**CITY OF LOS ANGELES**
INTERDEPARTMENTAL CORRESPONDENCE

**DATE:** May 29, 2015

**TO:** PUBLIC WORKS & GANG REDUCTION COMMITTEE
of the Los Angeles City Council
Attn: Office of the City Clerk
Room 395 City Hall

**FROM:** John L. Reamer, Jr., Director
Bureau of Contract Administration
Department of Public Works

**SUBJECT:** **COUNCIL FILE 14-1156 USE OF RADIO FREQUENCY IDENTIFICATION *(RFID)* TECHNOLOGY ON UTILITY REPAIRS IN THE CITY OF LOS ANGELES**

This report is presented in response to the City Council Motion (CF 14-1156) Pursuant to a motion by Hon. Mitchell Englander and Joe Buscaino, introduced on August 20th, 2014 which instructed the Department of Public Works to provide this research report on the feasibility of implementing a pilot program to explore and hopefully prove efficiencies that could be produced by technological modifications to the City's current requirements for utility trench identification.

## RECOMMENDATION

Request the City Council to authorize implementation of a pilot program whereby the Department of Public Works' Bureaus of Contract Administration and Engineering will actively test this technology for use on its utility trench permit sites.

## BACKGROUND

There are many scientific studies published by experts on the subject of utility trench and pavement restoration. Repair problems plague the majority of cities in this country as well as Canada and also overseas as far as Riyadh, Saudi Arabia. Virtually all cities with streets constructed of Hot Mix Asphalt Concrete (HMAC) have issues with repairs made after necessary utility work.

The issue of trench compaction lies fundamentally at the center of these discussions owing to the fact that appropriate effort to restore the underlying soil is critical to ensuring the best possible trench longevity. However, in the best case scenarios, even conscientious compaction efforts will result in a small percent of eventual failures. Added to this is the fact that workers and inspectors alike, while in the field, do not have the advantage of either time or scientific tools to obtain optimum quality assurance (by onsite testing) at each location. Practical standards for evaluation of soil conditions and compaction are applied as the work commences. (Todres, H.A., *Utility Cuts in Asphalt Pavements: Best Engineering Practices,* APWA - *attached*).

Additionally, in the interest of public safety and convenience, resurfacing usually occurs afterward in as short of time as possible. During resurfacing, the factors of proper HMAC mix design, rolling and sealing also have great effect on trench longevity. Regardless of methodology or design for trench repairs, the City protects itself by requiring a five year warranty on trench-work after acceptance of a permit.

Section 306-1.5.2 of the City's Standard Plan S-610 (Brown Book) requires all utilities performing permanent resurfacing of their street trenches to place a metal tag ("Medallion") on the wearing surface of such trenches every 50 feet in the length of the trench repair. Utility companies are required to warranty their resurfaced excavations for a period of five years after the work. This medallion aids City staff by identifying the utility owner in the event of a trench or paving failure which must be repaired as soon as possible in the interests of public safety and convenience. *(See attached photo).*

These medallions have proven effective in the past, however their application no longer consistently addresses the purpose for which they were designed. They can be dislodged by traffic, they can be ground off by subsequent paving operations, and they can be destroyed by later street repairs from another company or City agency. In addition, time intensive efforts by City staff to trace down permit information before contacting a utility for warranty work impacts daily service schedules to the public.

**DISCUSSION**

In the past few years, the City of Dayton Ohio has changed its specifications for identifying utility work on street paving, and the latest proven technology has several advantages over the old medallion system. Dayton, which has become a hub for companies involved in this technology[(1)], has implemented a program where RFID technology[(2)] has replaced the medallion system altogether. In place of a medallion, a coded heat-proof tag is embedded directly into the trench's wearing surface at a depth of 2 inches. This tag can carry any type of identification data the City wishes to keep on file whereas medallions, due to their physical size, are limited to minimal information of Company name and date of work. *(Attached Photo – GCN Magazine)*

In addition RFID tags, because they are not exposed to the elements of wear and tear, are virtually impervious to damage or displacement, and provide City staff and utility companies better and quicker response times to resolve any issues arising during the warranty period.

The City of Dayton Ohio uses this technology exclusively now. In our interviews with Mr. Steve Finke (City Engineer and Director of the Dayton Ohio Department of Public Works), he provided us with information on the procedures, equipment, training and other items necessary to establish this in Los Angeles. While the City of Dayton is much smaller in area, these procedures would not differ greatly other than in scope and number of utility repairs and companies involved.

**Three Bureaus within the Department of Public Works** would be utilizing this technology in our day to day involvement with utility work in the City's rights-of-way:

- **The Bureau of Engineering**, issuer of all utility construction and repair permits, would be the central agency for the programming of these tags, distribution of such tags to the individual utilities, and host of the City's trench resurfacing database.

- **The Bureau of Contract Administration (Inspector of Public Works)** being the quality control agency for the performance and acceptance of utility construction work, would be enforcing the use of these tags during inspection and acceptance of permit work under the City Engineer's requirements.
- **The Bureau of Street Services**, as the custodian of the City's streets, would be able to utilize this technology to efficiently locate and determine responsibility for pavement failures occurring from utility work, and more quickly obtain resolution to any problem requiring their response.

**The Department of Public Works,** as a whole, would benefit greatly from this technology by our ability to maintain a detailed and geocoded picture of utility work, its age, its owners, and its nature.

**A general description of the use of this technology would be as follows:**

- The Bureau of Engineering would code each of these tags with a unique identifier (series number and utility company code) and provide them to Utility owners for a materials fee.
- Subcontractors working for these utilities could be further coded to assist the utility owner in tracking which installer may be obligated for warranty costs.
- During permanent resurfacing of a utility trench, or even paving of a street over a new utility trench, these tags are embedded by the contractor/utility into the top lift of the paving material where the permit inspector would record them with a tag "reader" (electronic device) and upload that information into the Engineering permit system along with the inspector's acceptance of the permit work.
- This data would be available to City staff later, in the event of a failure of that work.

In the event a contractor fails to comply, administrative penalties are feasible with modifications to the Municipal Code. Also, it is possible for a tag to be placed remedially without pavement removal and significant secondary disruption to the street. This activity would be supervised by inspection and recording of the subsequent data.

Mr. Finke provided these statistics in interviews last year and February of this year:

- The City of Dayton began its program April of 2013
- The City of Dayton currently has 3000 RFID tags installed in its utility trenches matched to the data in their permit system.
- Installed RFID tags are used by City staff to cross-reference utility trench locations to the City's permit database using laptops and smartphones in the field.
- These tags are installed at a depth of 2" as specified by Dayton's City Engineer. Mr. Finke states that this is the optimum depth to ensure 100% consistency for the readers, however it may be possible to extend this slightly.
- No provision is made for remedial installation in the event the contract/utility does not comply. The trench is re-worked entirely.

Inasmuch as the program is relatively new, Dayton's database on trench failures has not matured to where a study can be made on the efficiency of obtaining real-time information on paving and trench failures. However, the process currently in place is a hard-copy record search done by hand by field inspectors using downtime for the administrative task and is similar to our in Los Angeles. The relative cost savings can be inferred owing to the fact that, in the coming years, failed trenches with installed RFID tags will be identified in the field in real time as opposed to the office time now spent. In Los Angeles our Department is forced to use a similar time intensive investigative process.

**Full Program Base Estimate**

Based upon the costs of initial implementation as reported by Mr. Finke, and after consulting CDO Technologies (maker of the equipment), the City of Los Angeles could start a pilot program for under $100,000. **These costs are only an estimate** however, and are submitted by your City staff, not the City of Dayton Ohio.

Such a pilot program in Los Angeles could apparently be implemented with the following equipment and processes:

- Purchase of four (4) **dedicated computer workstations** with Microsoft Operating System. (generic City-approved Dell **–** Bureau of Engineering's **4 District Offices.**)
- Purchase and Installation of **Vendor's Proprietary coding software** and hardware (at BOE). **(4 Licenses)**
- Purchase of compatible **Radio Frequency Tag "readers"**. Assigned to Department staff.
- Purchase of **Radio Frequency Identification Tags** (full cost recovery from utility user.)
- **Training** of City Engineer personnel in proprietary software use.
- **Coding of tags** for utilities. (full cost recovery from utility user.)
- **Selection of a partner Utility** owner for pilot program.
- **Identification of a City geographical area** where these tags will be installed.
- **Monitoring, enforcement and data collection.**
- **Stress test.** (City employees will be sent to installation locations and will try match trenches to permits.)

## ***Pilot Program Cost Estimate:***

The Bureaus of Contract Administration and Engineering could implement a pilot program to determine and report on the effectiveness and feasibility of implementing this technology city wide. The necessary equipment to conduct this program would involve a minimal investment and is listed here.

***CDO "Road Tag Bundle"***

1. **Desktop RFID Programming Station**
2. **Vendor's Proprietary coding software/hardware**
3. **Handheld RFID Reading Unit**
4. **Desktop Charging Station for Handheld Unit**
5. **1 year CDO Technical Support** **$ 28,500**

6. **Radio Frequency Identification Tags (qty 500)** **(*vendor provided* -$10,305 value)**
7. **Training** ***(Mr. Finke states that software is user friendly)*** **(*vendor provided* - $ 895.00 value)**

**Vendor's offering = $17,300.00**

8. **Coding of tags** **BOE Staff time**
9. **Monitoring, enforcement and data collection** **(Pre-Paid inspection fees)**
10. **Stress test** **BCA Staff time**

Post-pilot costs would be limited to purchase, coding and distribution of RFID tags, the possible purchase of additional reader units, and other workstations should other departments develop new innovations for this technology. Cost recovery realization would not be measurable for several years due to the fact that, like Dayton, there will have to be a considerable amount of trenches with these tags in place for some time before we can to measure real-time efficiencies when called upon to research failures.

The Bureau, at the request of Councilmembers Buscaino and Englander has approached the Department of Water and Power as the most likely candidate to join the Department of Public Works in this experimental program. Managers of DWP's Water Division are highly enthusiastic about this new technology, and are willing to participate in a pilot program which they also believe has other beneficial applications in their programs.

***(1) RFID Firms in Dayton (Sampling)***

- ***Alien RFID Solutions Center***
- ***Unisys Corp.***
- ***RFID Solutions Center***
- ***EPC Technologies, Inc.***
- ***CDO Technologies***

***(2) Source - Wikipedia***

***"Radio-frequency identification (RFID) is the wireless use of <u>electromagnetic fields</u> to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by <u>electromagnetic induction</u> from magnetic fields produced near the reader. Some types collect energy from the interrogating radio waves and act as a passive transponder. Other types have a local power source such as a battery and may operate at hundreds of meters from the reader. Unlike a <u>barcode</u>, the tag does not necessarily need to be within line of sight of the reader, and may be embedded in the tracked object. Radio frequency identification (RFID) is one method for <u>Automatic Identification and Data Capture</u> (AIDC)."***

# UTILITY CUTS IN ASPHALT PAVEMENTS: BEST ENGINEERING PRACTICES

by
A. (Alan) Todres, P.E.[1]
H. A. Todres, Consulting Engineer, 8920 Tamaroa Terrace, Skokie, IL 60076.

**Abstract**

**Compaction by utility crews** will usually be by means of pneumatic rammers or gasoline powered impact compactors that fit the confines of the small opening or narrow trench and can be carried on crew trucks. Wide trenches can accommodate larger equipment that may be appropriate for the larger and more specialized team performing such work. Even light equipment will achieve compaction provided that the soil is reasonably close to OMC, and that lift thickness and number of passes are appropriate. Although individual soils vary in their compactibility, especially in relation to the type of equipment used, lift thicknesses in the range of 6 to 9 inches (loose) will normally be successful. A useful aid to the crew is a simple depth gage (e.g. a band of tape the proper number of inches from the end of a broomstick handle) and this will ensure uniformity of results.

In the small rectangular opening it has been found best for the perimeter to be compacted first, with the compactor then being worked in towards the center on a "spiral" path. In non-cohesive materials this counteracts a tendency for material to be shoved outwards and upwards. Simple engineering studies can quickly determine the best lift thicknesses and the number of passes (or seconds per square foot of lift) needed. However, the crew in the field is still faced with two problems:

**Moisture content:** whether the soil is too wet or too dry, and how to adjust it to the right level
**Verifying density**

For moisture content, squeezing a lump of soil in the hand can often be informative for an experienced operator. If the soil is too wet, water will be expressed; if too dry, the soil tends to crumble. However, crews that deal only to a limited extent with soils, may find this difficult. A useful device for this purpose is a simple potted plant moisture meter (Todres, 1987). Clutching a of soil around the stem gives a readout that tells the operator approximately where the soil is in relation to OMC. If the soil is too wet it should be dried out by spreading in the sun or adding dry sand or cement, and if too dry, water should be mixed in. In either case the completion of the process is signaled by the moisture meter readout.

Verification of compaction by utility crews needs simple, inexpensive, and rugged equipment. Thus the traditional methods (sand cone, nuclear, etc.) used in large-scale construction are inappropriate in utility cuts (especially the small ones -- large trenches more closely resemble large-scale construction). Here a distinction must be clearly made between quality control (field verification by the crew) and quality assurance (checking by the company or agency).

If suitable equipment is available, QC can be performed at every opening, while QA, using traditional laboratory standard methods, can be performed at a random fraction. By this means testing logistics are simplified and costs held down, while a high level of assurance is provided. Indeed, the reward for good compliance is a reduction of QA testing, while the penalty for poor compliance is an increase in QA testing.

Two QC methods being used in the U.S. are a dynamic cone penetrometer (DCP) and a compaction meter. The DCP is a cone-tipped rod driven into the soil by a sliding weight that falls a standard distance and strikes an anvil attached to the rod. The configuration currently used derives from field work reported by Todres (1987). The device is light-weight, portable, inexpensive, and rugged. The usual method of use is to establish a correlation between relative density and the blow count required to achieve a fixed depth of penetration (3 ¼ inches in the standard model), by conducting field measurements in which both DCP and one of the standard laboratory methods of determining density are used. In practice this has been found widely successful for a broad range of soil types and specification standards across the country.

The DCP acts as a go/no-go device, and, although not a laboratory instrument, has been found in practice to be successful about 93% of the time, with false positives (where a pass is wrongly proclaimed) making up perhaps 7% of all instances, but in these cases the margin of failure tends to be small. QA testing that has been performed for crews using the DCP has confirmed its success. In practice, it is usual to verify that compaction procedures achieve density, by using the DCP at two or three spots near the bottom of the backfill (and modifying the procedures if the need is shown) and confirming by repeating near the top. Information concerning commercial availability can be obtained from SGS, Inc, (see Refs.).

The soil compaction meter was developed by Foster-Miller, Inc. under a contract with the Gas Research Institute (GRI). It has been commercialized by MBW Inc. (see Refs.). A buried sensor placed near the bottom of the excavation is attached to a handheld readout by a wire, and the sound waves transmitted through the soil from the compactor are analyzed to provide an indication of density. Advantages are the real time measurement and the ability to automatically record results.

However, equipment is somewhat costly, and the sensors are sacrificed.
Irrespective of the method used, an important issue is the recording of results. Both DCP and compaction meter provide recordable results, and good practice demands that these be logged (whether by crews or automatically) such that they can be checked individually against the QA results, or be referred to in case of failure. The discipline and traceability tend to be very salutary, and usually are well-liked by crews, management, and agencies as providing a clear assignment of responsibility and evidence of compliance.


***UTILITY TRENCH "MEDALLION"***

**Per Section 306-1.5.2 of the City's Standard Plan S-610**

**(Brown Book)**

CF 14-1156 "RFID Tags" BCA/PW Report

Inbox (5,648) - russ.s | GCN RFID tags curb street

gcn.com/articles/2014/03/25/dayton-rfid.aspx



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# RFID tags curb street repair time

By Dibya Sarkar Mar 25, 2014

In many cities like Dayton, Ohio, when utility companies dig up streets to install sewer pipes or fiber optic lines, they are responsible for properly filling in any holes or trenches. If the street cut isn't repaired properly, that area could sink or turn into a pothole – a problem for the city and a potential hazard for motorists.

Officials in Dayton realized that it sometimes took the city's only utility inspector weeks to identify which company was responsible for a defective restoration and get it fixed.

But in the last year, the city has come up with a nifty wireless fix for the problem. Dayton now requires utilities to embed a RFID (radio frequency identification) tag in the roadway. The tag resembles a 4- to 5-inch pixie stick coated in protective plastic and is



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