

RESEARCH SUMMARY



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Performance of Alternatively Sized Drainfield Systems Compared to Conventional Gravel Systems in North Carolina

December 2006

A third party North Carolina field study concluded at a 95% confidence level no statistical difference in failure rates between alternatively sized drainfield systems and conventional gravel septic systems.

The North Carolina On-Site Wastewater Section conducted a statewide survey which compared the performance of innovative systems with a 25 % trench length reduction to conventional gravel systems.

The purpose of this survey was to determine, within a 95% confidence level, if innovative systems sized 25% smaller were performing the same as full sized conventional systems. The North Carolina Department of Health and Human Services (NCDHHS) State Center for Health Statistics stated that a sample size of 300 systems was needed for each type of system surveyed in order to satisfy the 95% confidence level. This sample size would result in a valid analysis, regardless of the total number of

systems from which the sample was chosen. A total of 912 systems were inspected including 303 chamber systems, 306 synthetic aggregate systems and 303 gravel systems (**Table 1**).

Table 1: System failure rate for conventional gravel, chamber and synthetic aggregate systems

System Type	System OK	System Failed	Total	Percent Failure
Gravel	281	22	303	7.3
Chamber	277	26	303	8.5
Synthetic Aggregate	277	29	306	9.5
Total	835	77	912	8.4

It was determined that systems from each of the three physiographic regions must be included in the survey in order to be valid, since soils vary by region and state (**Table 2**). Two counties from each physiographic region were selected. These six counties were not only based upon region but also each had an excellent system of record keeping for septic tank system permits.

Table 2: System failure rate by physiographic region disregarding difference in system type

Physiographic Region	System OK	System Failed	Total	Percent Failure
Coast	256	34	290	11.7
Piedmont	286	31	317	9.8
Mountain	293	12	305	3.9
All Regions	835	77	912	8.4

The survey data was also analyzed to see if there was a difference in system failure rate as systems aged. System failure rates were collected and organized into three groups: 1) 2 to 4 years old, 2) 5 to 7 years old, and 3) 8 to 12 years old (**Table 3**).

Table 3: System failure rate by age group disregarding differences in system type

System Age	System OK	System Failed	Total	Percent Failure
2 to 4 years	283	24	307	7.8
5 to 7 years	351	26	377	6.9
8 to 12 years	201	27	228	11.8
All Ages	835	77	912	8.4

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The products used for testing were as follows:

- Conventional gravel trench 3 feet wide x 12 inches deep
- Chamber system trench
Avg. open bottom width = 29 inches
Avg. height of 12 inches
- Synthetic aggregate system trench
(3) 12 inch high bundles = 36 inches wide

Results of the study indicated that the statewide failure rate was 7.3% for conventional systems, 8.5% for chamber systems and 9.5% for the synthetic aggregate systems.

The purpose of this study was to determine if there was a 5% or greater difference in the failure rate of chamber and synthetic aggregate systems compared to conventional gravel systems. The difference in failure rate was less than 5% for each system type.

How did innovative failure rates and conventional gravel systems compare?

Hydraulic failure rates between conventional and chamber systems was 1.2%. The difference in failure rate between the conventional and synthetic aggregate systems was 2.2%.

How many systems hydraulically failed?

- Gravel – 22 failures out of 303 systems (7.3%)
- Chambers – 26 failures out of 303 systems (8.5%)
- Synthetic Aggregate – 29 failures out of 306 systems (9.5%)

What criteria were used to define a system failure?

- Hydraulic failure was defined as surface discharge of sewage on the ground surface at the time of evaluation
- Straight pipe
- Evidence of repair
- Pressure to soil surface with a shoe result in sewage coming to the surface
- Evidence of past failure

What was the size of innovative systems vs. aggregate systems?

Innovative systems were installed 25% smaller than conventional gravel septic systems.

Were all system types installed in different types of soils?

Yes, installations were done in different types of soil:

- Coastal region - Sands and Fine Loams
- Piedmont region - Fine Loams and Clays
- Mountain region - Coarse Loams and Fine Loams

Who conducted the study and why?

- Work was performed by a team of third party inspectors from Western Carolina University (WCU). The inspectors were Environmental Health Students under the supervision of Dr. Burton Ogle from WCU and were trained to inspect septic tank systems by a former employee of the NC Wastewater Discharge Elimination program.
- The study was conducted by the North Carolina On-site Wastewater Section as a part of recent legislation of North Carolina, to provide designation of approved Innovative on-site wastewater systems as accepted systems.



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