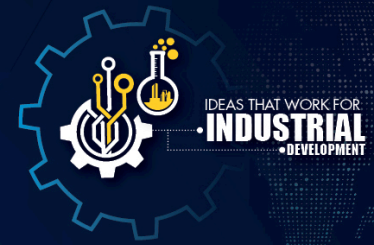


The CSIR's work in infrastructure innovation as an enabler for industrial development

Llewellyn van Wyk
CSIR principal researcher

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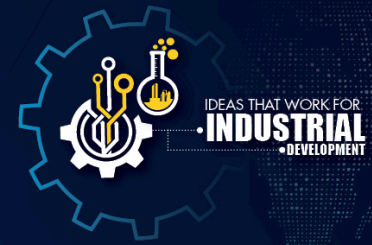


- Infrastructure condition
- Contractor performance
- New delivery model
- CSIR initiatives



Infrastructure condition 2011/2017 (SAICE)

SAICE 2011. SAICE infrastructure report card for South Africa.
Johannesburg: South African Institution of Civil Engineering



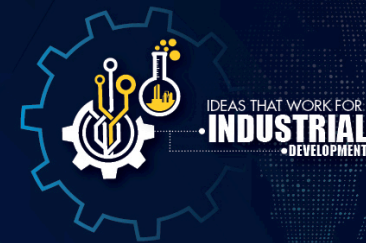
Infrastructure		SA 2011	SA 2017	USA 2017
Water	Bulk resources	D- (down)	D- (steady)	Dams D
	Major urban areas	C+ (steady)	C+ (steady)	Drinking water D
	All other areas	D- (steady)	D- (steady)	
Sanitation	Major urban area	C- (steady)	C- (steady)	Wastewater D+
	All other areas	E- (down)	E – (up)	
Solid waste management (disposal)	Major urban areas	C+ (up)	C (up)	C+
	All other areas	D – (steady)	D (up)	
Roads	National Roads	B (up)	B (steady)	D
	Paved provincial	D- (steady)	D (up)	
	Paved metro	C- (steady)	C- (steady)	
	District/local	D (steady)	D- (down)	

A = world class; **B** = fit for the future; **C** = satisfactory for now; **D** = at risk; **E** = unfit for purpose

Infrastructure condition 2011 (SAICE)

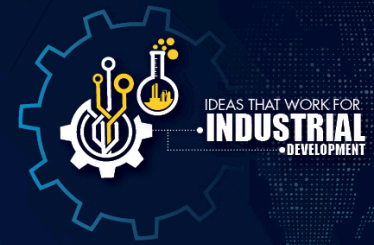
SAICE 2011. SAICE infrastructure report card for South Africa.

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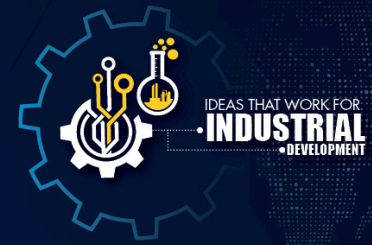


Infrastructure		SA 2011	SA 2017	USA
Airports	ACSA-owned	B+ (up)	B+ (steady)	Aviation D
Ports	Commercial Fishing harbours	B- (up) C (new category)	B- (steady) Not graded	C+
Rail	Heavy freight General freight Active branch lines Passenger (excluding Gauteng)	B+ (up) C+ (steady) D (up) D (steady)	B+ (steady) C (down) D- (down) D+ (up)	B
Electricity	Eskom generation Eskom transmission Local distribution	C+ (steady) B- (up) D (steady)	C+ (steady) B- (steady) D (steady)	Energy D+
Healthcare	Hospitals Clinics	D+ (down) D (down)	D+ (steady) D (steady)	N/A

Extent and complexity of the National Estate (urban sprawl & management)



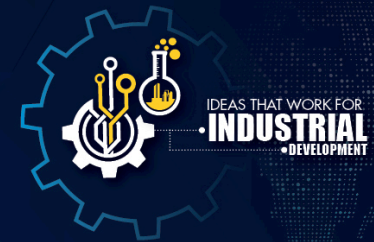
Construction industry performance



Issue	Trend 2015
Client satisfaction with contractor performance	“Noticeable” decrease from 2012
Client satisfaction with consultants	“Noticeable” decrease from 2012
Client satisfaction with construction schedule	“Significant” decrease from 2012
Client satisfaction with quality of work	“Significant” decrease from 2012
Level of defects	“Noticeable” increase from 2012
Health and safety	Construction related injuries and fatalities remains “unacceptably high”

CIDB 2015. *Construction Industry Indicators*. Pretoria: Construction Industry development Board

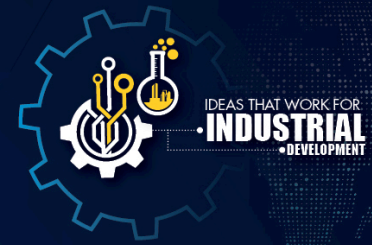
Skills levels in construction industry



Grade	Position	None/Other	Trade Test	Foreman Certificate	NDip	Btech+
5 & 6	Owner/Dir	45%	4%	6%	29%	17%
2 & 4		65%	5%	4%	19%	8%
5 & 6	Man/Prof	39%	1%	8%	31%	20%
2 & 4		47%	6%	5%	26%	17%
5 & 6	Supervisor	46%	10%	8%	33%	3%
2 & 4		59%	10%	13%	16%	3%
5 & 6	Tech/Art	30%	22%	26%	22%	0%
2 & 4		27%	29%	2%	37%	5%

CIDB 2017. *Contractor skills survey 2011*. Pretoria: Construction Industry Development Board

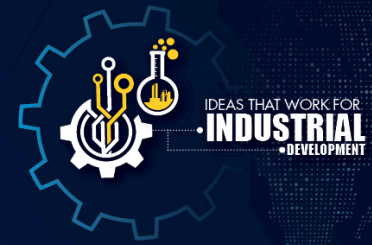
“Modernise or die”



- “A plan for change needs to recognise, based on past evidence, that the **industry will not change itself.**”
- “It needs to be led.....by **government** acting in a regulatory or strategic initiation capacity to **drive positive disruption.**”
- “Increase levels of investment in R&D and innovation in construction...**from traditional to pre-manufactured approaches.**”

Farmer 2016. *The Farmer review of the UK construction labour model*. London: Construction Leadership Council.

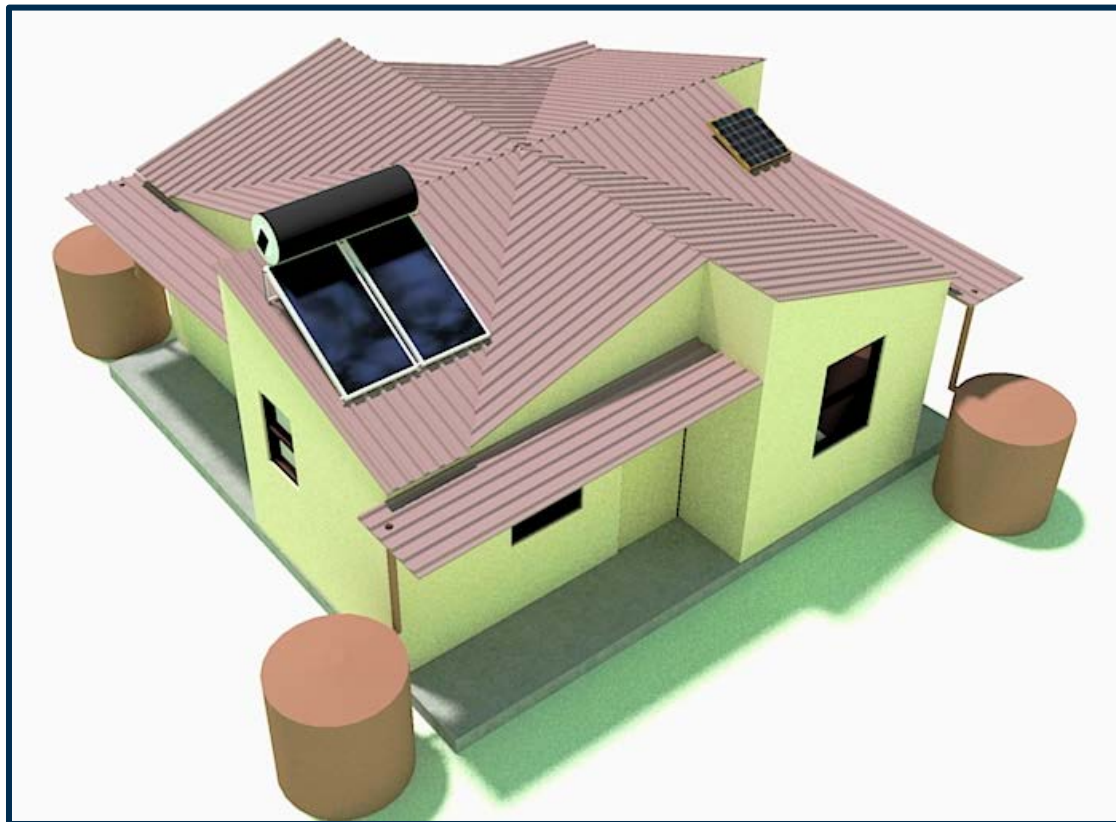
CSIR/Danish House



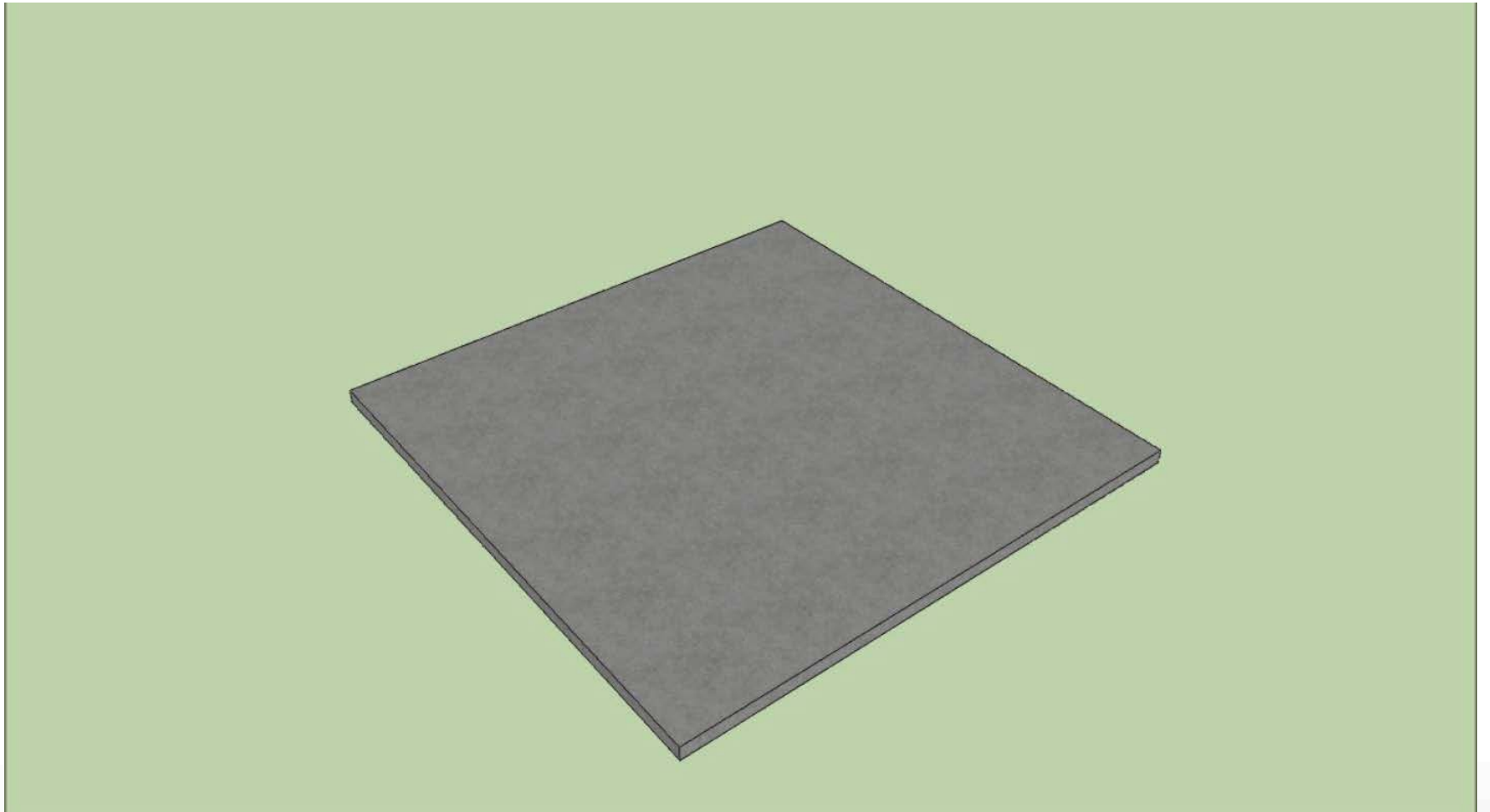
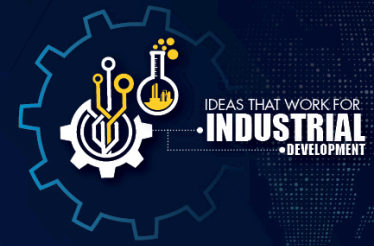
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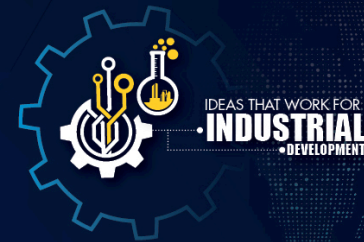
CSIR Low Income House MkII



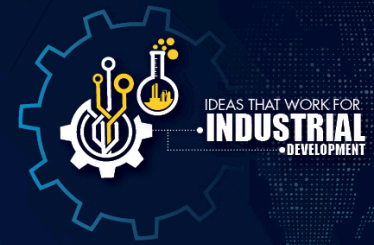
CSIR Low Income House MkII



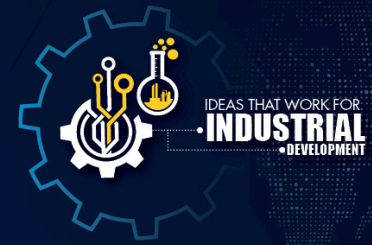
CSIR modular relocatable clinic



CSIR modular relocatable clinic

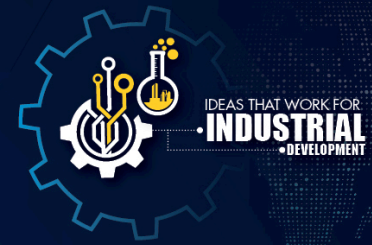


Metakaolin cement blend



- Replacement for Ordinary Portland Cement based on clay mineral kaolinite.
- Used to make concrete, blocks, bricks and pavers.
- Lower carbon footprint, enhanced strength, higher durability, and lower production costs.

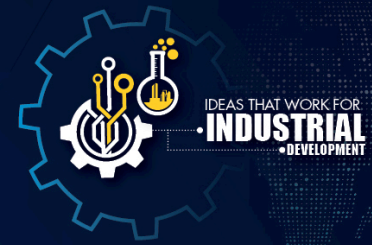
Advanced asphalt products



- High Modulus Asphalt (HiMA) for heavily trafficked roads.
- Mixture of very hard paving-grade bitumen and good quality fully-crushed aggregates.
- Working on additives to bituminous products to increase their fatigue life under heavy traffic.



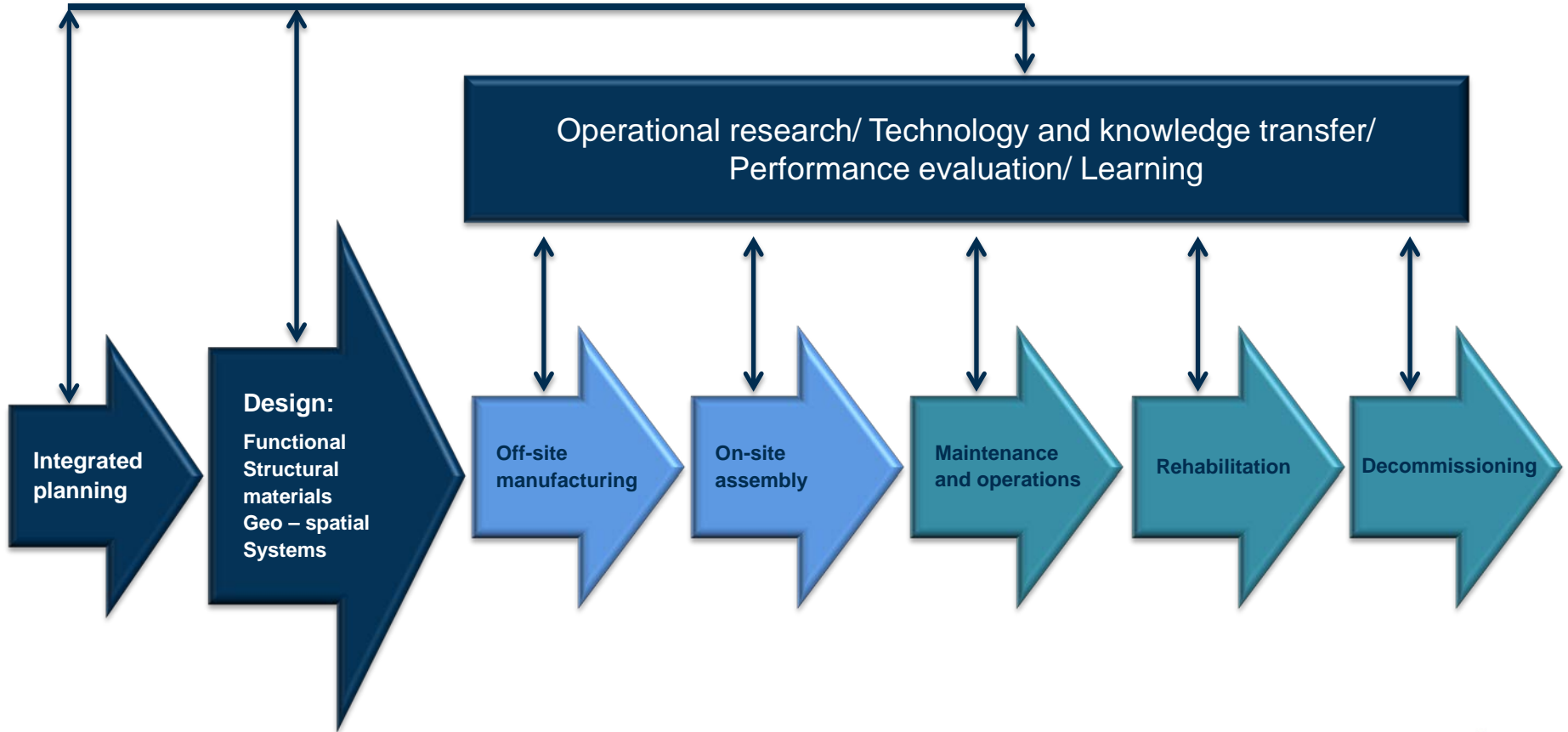
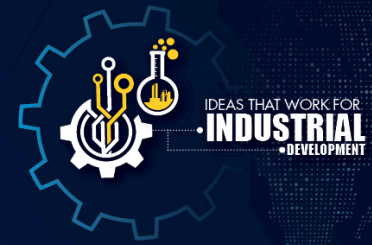
Geo-polymer bricks



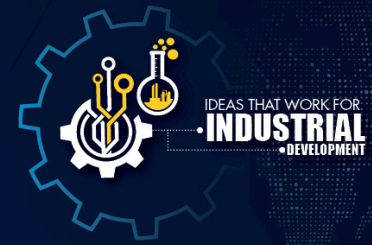
- Cementitious binders free of Ordinary Portland Cement. Based on a family of fly ash-based geopolymer binders.
- Benefits include encapsulation of hazardous waste, high strength, low oxygen permeability, low shrinkage, low carbon emission, and sulphate and acid-resisting properties.



Way forward: Modified supply chain

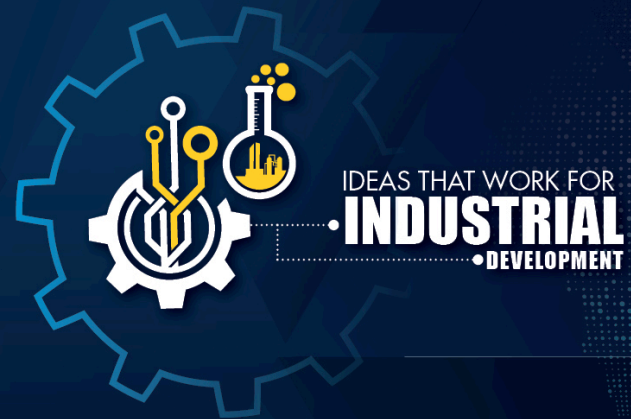


Conclusion



- “Deep-seated problems have existed for many years and are well known and rehearsed, yet despite that, there appears to be a **collective reluctance or inability to address these issues and set course for modernisation.**”
- “The current pace and nature of technological change and innovation in wider society is such that unless the industry embraces this trend at scale, **it will miss the greatest single opportunity to improve productivity and offset workforce shrinkage.**”

Farmer 2016. *The Farmer review of the UK construction labour model*.
London: Construction Leadership Council.



Thank you

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our future through science