Other Cities/Counties Contacted:

Maplewood, MN

They have the same 1" infiltration requirement COF has. They have been using Bio-retention in ROW since 1995 with no problems. Hundreds of residential and 30 used on street reconstruction projects or for regional BR. Some use underdrains and subsurface storage and many do not. They have not had to do any maintenance of the underdrains, but cleanouts are included in all designs. There have never been any concerns with infiltration compromising the adjacent roadbed from other City depts.

Many of the BR's use curb cuts to take the water from the street gutter into the BR. No problems with plows damaging them and they also use the BR for snow storage. They do use chemical deicers and try to use salt tolerant plants. Maintenance is performed by 2 temps in the spring and summer. This mostly consists of removing trash, pruning and weeding. Homeowners maintain BRs in ROW. Not much new development in this city.

They have mostly done retrofit installations and have had to relocate or work around franchise utilities. They have two porous asphalt installations, one in the public works parking lot and another in a park. They sweep 2x/yr.

Burnsville, MN

They have the same 1" infiltration requirement COF has. They have been using BR in ROW since 2003. Many of them are ~18" from EOP and they have seen no evidence of road degradation. Curb cuts are used to allow water to enter the BR. The City Engineer is still leery of the practice. The residential BRs do not have underdrains (sandy soils) and infiltration rates have increased over time. Underdrains are required in areas with poor soils. They are used for snow storage. Chemical deicers are used.

Homeowners maintain BRs in ROW and the City is responsible for major repairs (there have been none so far). Maintenance agreements are required and recorded against the property. Not much new development in this city.

They installed a BR in the public works yard ~2yrs ago. It has an underdrain and rock pretreatment area. Maintenance consists of weeding/mulching 3x/yr and cost is minimal. They anticipate removing sediment from the pre-treatment area at some point. They are expecting a 20yr life from this BR.

They have no permeable pavements but there many installations in the Twin Cities area. Doug Hartman is Public Works Supervisor (952-895-4555).

Durango, CO

They do have some (not many) BR (called Porous Landscape Detention in Colorado). One is at the City Library and the maintenance is contracted. Russell Planning and Engineering did the design using the UDFCD Criteria Manual (this is what the COF LID Manual is based on). Underdrains and liners are used. Public Works refuses to maintain any of these because of perceived costs and complexity. A recent development

proposed using bio-swales in the ROW but PW did not allow that. Jack Rogers is the PW Director.

They do not allow snow storage in the LID/detention facilities due to potential loss of usable volume in the event they get rain after snow. Other than the PW Director, other city depts. Don't have concerns with BRs in the ROW as long as they are designed properly.

Portland, OR

Portland is one of the national leaders in "Green Streets" with LID in the ROW all over the place. The first project was in 2003. There was initially some concern with other Depts about the effect this would have on the adjacent pavements. They did some stress tests on the pavements that reduced the concerns and they have not had problems. Underdrains and liners are used in some areas of poor (expansive) soils. She stresses that demonstration projects are important. Engineered soils are used.

They are looking at allowing developers treating their runoff in the ROW. They would build the LID, own it for the first 2 yrs, have a contractual agreement with the City that is filed with the deed, and perform all maintenance.

Maintenance consists primarily of trash pickup, cleaning sediment out, and weeding. What follows is from her email:

Inspect swales periodically, especially after major storm events. Remove sediment and trash, clean and repair inlets, curb cuts, check dams, and outlets as needed. Maintain side slopes to prevent erosion and ensure (City of Portland)

Inspect the vegetation and structure periodically and after major storm events. Vegetation maintenance is similar to that used for other types of managed landscapes. Maintenance needs include removing sediment and debris; cleaning and repairing inlets, embankments, berms, dams, and outlets as needed; controlling erosion; and ensuring proper drainage. Some plant replacement may be necessary. With proper construction and maintenance, a vegetated infiltration basin can last indefinitely. (City of Portland)

Planting and Startup maintenance costs. The average cost for initial Green Street planting and maintenance during the first 2 year establishment phase is approximately $16/square foot. We typically use gallon size plants in higher densities than required in our Stormwater Management Manual. This provides an instant landscape and helps minimize weed growth, limiting the amount of needed maintenance. This is an average cost, and also includes green street facilities that are planted with trees (not all facilities have trees). Trees typically require additional irrigation during the summer months.

Long-term maintenance costs The average annual cost is approximately $1.85/square foot. We typically maintain a Green Street about 4 times per year during the long term phase. Maintenance activities include sediment and weed removal, pruning or trimming plants, trash and debris removal.

In regards to utility conflicts, we first try to locate Green street facilities where there are no conflicts, however when there are no other options, and the utility doesn't want a Green Street over their line, then we will ask that they be moved. Our Transportation bureau gives utilities an easement under the street and so have the right to ask utilities

(cable, gas, etc.) to move a line. This doesn't happen often. If we run into a water line, we will also relocate or place a liner over or pvc sleeve around the pipe. Also, so the pipe doesn't serve as a conduit for water, we will seal around the ends with bentonite.

Greenwood Village, CO

PICP installation at a city parking lot. Working well and are considering using it in some intersections.

Colorado Springs, CO

LID not required yet. They do not have many infiltrating BMPs or permeable pavements. Projects with bio-swales in the ROW are OK with Streets as long as they know about it early on.

City/county of Denver, CO

They do the maintenance of the BMPs in the ROW. Underdrains are typically used and there are no concerns with the infiltrating BMP in the ROW if it is properly designed. The do have three permeable parking lots (porous concrete, PICP, porous asphalt, with underdrains, and use rubber tipped plows for snow removal. No freeze-thaw issues have been observed yet. She has an engineering PhD and her dissertation was on permeable pavements.

No mandated LID program. Recently installed BR in a street reconstruction project (~1 yr ago). They used a very conservative design with underdrain and 20 mil PVC liner. It was a conservative in-house design that is installed between BOC and the front of the sidewalk (2-7' wide). The sides were lined to prevent migration into the adjacent roadbed, which is only 10" from the BR and capillary action was considered. Drought tolerant seed was used and it is pretty weedy right now. Due to space constraints, they used the Raintank from Invisible Structures instead of drain rock. Maintenance ports were added and the whole system can be jetted/vac'd. There are two cells in series and they have seen some significant volume reductions (he wouldn't say how much). This system treats the runoff from one block length of the road. Chemical deicers (mag chloride) are used and they are actively monitoring this site for water quality and quantity.

Darren says that above ground BMPs are best for maintenance since you can see them. They are planning on using extended detention, bio-swales, and bio-retention on a road reconstruction project to start in February. It will treat runoff from 4 city blocks and cost $8 million. All BMPs have O&M instructions and he recommends all have some type of energy dissipater to reduce erosion. They also have a porous asphalt/modular block parking lot with subsurface storage that UDFCD is monitoring for effectiveness. This is the second winter and it is performing well with no problems.

Seattle, WA

Maintenance is done by the stormwater utility following a comprehensive manual with has four levels of service.

Regarding infiltration damaging road bed: OUR BOTTOM OF INFILTRATION FACILITY IS SETBACK FROM THE BOTTOM OF THE ROADWAY BASE. SEE THE DETAILS ON OUR RIGHT-OF-WAY IMPROVEMENT MANUAL.
http://www.seattle.gov/transportation/rowmanual/manual/6_4.asp

Franchise utilities: THEY HAVE TO RELOCATE TO ACCOMIDATE OUR DESIGNS. (ALTHOUGH FOR MAJOR GAS LINES WE DESIGN AROUND THEM). WE CIRC THE PLANS TO THEM AND BUILD TIME FOR RELOCATION INTO OUR SPECS. SEE SOME OF THE PROJECT CONSTRUCTION SPECS FOR INFO IF YOU WANT. 1ST AVENUE OF THE Broadview greengrid project is one where we designed around the gas line.

Charlotte-Mecklenburg, NC

They will assume the responsibility for single family LID IMP's located on private property. There is a 2 yr warranty period during which the developer is responsible for the IMP. They post a performance bond during this time. At the end of 2 yrs, they can request that CharMeck take over the IMP. Inspections are done first. This has been in place since 2007 so they don't have much experience with maintaining them yet. Any other IMP/BMPs on private property require money to be paid into a escrow account to cover the cost of a new IMP when it reaches the end of its design life.

No LID in the ROW is allowed because the Charlotte DOT does not want to deal with maintenance. They have seen LID failures and all have been caused by sediment washing into the LID during the construction phase.

Engineers Contacted:

Russell Planning & Engineering, Inc – Durango

They worked with the City of Durango on some LID projects. Durango has expansive soils and recommends using liners as "cheap insurance". They are involved with the stormwater management in a TND called Three Springs.

Comments from NPS Listserve

The surface area of the bioretention cell should allow percolation even with a blockage.

"If the underdrain prevents ponding, it would be suitable to protect the pavement. If it does not, a moisture barrier is required unless the ponding area is sufficiently offset from the edge of pavement. The minimum offset is dependent on the soils and slope. The more water retentive the soil and flatter the slope, the farther the ponded area must be from the pavement structural section to avoid adversely impacting it. Moisture barriers include curbs that extend below grade to the bottom of the adjacent pavement subgrade or HDPE liners."