



# Keyhole Construction and Pavement Restoration Techniques



## Presentation and Demonstration

- **Project overview**
- **Keyhole history**
- **Similarities to arthroscopic surgery**
- **Primary equipment**
- **Keyhole sequence**
- **Quality Control**
- **Benefits of Process**
- **Demonstration**

## History

- **Small (Keyhole) Excavations initiated in 1960's**
- **Used primarily for leak repair**
- **1990's rekindling of interest ("potholing" for locates)**
- **Enbridge - Consumers Gas developed "rotary cutter"**
- **Other core boring grouts/bonding agents developed**
- **Wide range of tools developed**
- **Currently - wide range of activities and tools in use today**
- **Adoption of keyhole process by industry leaders**

## Keyhole Techniques akin to Arthroscopic Surgery

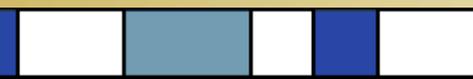
### Arthroscopic Surgery

- Smaller Incision (Portal)
- Short Recovery Period
- Small Scar
- Lower long-term Cost

### Keyhole Operation

- Smaller Opening (Keyhole)
- Quicker Restoration
- Small Repair Patch
- Lower long-term Cost

## Primary Keyhole Coring Equipment



## Vacuum Excavation Equipment



## Spotting the core location



## Coring Operation



## Clean Cut



## Remove the core



## Various types and depths of roadway materials



## Vacuum Excavation



## Pipe Work



## Backfill and Tamp



## Grout/bonding agent



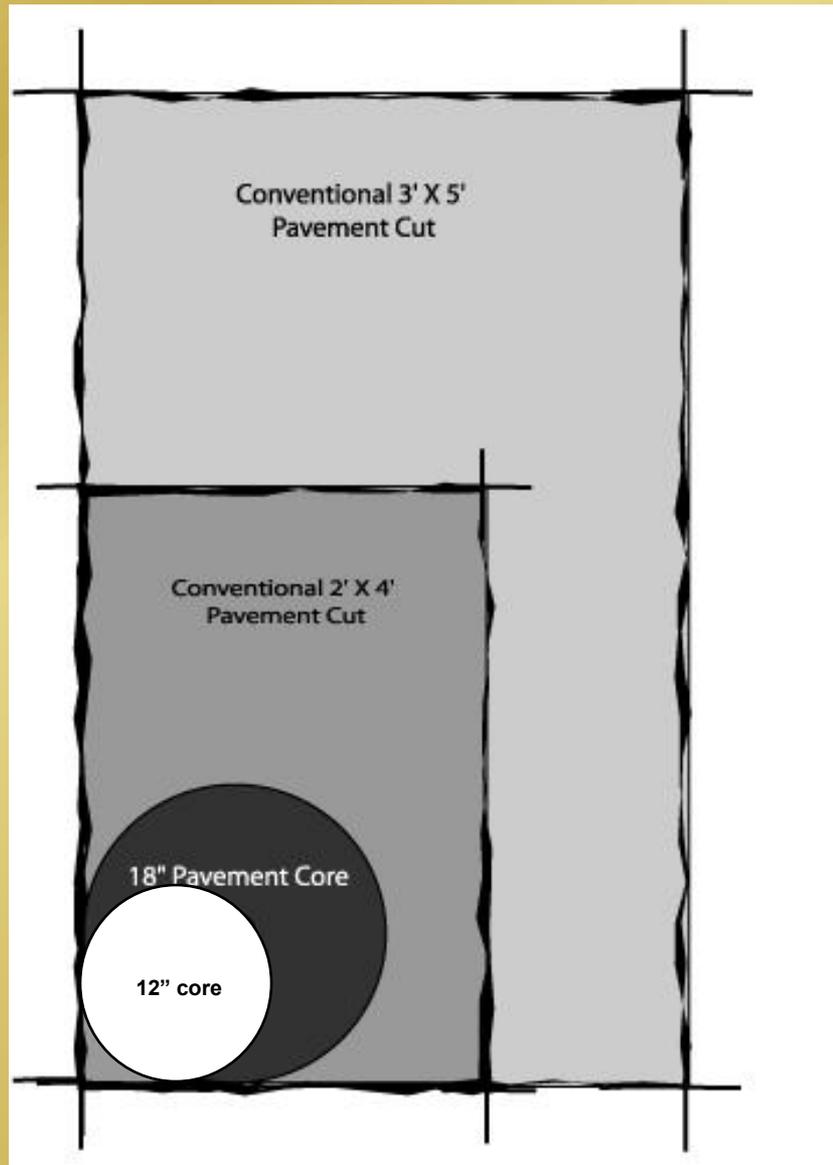
## Core replacement



## Quality Product



## Reduced profile



**Traditional Restoration**



**Keyhole Restoration**



## QA-QC Protocols

### Tracking core stability

- **Track relative stability/movement between core and surrounding pavement**
- **Documentation of existing pavement condition**
- **Documentation of any changes in pavement condition**
- **Tracking core/replacement performance over time relative to surrounding pavement**

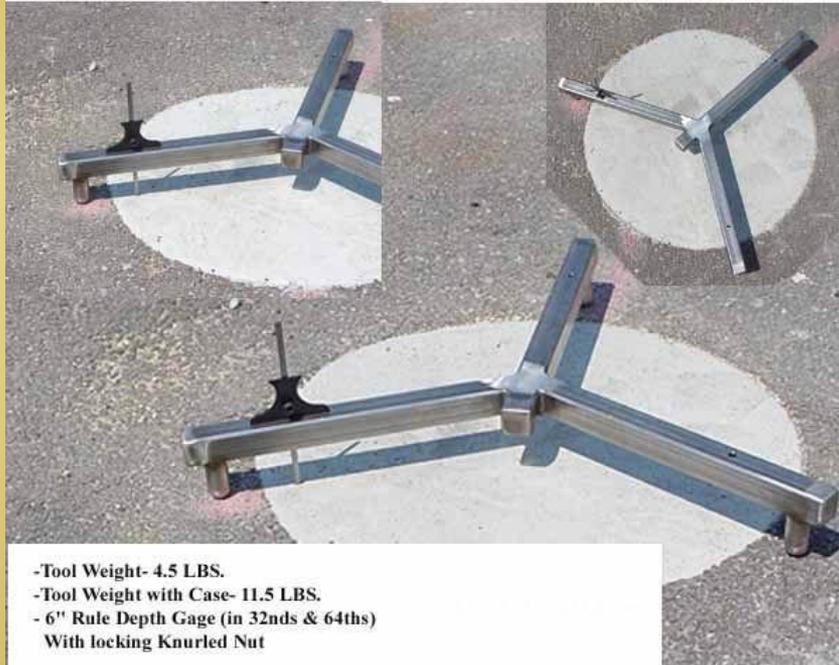
## QA-QC Protocols

### Core Tracking Records

- **Assigned ID number to each core**
- **Address & As-Built sketch**
- **Location to center of core (potentially using GPS)**
- **Record of backfill type, core grout/bonding agent type**
- **Photographic record of finished core replacement**
- **Record of crew performing the work**

# Keyhole Applications Initiative

## QA-QC Protocols



- Tool Weight- 4.5 LBS.
- Tool Weight with Case- 11.5 LBS.
- 6" Rule Depth Gage (in 32nds & 64ths)  
With locking Knurled Nut

## Benefits

- **Fast ! (Typically < 4 hours total)**
- **Less inconvenience to vehicular traffic**
- **No over night plating**
- **Reduced exposure time of workers and traveling public**
- **Road cut is MUCH smaller in size**
- **Controlled and consistent size of opening**
- **Exceeds AASHTO weight bearing standards**
- **No collateral damage to roadway (No Jack Hammer)**
- **Circular hole prevents stress cracks (No square corners)**
- **Less intrusive**
- **Existing material replaced (Same look and feel)**

## Jurisdictional Approvals

**Numerous jurisdictions have approved the use of coring and replacement of the core as a permanent paving technique, including:**

- **City of Detroit**
- **City of Toronto**
- **Penn DOT**
- **Virginia DOT**
- **Maryland DOT**
- **City of Portland**
- **Montgomery Co.**
- **Prince Georges Co.**
- **And many more...**



## Keyhole Applications Initiative

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