CONDOMINIAL (SIMPLIFIED) SEWERAGE

Duncan Mara
University of Leeds, UK
Periurban areas: inadequate sanitation
Open stormwater drains (if there are any) receive raw wastewater discharges
Simplified sewerage

Rigorous hydraulic design based on:

- a minimum sewer diameter of 100 mm
- a minimum tractive tension $\tau_{\text{min}}$ of 1 N/m$^2$
- a minimum value for peak wastewater flow of 1.5 litres/second

This results in a minimum gradient of 1 in 200, and a 100-mm dia. sewer being able to serve 234 households of 5 people with a water consumption of 100 litres per person per day.

“Small flows flow better in small pipes”
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* CONDOMINIAL SEWERAGE *

Planned Area

Unplanned Area (retrofit)
Case study: Development of Simplified Sewerage in Brazil

Simplified sewerage was first installed in ‘Quadra 90’, Natal in 1981.
Rocas, Natal, northeast Brazil
‘Quadra 90’ before simplified sewerage installed
Natal, Northeast Brazil, 1983

Condominial sewerage

Total annual cost per household (1983 US$) vs. Population density (persons/ha)

- Conventional sewerage
- Condominial sewerage
- On-site systems
In this case, simp. sewerage cheaper than on-site san. at densities $>\sim160$ persons/ha
Comparative costs (1997 US$) of conventional and condominial sewerage in Parauapebas, Pará, north Brazil

<table>
<thead>
<tr>
<th>Item</th>
<th>Conventional sewerage</th>
<th>Condominial sewerage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total cost</td>
<td>Cost per connection</td>
</tr>
<tr>
<td>Excavation</td>
<td>263,000</td>
<td>39</td>
</tr>
<tr>
<td>Inspection chambers</td>
<td>181,000</td>
<td>27</td>
</tr>
<tr>
<td>Sewers</td>
<td>185,000</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>629,000</td>
<td>94</td>
</tr>
</tbody>
</table>

Source: Melo (2005):
## Costs in South Africa, 2002

<table>
<thead>
<tr>
<th>Sanitation technology</th>
<th>Construction cost (ZAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simplified sewerage</strong></td>
<td>2500–3000</td>
</tr>
<tr>
<td><strong>EcoSan toilet</strong></td>
<td>3000–4000</td>
</tr>
<tr>
<td><strong>Conventional sewerage</strong></td>
<td>6000–7000</td>
</tr>
</tbody>
</table>

Average exchange rates in 2002:
ZAR 1000 = USD 87 = EUR 100
Condominial sewerage:
Monthly cost to householder

State of Rio Grande do Norte in northeast Brazil, 2017:

Minimum water tariff for ‘social’ housing (up to 10 m$^3$ per month − i.e., 67 litres per person per day for a family of 5):

BRL 7.73

35% surcharge for condominial sewerage:

BRL 2.71 − 0.3% of minimum wage
Brasília: a very rich area being served with condominial sewerage
Hillside favelas in Rio de Janeiro city, where condominial water supply and sewerage were installed in 1990s (first in Rocinhas)
Health aspects

Condominial and conventional sewerage in Salvador, serving ~1 million people

- Reduction in diarrheal disease in children under 3: 22%, but 43% in poor areas served by condominial sewerage
- Reduction in ascariasis in children aged 1−4: from 24% to 12%; trichuriasis, from 18% to 5%; and giardiasis, from 14% to 5%.
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Reasons why simplified sewerage now used widely throughout Brazil

- CAERN’s success with condominial sewerage in Natal presented at the 1983 ABES Congress, followed by papers in ABES’s journal *Engenharia Sanitária* [ABES: Brazilian Assoc. of Sanitary & Environmental Engineering]

- ABES set up a Low-cost Sanitation Committee (1983-86) which produced the 1986 Brazilian Design Manual for Simplified Sewerage
The 1986 revision of the Brazilian National Sewerage Design Code adopted a minimum sewer diameter of 100 mm [before then min. dia. was 150 mm] and a $T_{\text{min}}$ of 1 N/m$^2$

A few very good, very committed and politically well-connected (and young) low-cost sanitation engineers

Positive interest in condominial sewerage by the World Bank acted within Brazil to give it a ‘seal of international approval’
Thank you!
Thank you!

and special thanks to José Carlos Melo who developed condominial sewerage in Brazil.