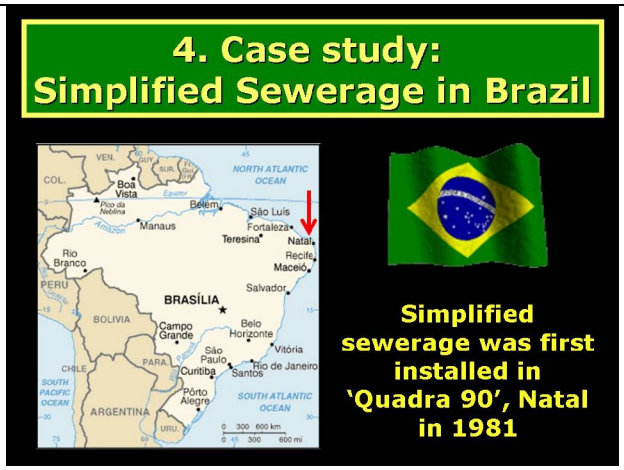
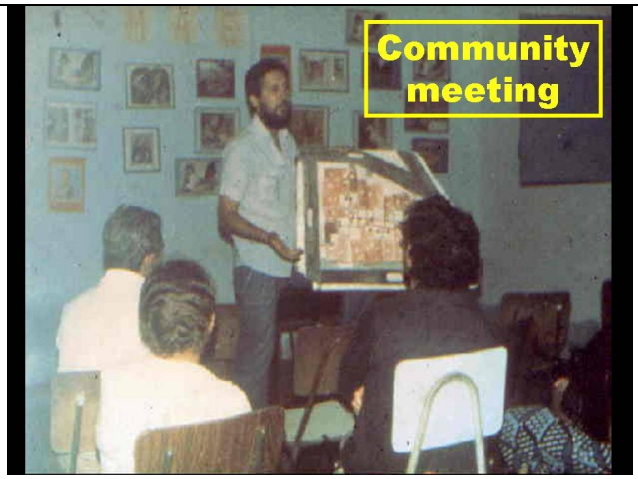
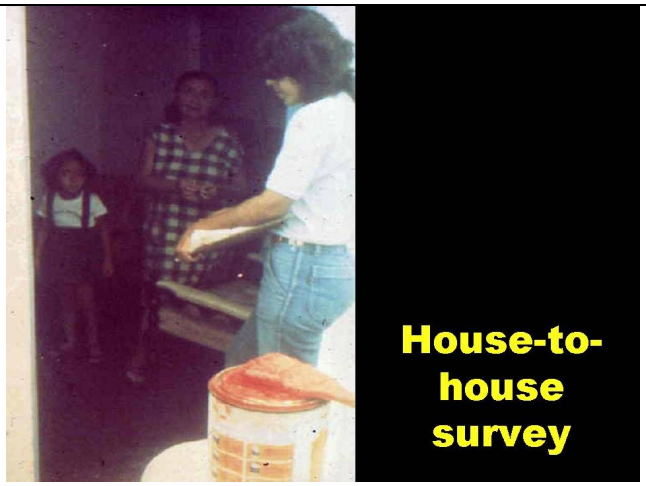
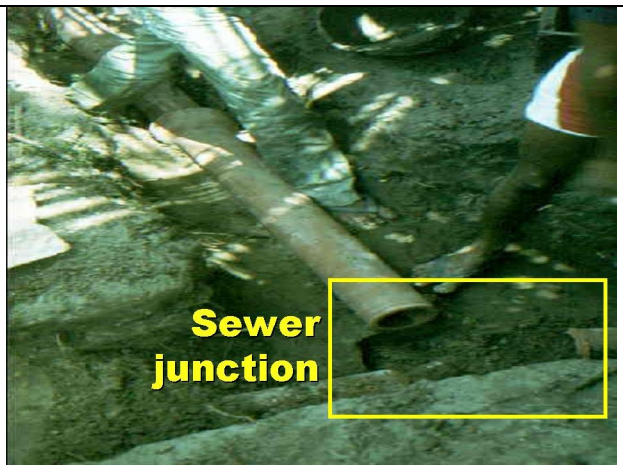
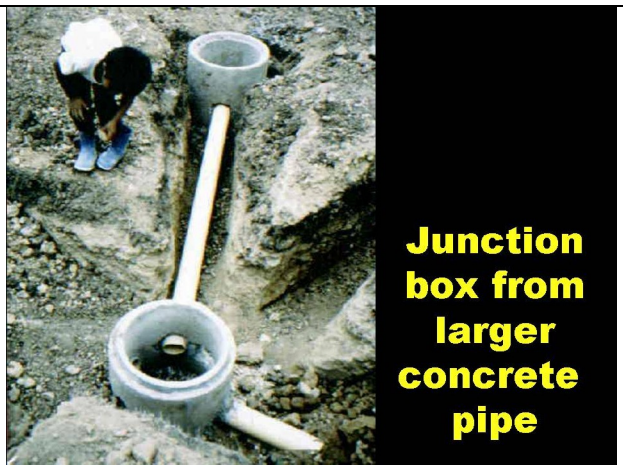
SIMPLIFIED SEWERAGE

Part 4 of 4

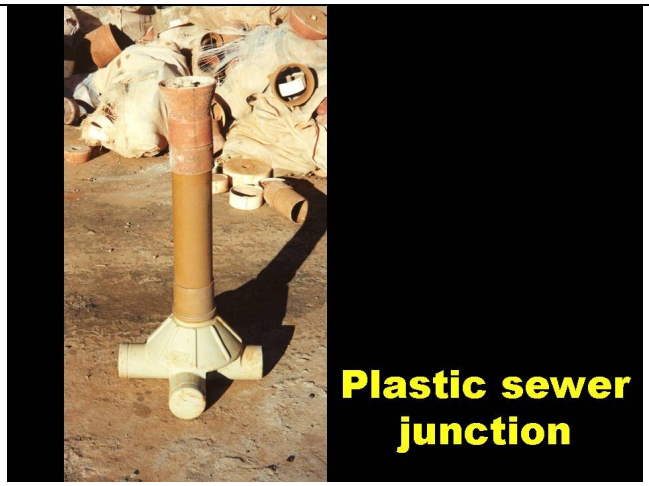
1.		We are now going to look at the development of simplified sewerage in Brazil. Simplified sewerage was first installed in 'Quadra 90' (Housing Block 90) in Natal in the northeast of Brazil in 1981.
2.		This slide shows the conditions in Housing Block 90 before simplified sewerage was installed. There is a stream of wastewater, in fact mainly sullage, flowing in the lane between the houses,
3.		and this is because the only way the householders had to dispose of their sullage was simply to chuck it over the wall into the lane.

4.		This slide shows the layout of Housing Block 90 and the initial thoughts on where the simplified sewers would be positioned. These are shown as yellow lines and the black squares are junction boxes.
5.		This scheme was presented by the local water and sewerage company to a meeting of block residents to explain to them what the system was, how it would work, and what their responsibilities would be and how much it would cost them.
6.		When the community accepted the scheme it was then necessary to conduct house-to-house surveys to find out exactly how many people were in each house and therefore how much wastewater was likely to be produced.

7.		Plans had to be drawn at a scale between 1 in 200 and 1 in 500, so it was necessary to do some fairly detailed surveying.
8.		Some houses were below road level which would have made conventional sewerage an impossibly expensive solution.
9.		100-mm diameter clay pipes were used, simply because at that time in Natal these were cheaper than PVC pipes.

10.		Wherever there was a sewer junction,
11.		there was a brick junction box made and covered with a thin reinforced concrete cover slab.
12.		This shows an alternative way of making junction boxes from larger diameter concrete pipes.

13.	**FINANCIAL COST TO HOUSEHOLDERS** **Natal, 1983** ▪ Capital cost: **US$ 325 per household** [Conventional sewerage: ~US$1500 per household] ▪ CAERN (local water & sewerage company) was able to recover its costs over 30 years by **surcharging the monthly water bill by only 40%** (rather than **100**% as for conventional sewerage)	When we look at the financial cost to the householders, and this is for Natal in the early 1980s, the capital cost was $325 per household, compared with roughly $1500 for conventional sewerage. CAERN, the local water and sewerage company, was able to recover its costs over 30 years by surcharging the monthly water bill by only 40 percent, rather than the 100 percent they use for conventional sewerage.
14.	❑ **Water charge = "minimum tariff"** [assumed (ie, unmetered) consumption of 15 m^3 per household per month] **= US$ 3.75** (in 1983) ❑ **Simplified sewerage charge** (40% surcharge) **= 0.4 × $3.75** **= US$ 1.50 per household per month** (in 1983) **Clearly low cost!**	The water charge paid by the residents was the minimum tariff – that is to say, an assumed, therefore unmetered, con-sumption of 15 m^3 per household per month, and in 1983 the charge for that was the equivalent of US$ 3.75. So the surcharge for simplified sewerage was 40 percent of this: that is to say, $1.50 per household per month in 1983; so clearly it is a low cost sanitation solution.
15.	 **Brasília: a very rich area...**	This is Brasília, the capital of Brazil, where the local water and sewerage company has been using simplified sewerage in poor and rich areas; and here we see a very rich area, Lago Sul,

16.		being served with simplified sewerage.
17.		The junction box they use is a plastic sewer junction box and these are very cheap when they are bought in bulk. They are made in the south of Brazil and they cost about US$ 5.
18.		Operation and maintenance of the simplified sewer network in Brasília is done with a water-jet unit mounted in a commercial van. If there is a blockage in the sewer, then a high-velocity water jet is introduced at the junction box just upstream of the blockage, and the blockage is then jetted down the sewer to the next junction box where it is caught and removed.

19.	**Reasons why simplified sewerage now used widely throughout Brazil** ❑ Developed by R&D section of CAERN (State Water & Sewerage Co. of Rio Grande do Norte) as solution to the up-to-then intractable problem of sanitation in its periurban areas ❑ 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 & Env. Eng]	Finally we are going to look at the reasons why simplified sewerage is now so widely used throughout Brazil. It was developed in the early 1980s by the Research and Development section of CAERN, the state water and sewerage company of the State of Rio Grande do Norte in the northeast of Brazil, as a solution to the up-to-then intractable problem of sanitation in its periurban areas. CAERN's success with condominial sewerage in Natal was presented at the 1983 ABES congress (ABES is the Brazilian Association of Sanitary and environmental engineers), and this was followed by technical papers published in ABES' journal *Engenharia Sanitária* ('Sanitary Engineering').
20.	**Reasons why, cont'd** ❑ The CAERN project in Natal evaluated by the Brazilian TAG [Technology Advisory Group] office of UNDP/World Bank Low-cost Sanitation Project ❑ Resulting positive evaluation led to the establishment of the ABES Low-cost Sanitation Committee (1983-86) and the production of the Brazilian Design Manual for Simplified Sewerage ❑ This, in turn, led to the adoption of a minimum sewer diameter of 100 mm in the 1986 revision of the Brazilian National Sewerage Design Code [before then min. dia. was 150 mm]	The CAERN project in Natal was then evaluated by the Brazilian TAG office of the UNDP/World Bank Low-cost Sanitation Project and the resulting positive evaluation led to the established of the ABES Low Cost Sanitation Committee between 1983 and 1986 and the production in 1986 of the Brazilian Design Manual for Simplified Sewerage. This in turn led to the adoption of a minimum sewer diameter of 100 mm in the 1986 revision of the Brazilian national sewerage design code (before then the minimum diameter was 150 mm).
21.	**Reasons why, cont'd** ❑ Early CAERN designs used minimum self-cleansing velocity. Design based on tractive tension [shallower min. gradient − 1 in 214, *vs* 1 in 131 for self-cleansing velocity] introduced by state water co's in south of Brazil (São Paulo & Paraná) in 1985 and also included in the 1986 National Sewerage Design Code, as was min. peak flow of 1.5 l/s ❑ The 1975 National Sewerage Design Code included Macedo's Basic Design Concept [design sewer gradient for q_i and sewer diameter for q_f] − important because in periurban areas in Brazil q_f can be up to 5 × q_i	The early designs by CAERN used a minimum self-cleansing velocity. The design based on a minimum tractive tension of 1 Pascal was introduced by state water companies in the south of Brazil in the states of São Paulo and Paraná in 1985, and this was also included in the 1986 revision of the national sewerage design code, as was the minimum peak flow of 1.5 l/s. The 1975 version of the national sewerage design code had already included Macedo's basic design concept, where we design the sewer gradient for the flow at the start of the design period and the sewer diameter for the flow at the end; and this is important for simplified sewerage because in periurban areas in Brazil q_f can often be up to 5 × q_i.

22.		There are three final reasons why simplified sewerage has been adopted so widely in Brazil. Firstly, because it is very easy to disseminate new technologies throughout Brazil at ABES' biennial congresses. Secondly, with simplified sewerage there were a few very good, very committed and politically very well connected, low-cost sanitation engineers. And thirdly the positive interest in simplified sewerage shown by the World Bank acted within Brazil to give it a seal of international approval.