Using Cornell Structural Soil to Plant Towanda's Trees

By Jim Lacek, DCNR, Bureau of Forestry, Service Forester

Plans Are Completed

The improvement of Towanda's main street is a story of long-term planning, innovation, and partnership between many diverse groups. Beginning in 1989, the project bloomed under the leadership of Towanda borough manager Tom Fairchild. With financial assistance supplied by the Bradford county commissioners community development block grant, a borough comprehensive plan was prepared.

The comprehensive plan recommended the development of a main street committee. A committee was formed, additional funds acquired, and a landscape architect (Haas Landscape Architects) hired to design a streetscape of main street and its intersections. The purpose of the streetscape plan was to improve lighting, pedestrian circulation, parking, and the overall aesthetics of the historic downtown commercial district. It included the cooperation of GPU Energy, Commonwealth Telephone Company, and AT&T cable services for the removal of all overhead wires and existing street lighting including the wood poles supporting these utilities. The streetscape plan positioned all permanent structures including building overhangs, doorways, setbacks, and parking spaces and recommended the location and style of new Victorian-style streetlights and the placement of street trees. The location of underground utilities such as gas, sewer, water, or their shut-off boxes were not located on the streetscape plan. Instead, the Towanda sewer and water system and Valley Cities Gas Service located these services and painted their positions on the curb.

A trench is constructed for both tree roots and electric lines.

Trees Are Selected For Planting

Borough manager Tom Fairchild successfully applied for a grant to implement the streetscape plan using "Cornell structural soil". The grant award of $70,000 from the Northeastern Pennsylvania Urban and Community Forestry Program administered by the Morris Arboretum provided funding for 85 trees, making Cornell structural soil, and other related expenses for the main street construction year.

The shade tree committee, with cooperation from Penn State extension urban forester Vinnie Cotrone and DCNR service forester Jim Lacek, reviewed the streetscape and made some minor adjustments to the plan. Changes were made to tree locations because of conflicts with underground structures, pedestrian traffic flow, street signs, building signage, entrance doors, and awnings. Where possible the new trees were centered between the locations of new streetlights. After the plan was finalized, the proposed tree planting pits were boldly marked with spray paint on the sidewalks to attract the attention and comments of building owners and store merchants. The paint marks on the sidewalks raised the interest of merchants and building owners who offered comments on proposed tree locations and some modifications were made when necessary.

Tree species and varieties were selected while visiting the planting sites and recorded on the streetscape plan. Some site conditions dictated the use of tall, narrow, salt- and drought-resistant trees. Trees selected for these places were Redspire callery pear, Sentry ginkgo, columnar European hornbeam, columnar English oak, zelkova, and columnar Norway maple. Where space was available, larger, spreading trees were selected including Patmore green ash, Autumn Purple white ash, Skyline honeylocust, tree lilac, silver linden, Cumulus serviceberry, river birch, Bloodgood London plane, Kentucky coffetree, Amur corktree, and red maple.

Mechanical analysis of clay loam soil for the structural soil mix.

Gravel less than 5%
Sand 25 to 30%
Silt 20 to 40%
Clay 25 to 35%

Cornell Structural Soils Are Used

Cornell structural soil, developed by Dr. Nina Bassuck, consists of a measured blend of crushed stone, clay loam soil, and hydrogel. The soil allows for plant growth and the stone supports the weight of cement and asphalt. The soil requirement is for high clay content and low sand and silt content, so the borough had difficulty in locating a soil to meet this requirement. Soil and crushed stone samples were sent to Cornell labs for testing until the proper materials were located.

Crushed stone, soil, and hydrogel from Amereq, Inc. of New City, New York were purchased, stored on borough property, and mixed when needed. To manufacture 1020 tons of Cornell structural soil the following supplies were used: 170 tons clay soil, 850 tons crushed stone, 400 pounds hydrogel, and 19,000 gallons water. Before mixing the materials to create Cornell structural soil, training of the borough work force was done by construction supervisor Jim Haight using the video "Cornell Structural Soil." Jim developed the following procedure to produce a batch of soil: eight one yard buckets of stone, two one yard buckets of soil, and four one pound cans of gel. To mix the soil, spread stone evenly over mixing yard area and dampen stone with water. Evenly cast gel over damp stone and mix stone and gel with front end loader. Re-spread gravel and gel mix over yard area and distribute soil over gravel/gel mixture using front end loader. Mix and re-pile, cover with tarp and use as needed. A mix of 20 to 40 tons was made and stored at any one time. The first few batches were over-gelled until employees were accustomed to assembling a supply.

Trees Were Planted

Installation of soil, trees, and improvements was done as follows: cutting pavement for planting trenches, removing concrete and digging planting trenches, placing pedestals for walk lights, installing underground electrical system to pedestals, installing and compacting structural soil mix, placing Victorian style lighting, planting trees, paving driveways and road cuts, laying decorative paver bricks over planting trenches, and watering trees as the dry summer fell upon us.

Sidewalk and street pavement cutting work was contracted by

Final Project Tally

118 new Victorian-style walkway lights (street lights)

6800 lineal feet of trenching 3400 on both sides of main street

85 new trees

7,000 square feet of concrete paver brick installed (30,000 bricks)

3,300 proud residents and thousands of observing tourists and other travelling public

Cost estimates are:

$70,000, borough cost in 1999

$260,000, GPU Energy

$60,000, TV cable, phone company, sewer and water company.

$390,000, expenditure by the local partnership

$70,000 grant through NE PA Urban & Community Forestry program

$460,000 total cost

The Cornell structural soil is lightly compacted and will support the weight of concrete and asphalt.

GPU, formerly Pennsylvania Electric Company. The contractor, using a diamond blade saw, cut the concrete on a line established two feet away from and parallel to the curb for the entire length of the tree planting area.

New services for electricity, TV cable, and telephones were relocated by the utilities to the rear or side of those buildings fronting main street and underground leads were installed to feed electric current to the new streetlights.

Towanda borough employees removed the cut pavement and sidewalk material, digging a trench two feet wide and two feet deep. At the locations designated for tree planting, concrete cuts were made to expand the trench area to a four-foot by four-foot pit two feet deep. The four foot planting areas were re-filled with a high quality top soil while the 2-foot trenches along the curb were filled with structural soil. The electric company installed underground conduit in the trenched area feeding electric current to the newly installed Victorian style streetlights. Hot on the heels of the electric company's installation crew was the borough back fill crew. Ever mindful of the open trench lawsuit syndrome, the trenched area was rapidly packed with Cornell soil mix retrieved from the borough's storage lot and set in place with a vibrator compactor. Trenches under roadway and driveways were filled with a stone mix and new concrete roadway installed. Later, the tree pits were reopened and the trees planted in the top soil by the borough crew. Trees were planted so the tops of their balls were four inches deep to allow for the placement of brick pavers over the planting pits. The top four inches of top soil was removed, soil filter fabric installed, a layer of bedding sand installed and packed, and the paver bricks installed by a paving contractor.

Structural soil is used to back fill the tree root/electyric line trench.

The summer drought of 1999 placed an additional burden upon the borough requiring them to use a water tanker to irrigate the newly planted trees regularly until the rains came. Also, the winter of 1999-2000 was a test of the stability of the paver brick to snowplowing and frost heaving. The lack of snow cover, heavy icing and use of anti-skid salt, all created a heavy ice crystal condition under the brick. Some minor frost heaving did occur but is not expected to be a maintenance problem. The use of lightweight snowplows, garden tractors with blades, did not disrupt or lift any of the paver bricks.

Overall the borough is quite pleased with the results of almost fifteen years of planning and a few months of hard work. The stop and go activities of the installation process required four months in the busy schedule of the projects partners, the borough work force, the electric company, TV cable company, phone company, and the sewer and water authority. Public reaction has been outstanding. Some minor vandalism occurred but the outcry from the public and press helped resolve these problems. The local support from borough residents, merchants and from neighboring communities helped lighten the load of sweat and blisters to those who did all the work. Response from tourists, shoppers, and former residents has been heartening.

The Towanda story proves that it takes leadership, lots of good planning, plenty of cooperation, a dedicated community and borough council, innovative thinking, a skilled and professional work crew of six valued borough employees, and some outside assistance to complete a project of significant merit.

Towanda At A Glance

Population: 3300

Size: 2.1 square miles

Street miles: 16 miles

Trees planted since 1985: 600

Average annual expenditure for trees: $5.00/capita