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In the past, the typical street reclamation practice for the City of Fort Worth, TX was to recycle a street full-depth, add 6% Portland cement, blend and process the treated material, and then repave. In the late 90's, this practice was modified to used Roadbond EN 1 soil stabilizer plus 3% Portland cement on three street reclamation projects. The goal was to reduce shrinkage cracks commonly associated with Portland cement stabilization without sacrificing the resulting strength.

The trial streets were Floyd Drive in 1996, Lowden Street in 1997, and Earl Street in 1998. On each project, the street included a section of Roadbond EN 1 soil stabilizer plus 3% Portland cement, and a control section of the usual 6% Portland cement. On April 25, 2016, each section was tested for in-place CBR with a Kessler DCP.

The device is hand held and is equipped with a 17.6 pound (7.98 kg) weight that drops from 22.6 inches (57.4 cm) and strikes an anvil. These blows drive a 7/8" (22.2 mm) diameter 60° cone into the ground. Measurements in millimeters of the penetration depth into the soil are recorded. Once the data is obtained, the number of blows delivered to the anvil and the total depth of the penetration are entered into a Microsoft XL template that was developed by the US Army Corps of Engineers. The template converts the raw data to CBR. CBR is then easily converted to resilient modulus and used in pavement design.

A one-inch diameter hole was bored through the pavement to gain access to the treated base material at several locations. Once the treated material is accessed, the DCP is positioned and the weight is dropped 2 times to seat the cone into the soil. The initial depth is recorded and the weight is dropped a number of times to achieve a minimum of 25 mm of penetration. The actual penetration and blows required are recorded. The number of blows delivered and the total penetration is entered into the XL template to calculate CBR.

The treated soil included a local "pit-run" gravel that was used as base material when the streets were first built. This gravel contains some measure of stones, and in several instances these stones blocked the penetration of the cone. This was evident by little or no penetration occurring even with many blows of the weight. This occurred several times and the results were discarded, but for graphing purposes, they were assigned a zero value and not included in the average.

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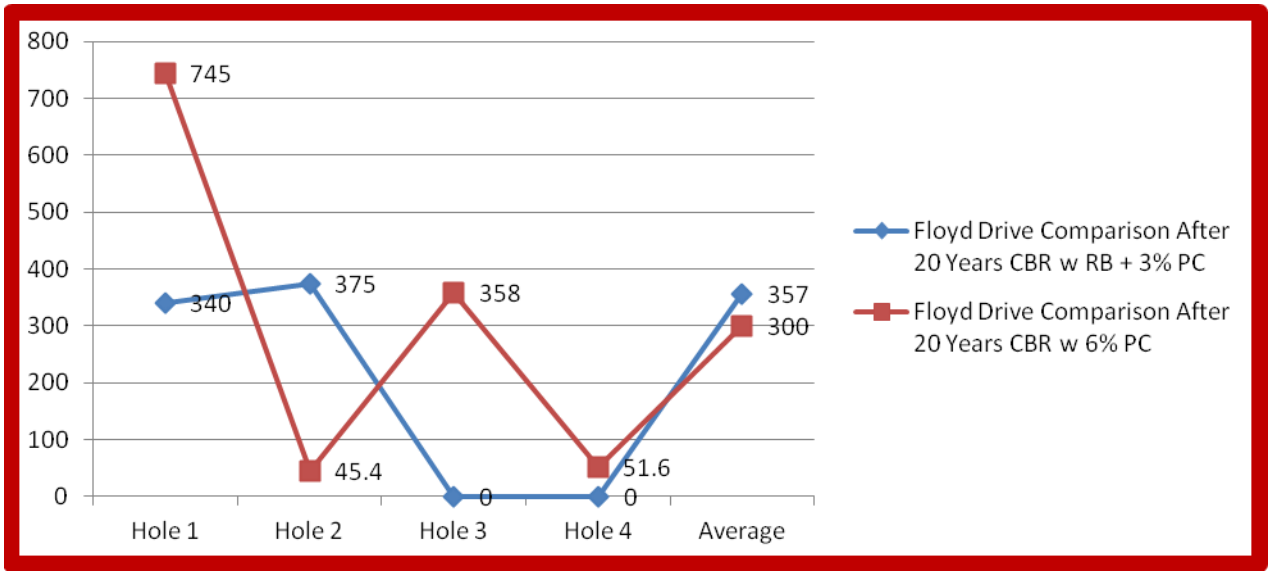
The results of the Floyd Drive appear in the following table.

Floyd Drive 1996	RB + 3% PC	6% PC
	Blows / mm	Blows / mm
Hole 1	55 / 48	60 / 26
Hole 2	30 / 24	11 / 58
Hole 3	Discarded	30 / 25
Hole 4	n/a	10 / 47
Avg CBR	**357.5**	**300**

The following chart illustrates the CBR comparison of Floyd Drive.



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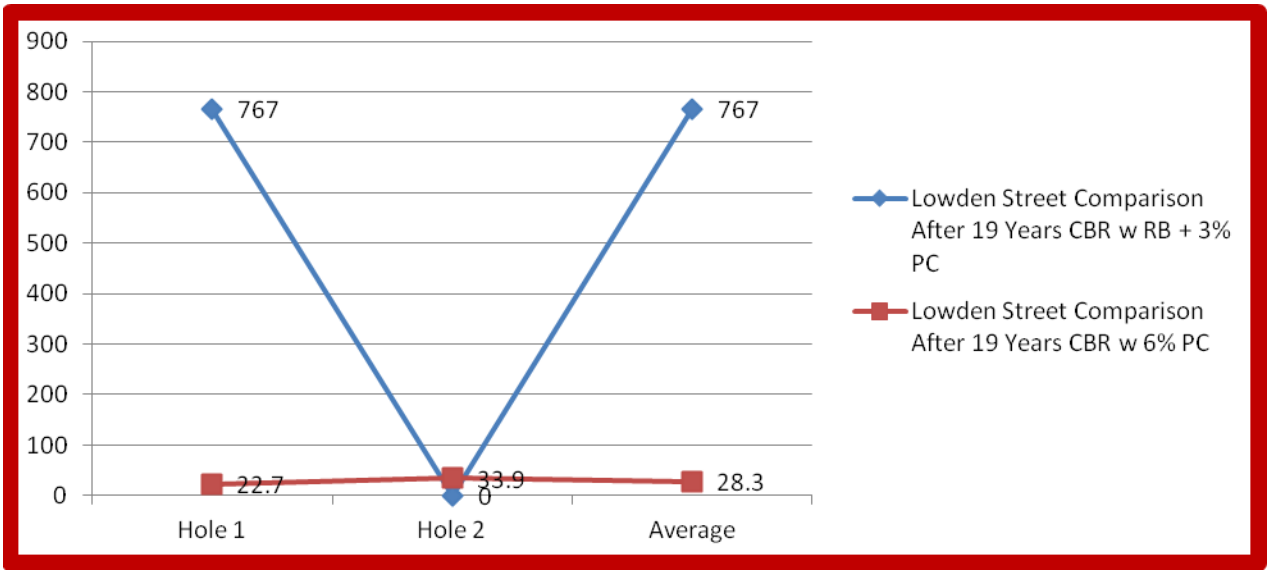
The results of the Lowden Street appear in the following table.

Lowden Street 1997	RB + 3% PC	6% PC
	Blows / mm	Blows / mm
Hole 1	45 / 19	5 / 49
Hole 2	Discarded	6 / 41
Avg CBR	**767**	**28.3**

The following chart illustrates the CBR comparison of Lowden Street.



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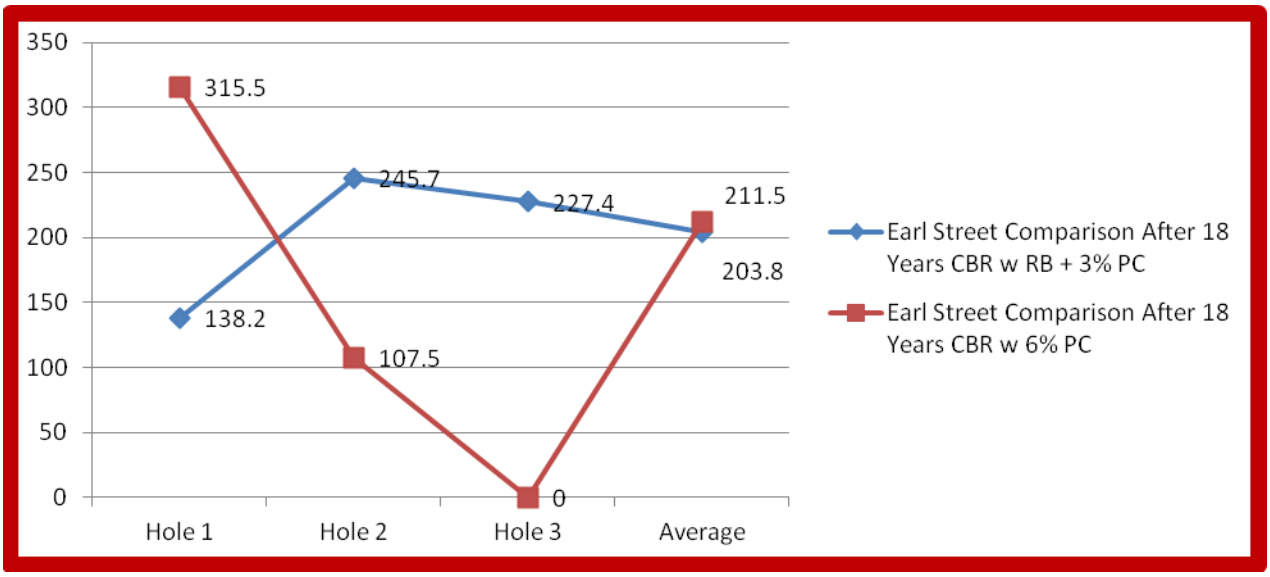
The results of Earl Street appear in the following table.

Earl Street 1998	RB + 3% PC	6% PC
	Blows / mm	Blows / mm
Hole 1	20 / 39	30 / 28
Hole 2	30 / 35	25 / 61
Hole 3	20 / 25	Discarded
Avg CBR	**203.8**	**211.5**

The following chart illustrates the CBR comparison of Earl Street.



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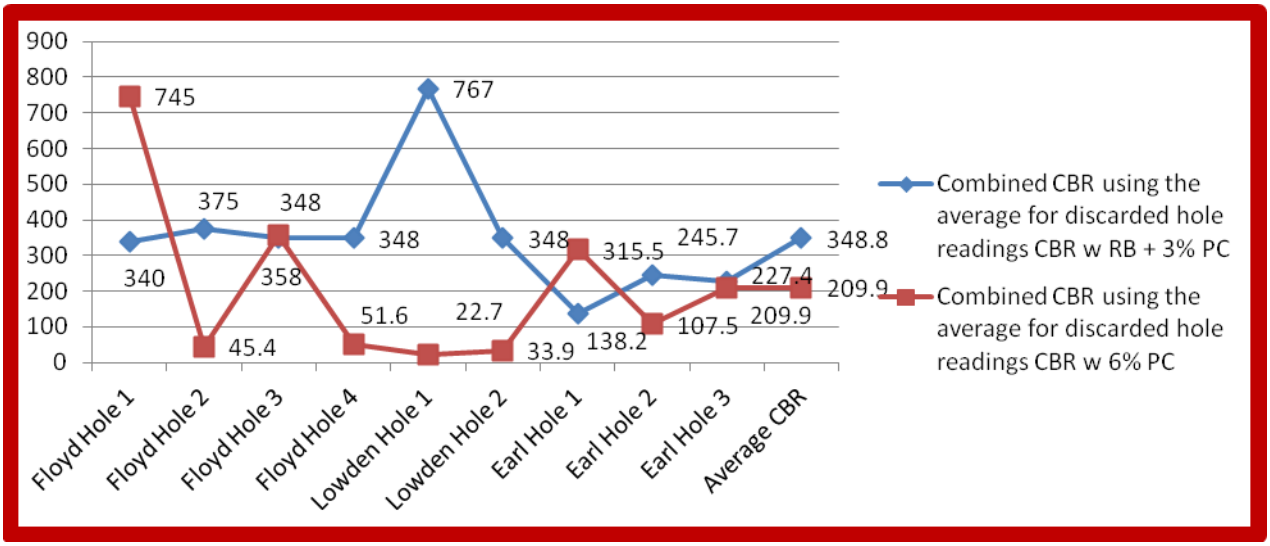
The following chart summarizes the combined CBR of all three streets. The average CBR of each design mix was used to replace the zero value assigned to the discarded holes that resulted from stone interference of the cone penetration.



The City of Ft. Worth has fully implemented the Roadbond EN 1 plus 3% Portland cement program for street reclamation, and it is evident from the test results that this plan results in long-term base strength that, with the exception of Earl Street, exceeds the strength of Portland cement alone. Roadbond EN 1 also delivers reliable strength with an average CBR of 348 and a minimum CBR of 138.2. Straight Portland cement resulted in an average CBR of 209.9 and four of the nine holes tested had CBR values less than 60.

Roadbond EN 1 and reduced rates of Portland cement resulted in significantly fewer cracks in the pavement, and therefore required less maintenance over time. In addition to that, owing to the environmental impact of Portland cement production, transportation, and installation, Roadbond EN 1 with less Portland cement is an eco-friendly strategy for street construction and maintenance.

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