Introducing Non Sequiturs and Constraints for Sustainable Development

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The requirements contained in this International Standard are applicable to any city... that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size and location.
Infrastructure for Stable Communities and Non Sequiturs
What are Engineering ‘Non Sequiturs’?

Non Sequiturs

Are sometimes unknown expectations and behaviors associated with infrastructure.

Visible Non Sequiturs
“Physical structure is crucial in a system, but is rarely a leverage point, because changing it is rarely quick or simple. The leverage point is in proper design in the first place.”

- Donella H. Meadows, Thinking in Systems – A Primer

Urban infrastructure are “socio-technical systems” that determine the nature of flow and interaction
What’s the Project? What Expertise is Required?

How A Lack Of Toilets Puts India's Women At Risk Of Assault

by JULIE MCCARTHY

June 09, 2014  3:59 AM ET
Maslow and Underlying Systems

- Morality
- Achievement
- Friendship, Family
- Security, Health
- WaSH, Air, Food

Resilient Economic and Educational Systems
Resilient Social System
Resilient Security/Health System
Resilient Infrastructure System

Interdependence
Proportional Time Spent: Post Disaster/Informal Slums

- Morality
- Achievement
- Friendship, Family
- Security, Health
- WaSH, Air, Food
2

Systems and Paradigms
“Paradigms are the sources of systems.”

- Donella H. Meadows, Thinking in Systems – A Primer
Comprehensive Infrastructure, e.g. Denver
Potable water supply is an indicator of city health and quality of life.

- ...potable water through a pipe that is connected to a network, the supply of which is relatively continuous given that it includes a deposit built for its storage.
What is the effect of ‘relatively continuous’ water supply?

United Nations, Department of Economic and Social Affairs, Population Division (2014).
‘Relatively Continuous’ Water Contamination

1. Reverse pressure in pipes
2. Insect and air-borne contamination
3. Unsanitary mobile storage vessels
A Single Approach for Sustainable Development?

A
Failed Comprehensive
Formal?

B
Disconnected
Humanitarian?

Can you look at both paradigms as a single system?
Are ‘appropriate technologies’ the common denominator?
Resilient Cities and Constraints for Low-Carbon Infrastructure: Kigali
“The ability to self-organize is the strongest form of system resilience.”

- Donella H. Meadows, Thinking in Systems – A Primer
Resilience and a City’s DNA

Subsystems

Morality

Achievement

Friendship, Family

Security, Health

WaSH, Air, Food

‘Weak Links’

Constraints?
- Resources
- Security, Health
- Social

WaSH, Air, Food
What are the Constraints?
ENERGY AND SOCIAL CONSTRAINTS

Storm Water and Municipal Solid Waste
Panic can drive innovation!!
Kigali: One Watershed at a Time

What can you do with ‘free energy’?

- Storm Water Collection
- Storm Water Detention
- Wetland Buffer
- Constructed Wetland
- Markets
- Composting
• MSW *unregulated* by government. Nearly all collected by genocide survivor women associations: SAMI and AMIZERO

• Household collectors transport waste (up to 5 km) to separation sites by foot or bicycle.

• Design is to reduce burden of vertical gains on collectors and facilitate the good work.
A: MSW Landfill
B: Hazardous Waste Facility
C: Separation Site
D: Central Collection
E: Industrial Source
F: Processing Briquettes/Compost
G: Residential Source
H: Commercial Source
ETZ: Environmental Treatment Zone
I: Primarily Treated Effluent

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Road Typologies and Material Flow and Employment
Cobblestone: Local, Labor-Intensive, and Repairable
CHAPTER III. GUIDING PRINCIPLES

• **Strategy 3.1.** Promotion of the production and use of local materials of construction.
  
  – The creation of manufacturing units of **durable** local materials, the control of the techniques of production, the lowering of the costs to make them available to the weak rural incomes of households.
Informal Communities: Physical Constraints
Initial Layout of Low Cost Single Family House
Integrated Infrastructure for Maslow
Low-cost, Integrated Infrastructure: Kimisange
Batsinda: Low-income Community
Conclusions

• Non Sequiturs are long held beliefs that impact the expected performance of infrastructure and should be considered for overall project approach.

• In most countries, constraints are more than economic. Being forced to consider these constraints can lead to innovation.

• Incorporating Non Sequiturs and Constraints requires true interdisciplinary coordination.
Thank You

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