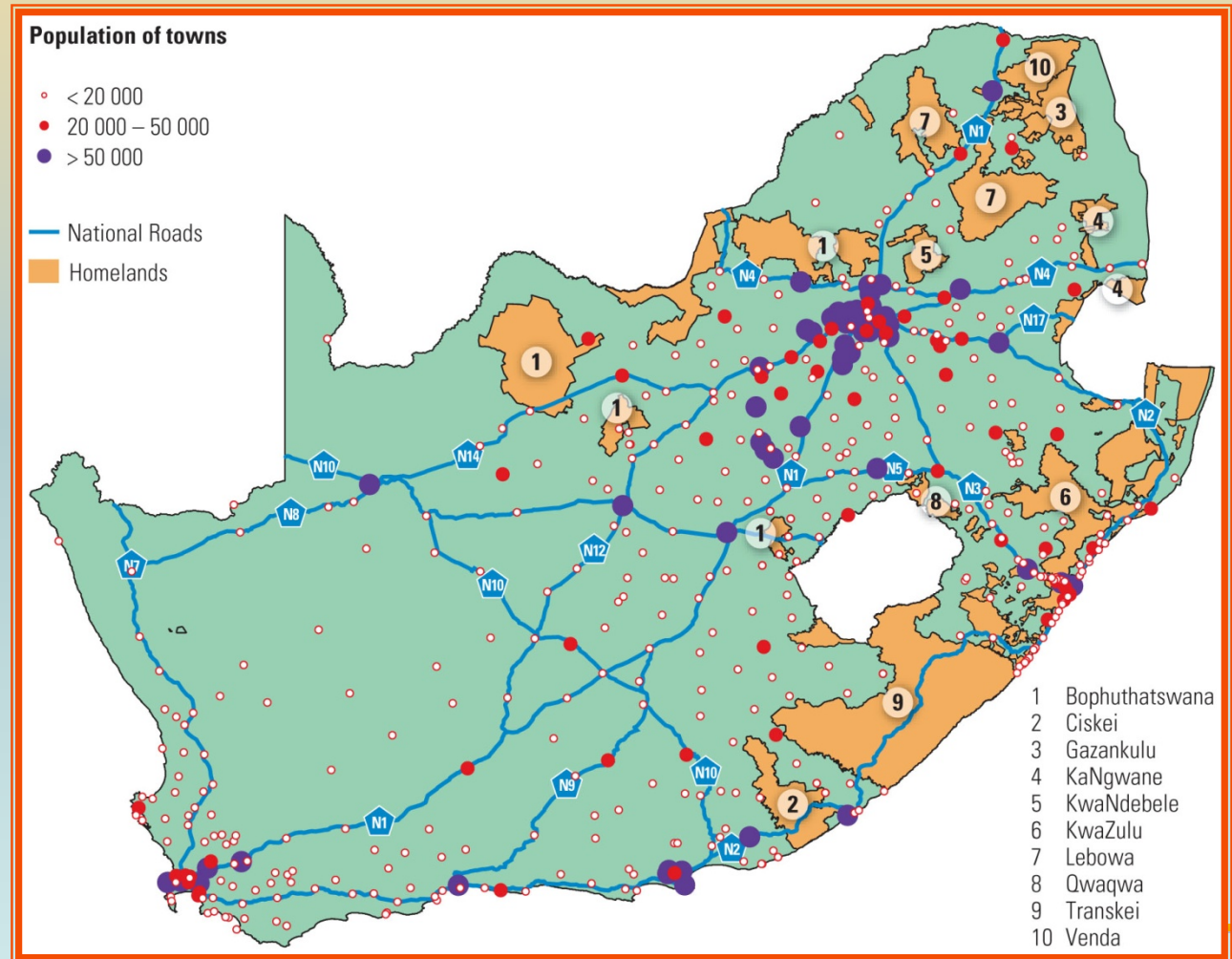
Capacity building in civil engineering

ROAD FORUM
10 NOVEMBER 2009

Allyson Lawless

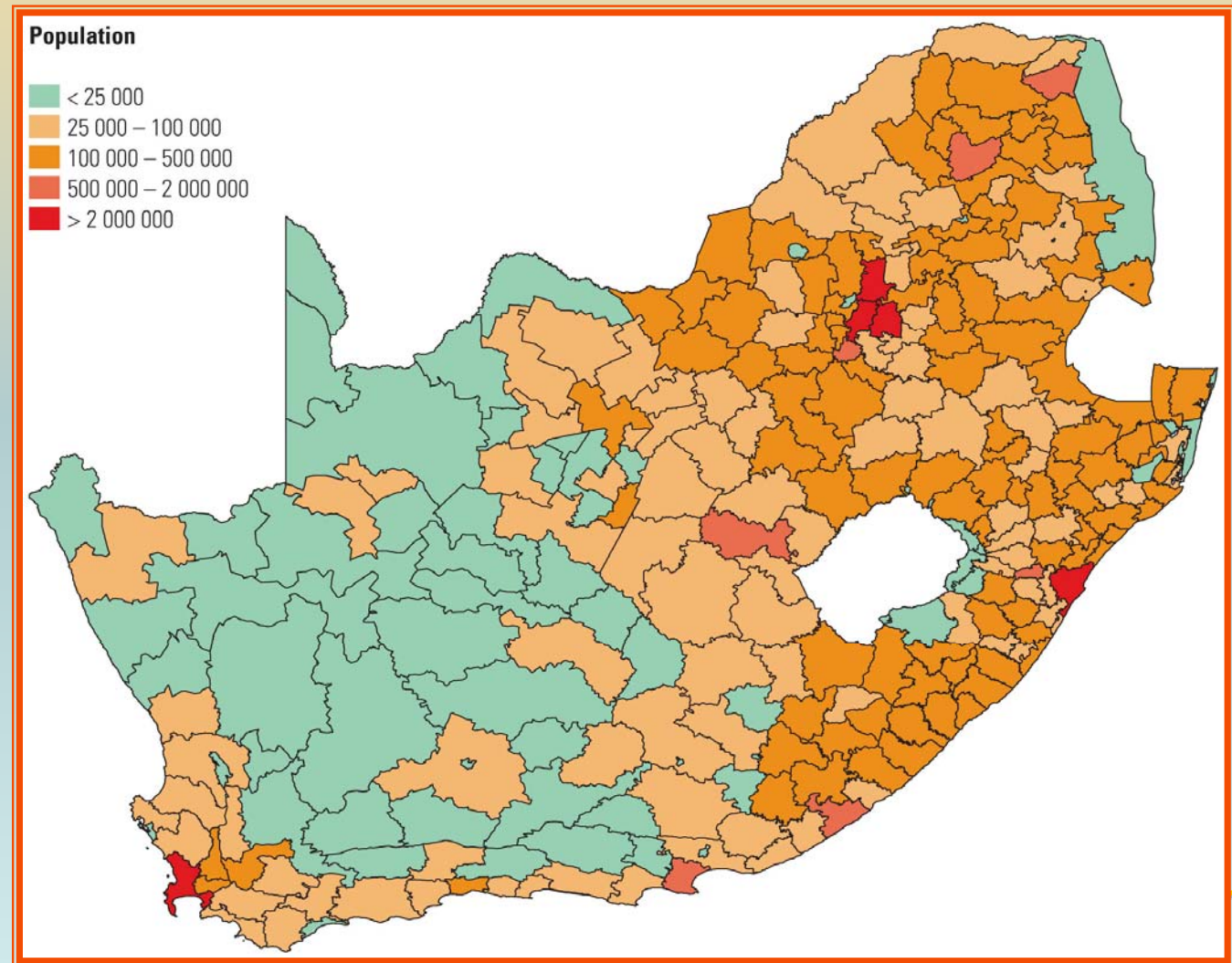
Developed local government in 1989

- Population served ~ 14 million
- Civil engineering professionals ~ 2500 +
- 21 + civil staff per hundred thousand population

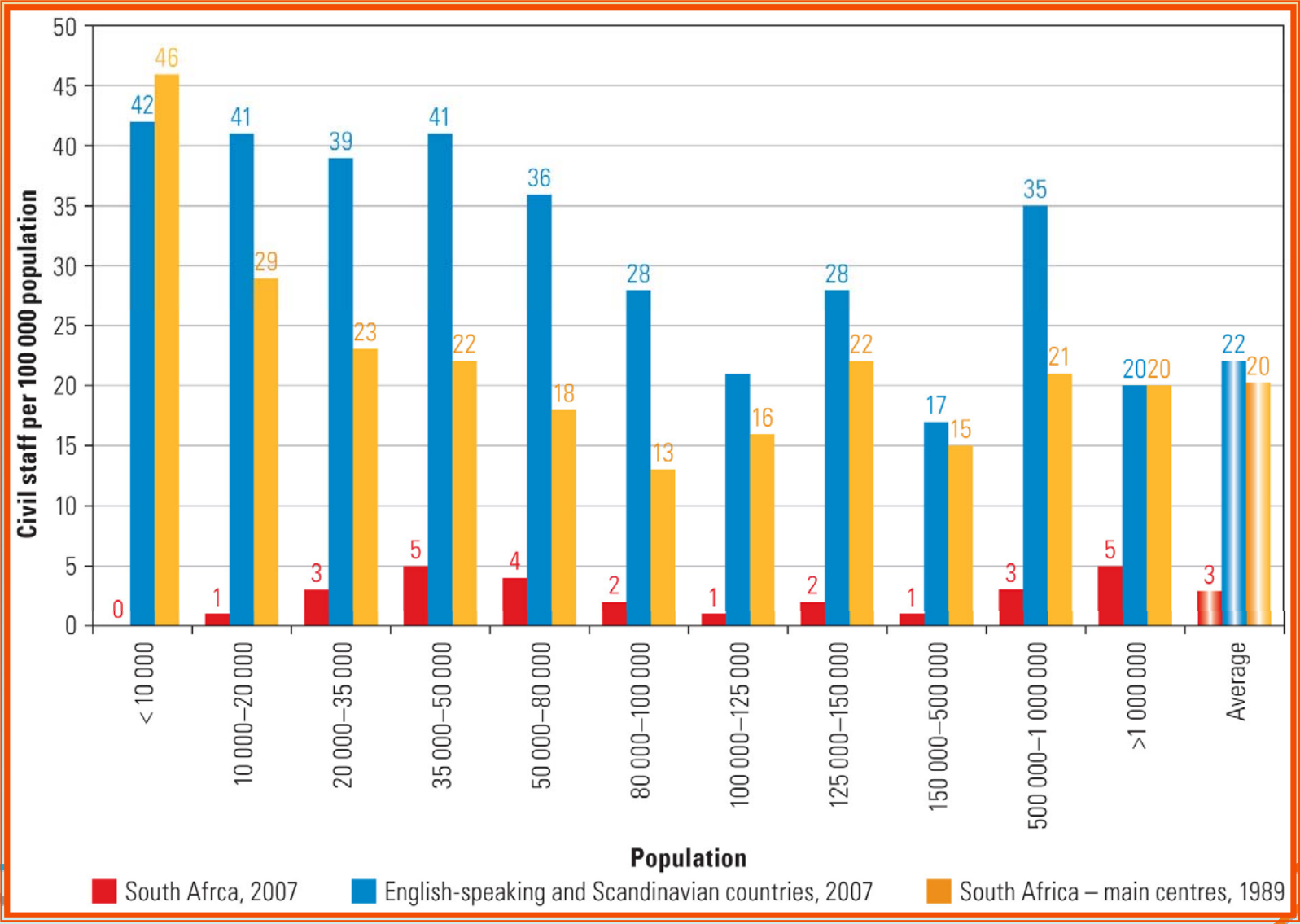


Local government since 2000

- Population served ~ 47 million
- Civil engineering professionals ~ 1300 +
- ~2.8 civil staff per hundred thousand population

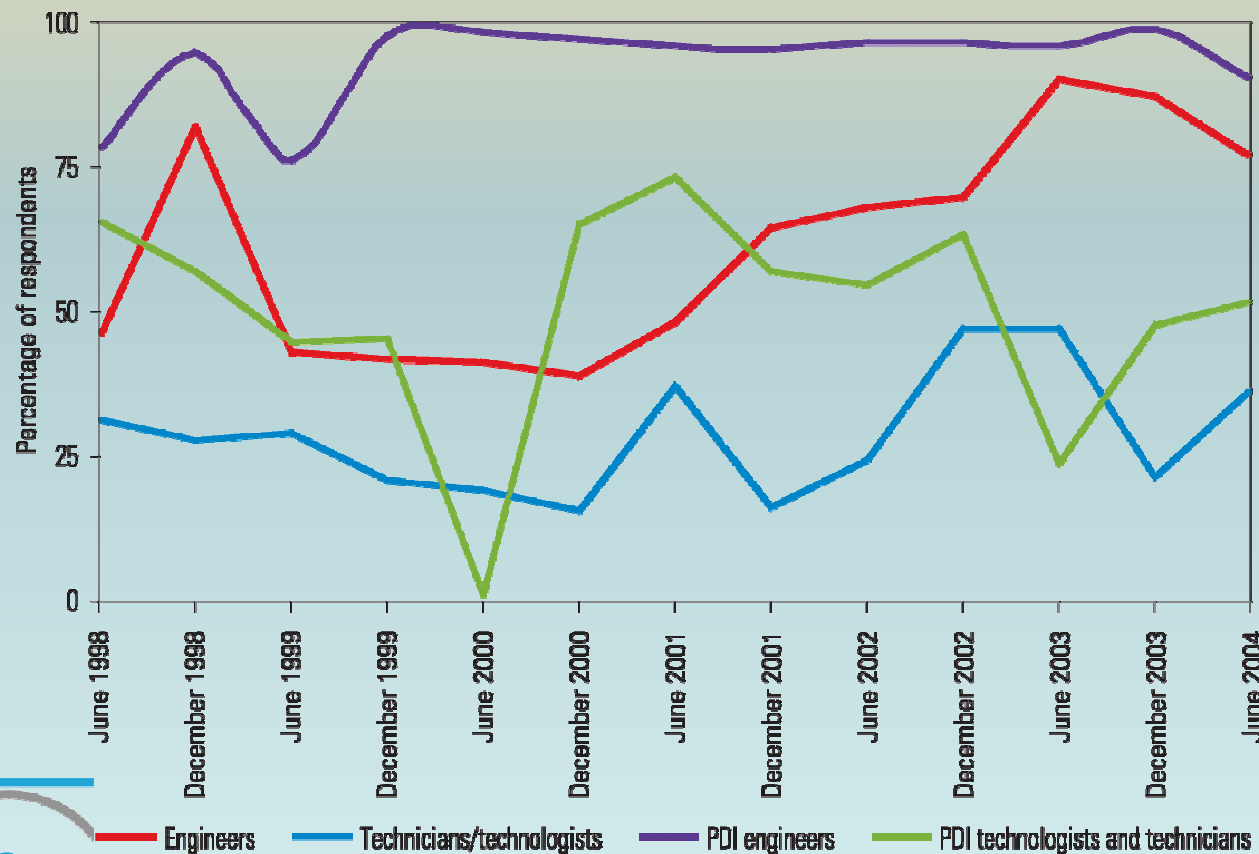


Successful local authorities internationally



Demand – the private sector

Consulting demand 2004



Staff working long hours and weekends

Consultants and contractors

- Becoming selective about projects
- Increasing prices as they can be selective
- Having to turn international work away due to lack of capacity

Engineer to population ratios

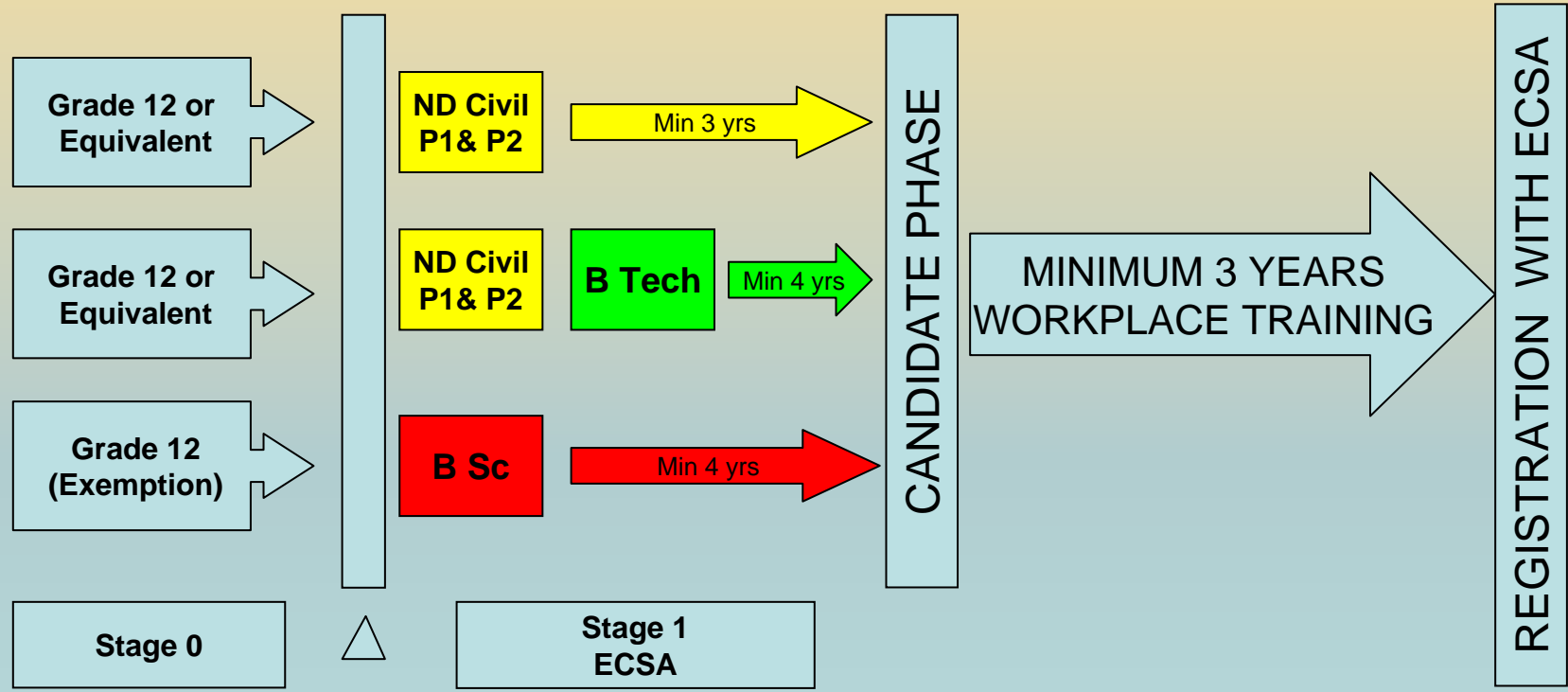
Country	Population Per engineer	Country	Population per engineer
Norway	122	Australia	455
China	130 *	Hong Kong	463
Finland	136	Malaysia	543
India	157 *	Chile	681
Greece	172	Poland	748 *
Denmark	179	Singapore	1 341
Canada	179	Korea	2 135 *
Sweden	209	Hungary	2 214
Germany	217	Romania	2 909
Brazil	227	South Africa	3 166
Iceland	266	Sri Lanka	5 595
France	276	Tanzania	5 930
Ireland	280	Namibia	6 346
Japan	303 *	Zimbabwe	6 373
UK	311	Zambia	12 783
Argentina	453	Ghana	12 792
USA	389	Swaziland	12 238

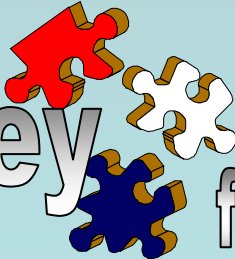
Experiential and workplace training

The student and graduate challenge!

STAGE 1

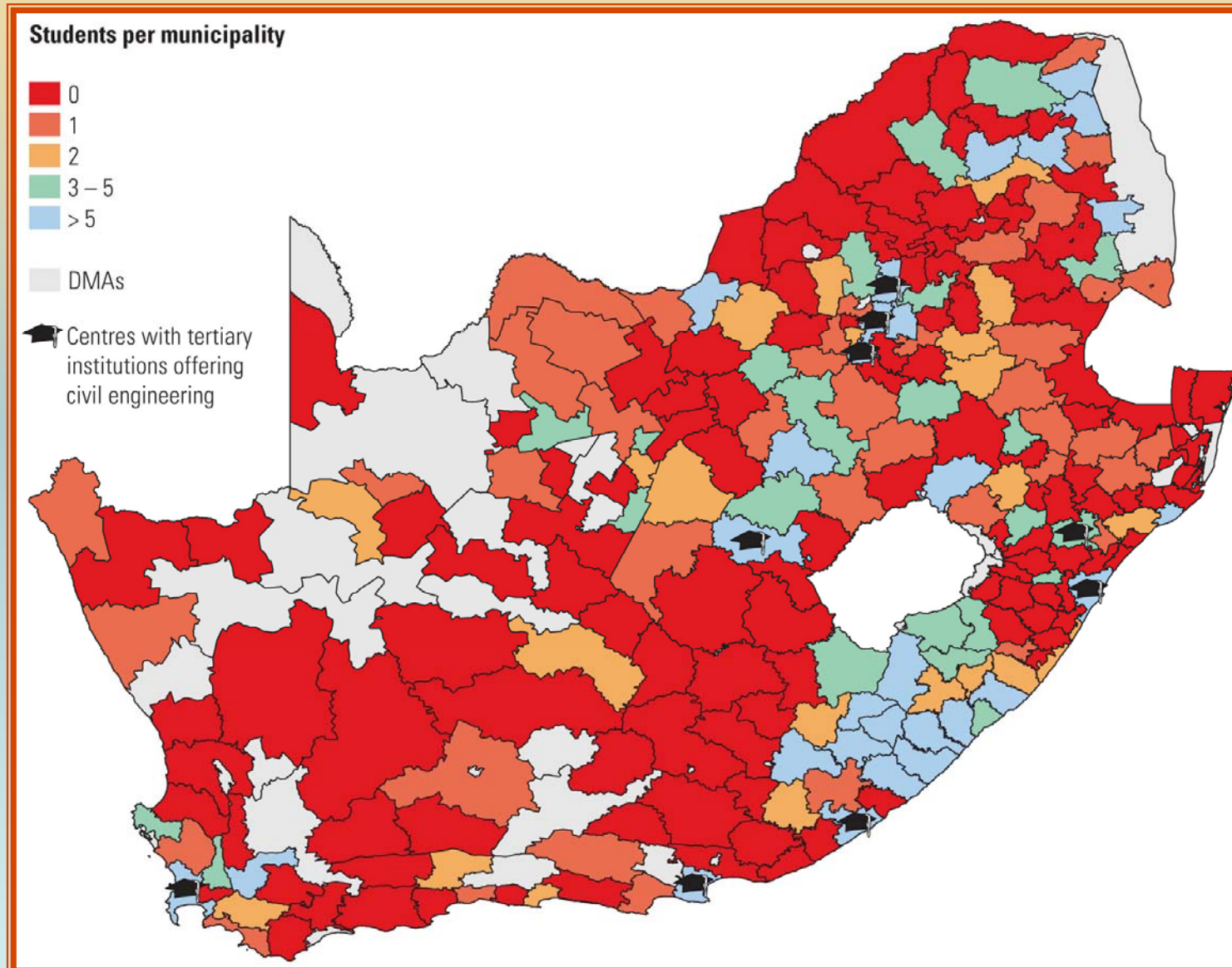
STAGE 2



The Journey  from tertiary to registration

Career guidance to attract all with talent

Map = civil engineering ND students, 2005



Address tertiary throughput

- Bursaries / funding
- Selection
- Foundation
- Improve staff to student ratios
- Facilities
- Tutor system
- Subvention
- Appropriate syllabi
- Consider Centres of Excellence, private institutions

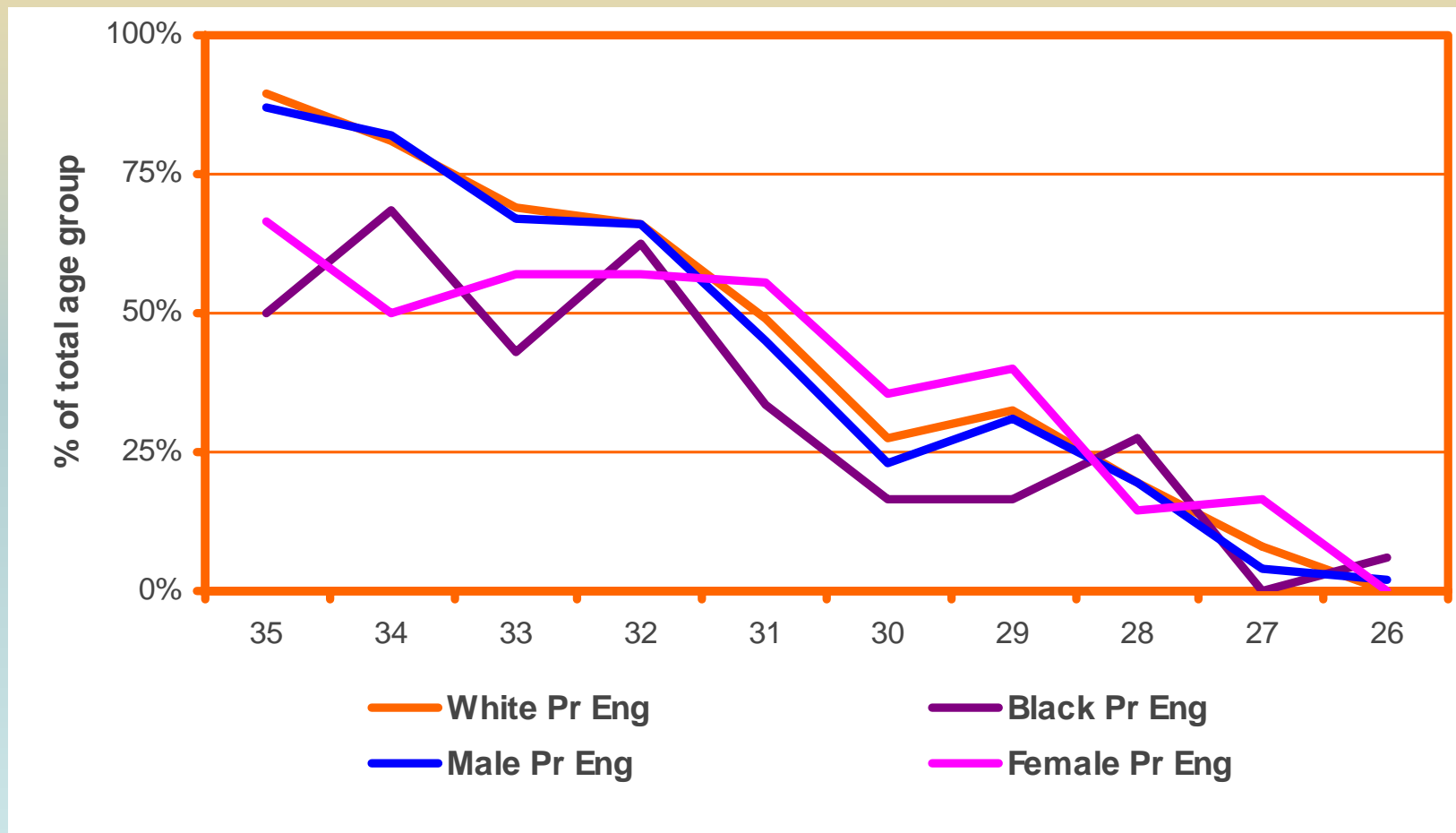
Address tertiary throughput

- Universities of Technology – support one year experiential training
- Funding from SETAs for this year
- Develop skills in design, drawing, construction, survey, testing
- Can generally be supported by graduates with one or two years experience

Graduate challenge in the workplace

- Graduates not career ready
 - Poor numeracy
 - Poor literacy
 - Limited problem solving skills
 - Unable to apply theory
- Senior staff too busy to supervise and transfer skills
- No technical capacity to plan and monitor progress
- ECSA registration a good measure of competence, but difficult to attain

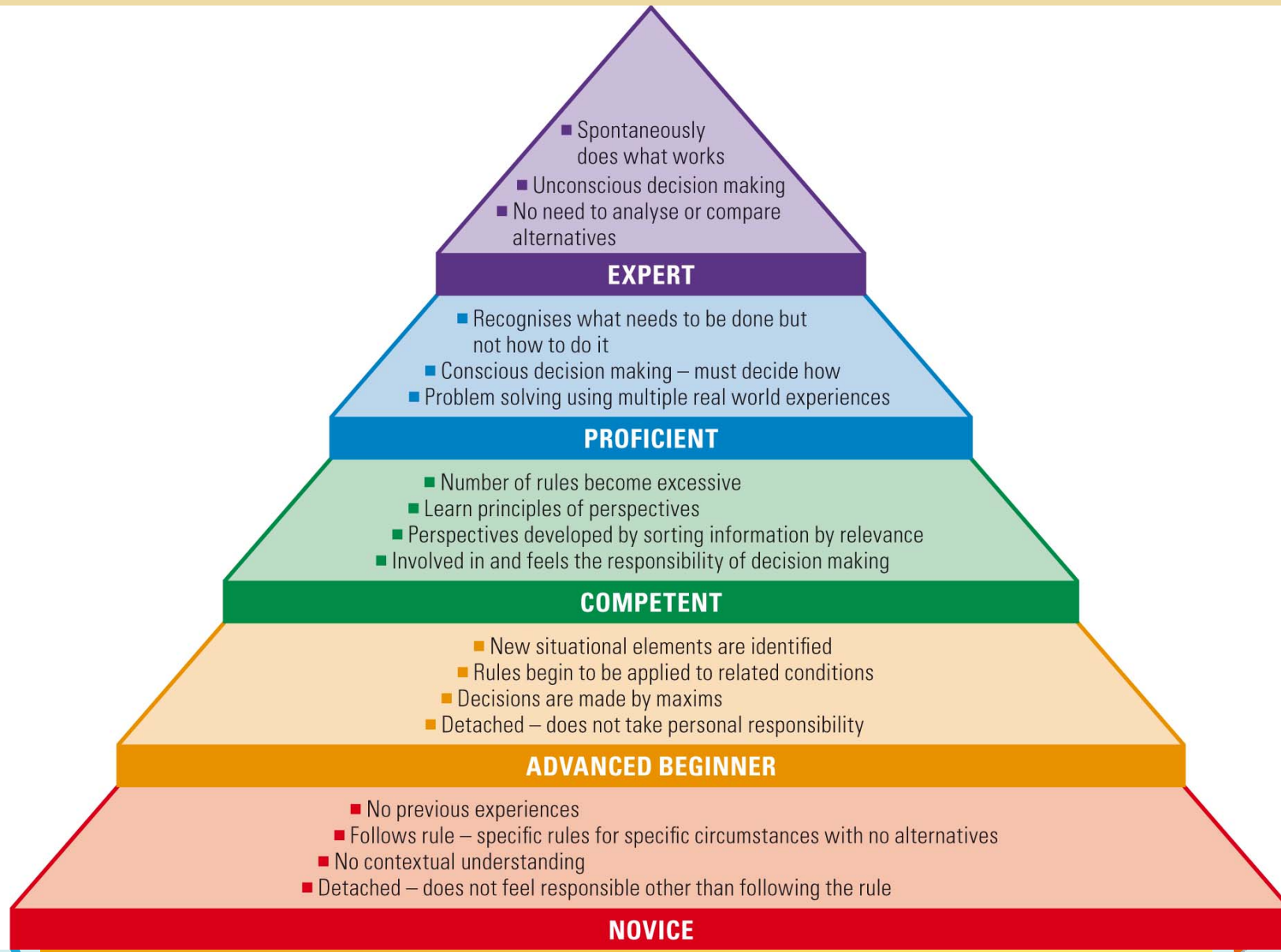
The result – limited ECSCA registrations before 34



Competence

- What is competence?
 - **Knowledge** - through formal instruction (may require enhancing!)
 - **Skills** - doing in other words be able to do
 - **Attitude** – having the right attitude towards the project, job, company etc
 - Knowledge needs to be transferred into doing and creating attitude/aptitude for profession
- What role players needed to develop competence

The skills acquisition pyramid



The role players in the registration process

**ECSA – set standards,
interview and register**

**Employer to manage WPTP
including rotations**

**Mentor to plan WPTP and
monitor progress**

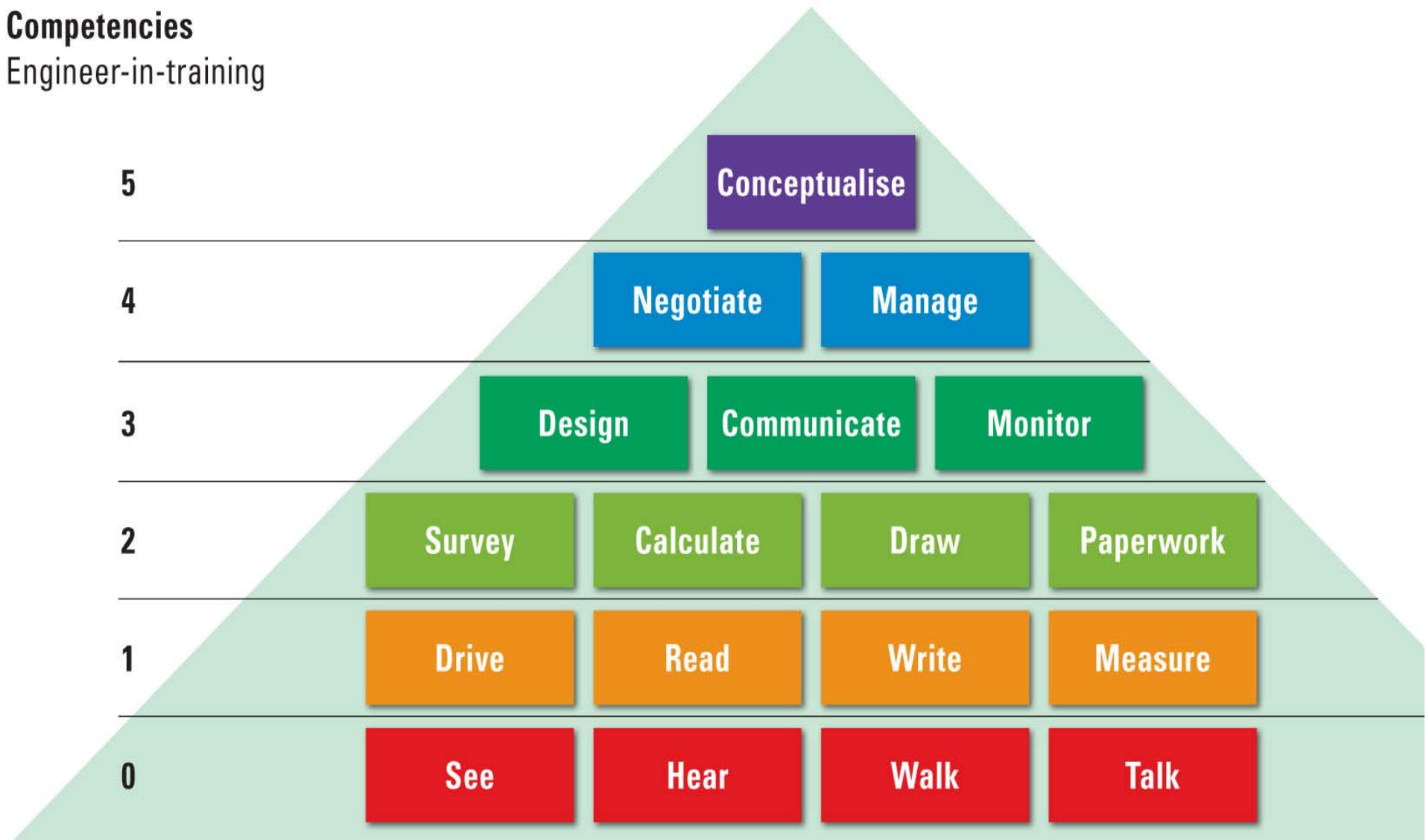
Supervisors to transfer skills

Candidates require training

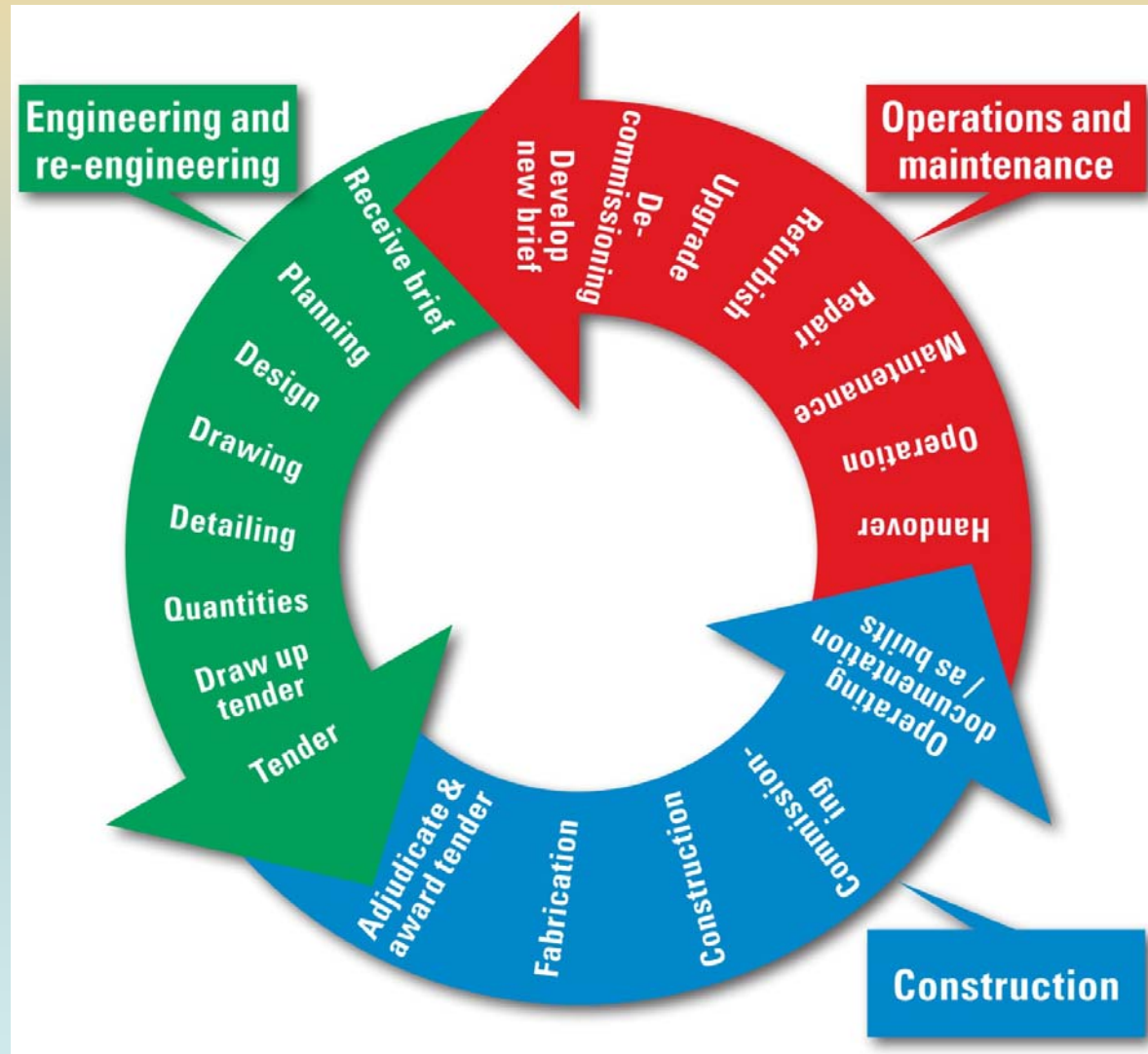
The workplace challenge – not career ready

Competencies

Engineer-in-training



The project cycle – skills to be acquired



Many opportunities to learn as juniors but inadequate supervision

Phase		Level	Process followed	Planning	Design	Construction	Operation & maintenance
Preliminary	Increasing experience ↑	Senior management	Intuitive	Forward and master planning	Collect brief and select options	Land and negotiate contract	Initiate O&M activities
Pre-implementation		Mid-management to senior-management	What-if ability – must be able to make decisions	Feasibilities	Design considerations and detailed design	Resource allocation and project planning	Monitor O&M activities
Implementation		Junior staff to middle-management	Process can be largely rule-based	Programming, collecting data	Detail and production drawings	Site supervision and monitoring	Manage O&M teams

The ECESA Stage 2 process requires guided practice

Active learning



Passive reception

Increasing cultivation of wisdom

Learning by doing through guided experience

- guided practice
- guided observation
- guided problem solving
- guided experimentation

Socratic questioning

Stories with a moral

Rules of thumb

Directives/presentations/lectures

Developing high performance

- $P = A \times M \times E$
 - P = Performance
 - A = Abilities = Personal and Acquired Skill
 - M = Motivation = Desire and Belief
 - E = Environment = Personal & Workplace

Key elements for success

- **Care** - Mentor and supervisor must never forget the maxim 'I don't care what you know until I know that you care' *Josh McDowell*
- **Set goals** – Plan training and let the graduate see where (s)he is going
- **Give graduates responsibility** – but be available to monitor, advise, review - huge frustrations when treated as 'babies'

The workplace training plan

EXAMPLE OF FIRST 12 MONTHS TRAINING PROGRAMME PLANNING SHEET

Graduate Name : PRECIOUS SUPERSTAR

Mentor : JOE SOAP

MUNICIPALITY	DEPARTMENT / CONSULTANT / SUPERVISOR	PROJECT Name & Number	PERIOD Start & End Dates	Administration	Drawings	Planning	Survey	Design	Materials and Testing	Contracts	Construction	O & M
EMFULENI	Roads and stormwater	J123/6	1 Aug 08	Log complaints, failures, work done			Set out Intersection			Assist with drawing up contracts	Project Management, Payment Certificates, etc.	
	Jack Doe	Upgrade gravel roads	15 Dec 08									
E	Roads and stormwater	J525	1 Sep 08	Log complaints, failures, work done								Supervise Road maintenance teams
	Jack Doe	Repair of Sebokeng Roads	15 Dec 08									
X	Roads and stormwater	J961	1 Nov 08			Traffic counts for transport study						
	Jack Doe	Traffic counts	15 Dec 08									
A	Best Consulting	J916	1 Jan 08		Prepare production drawings			Design new road				
	Johan	New Road	28 Feb 09									
M	Best Consulting	J416	1 Mar 09		Prepare production drawings			Design new structure for taxi rank				
	Johan	Taxi Rank	30 Apr 09									
P	Best Consulting	J612	1 May 09					Design network for new townships				
	Johan	W & S Network	31 Jun 09									
L	Water and Sanitation	J621	01 Jul 09	Check stock levels					Assist with upgrading lab & write up testing procedures			
	Phumela	Upgrade Laboratory	31 Jul 09									
E												

NOTE : PLEASE TRY AND ENSURE THAT ALL PROCESSES IN THE PROJECT CYCLE ARE COVERED

Rotation may be necessary

- In-house
- Consulting
- Contracting
- Municipalities
- Laboratories
- Centres of Excellence

Cognitive apprenticeship

- **Modelling** –by the supervisor
- **Coaching** – the learner practicing while the coach offers feed back
- **Scaffolding** – providing support which is gradually reduced as the learner becomes more proficient
- **Articulation** – getting trainees to describe their reasoning or problem solving processes
- **Reflection** – comparing their own reasoning or problem solving processes with those of an expert or peer
- **Exploration** – where trainees take on problem solving without

Expensive process – requires funding – look to SETAs...

Recognise Candidateship for Stage II

- Encourage companies to
 - Employ retired mentors and supervisors
 - Orientate graduates, supervisors and mentors on the process
 - Ensure adequate rotation and exposure to all facets of the project cycle
- Liaise with DOHET to
 - Recognise engineering workplace training as an 'candidateship'
 - Advise SETAs that they should pay levies against these training costs
- Liaise with National Treasury to
 - Offer tax incentives on this 'candidateship', as is the case when students are registered on a learnership
- Liaise with ECSA to
 - Publish outcomes
 - Develop method of accommodating and assessing progressive submissions

Trainees in action



More trainees in action

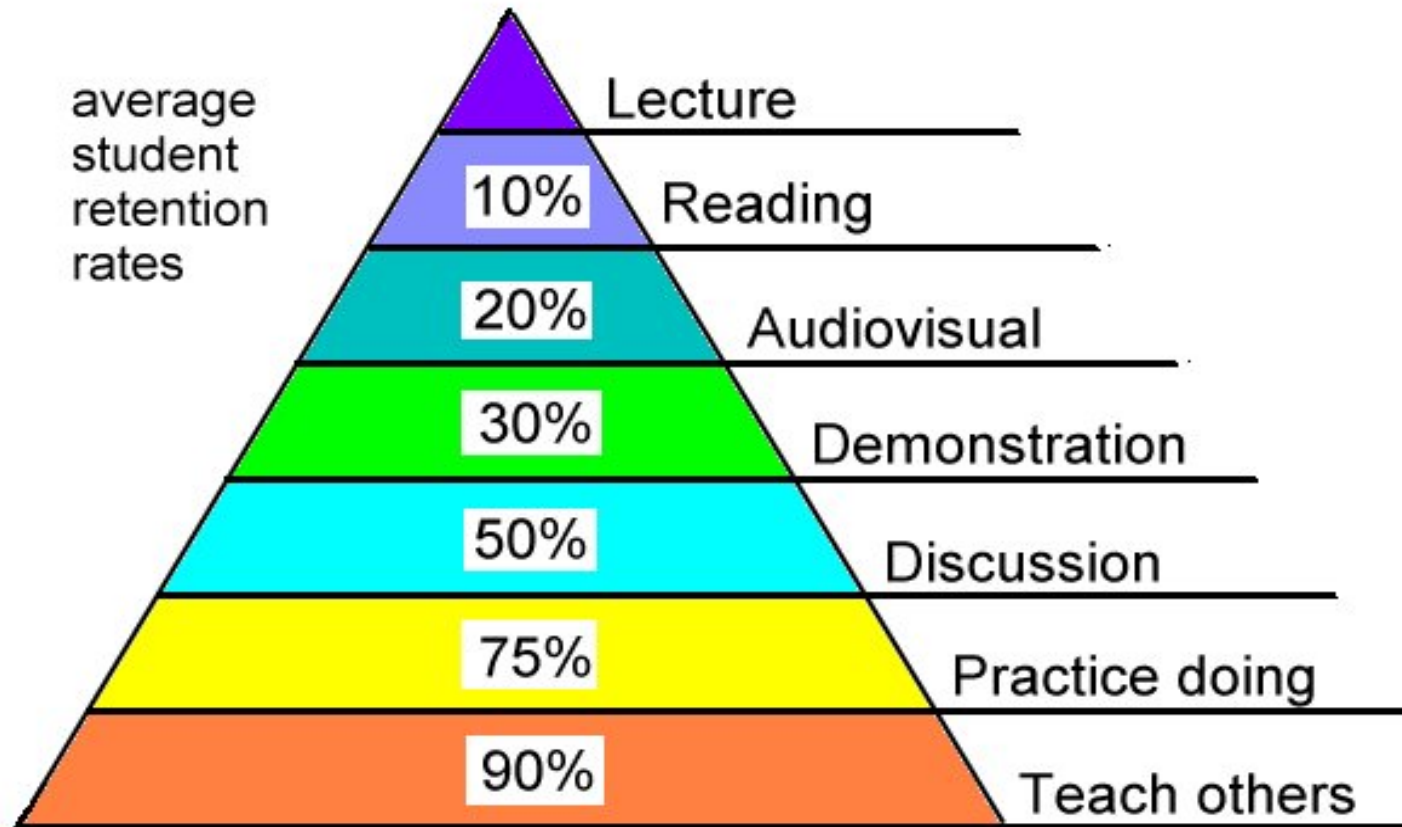


DBSA Young Professionals



How we learn

Learning Pyramid



Source: National Training Laboratories, Bethel, Maine

The Civil Engineering Academy

- Other methods of transferring skills
 - Applied courses / workshops
 - Afternoon lectures
 - ‘Mundane’ site visits
- Launch 2010 - above plus:
 - Timesheets, tracking form applications
 - Courses for mentors, supervisors, HR & graduates
 - Portfolio of Evidence file
 - Panel of supervisors/mentors