

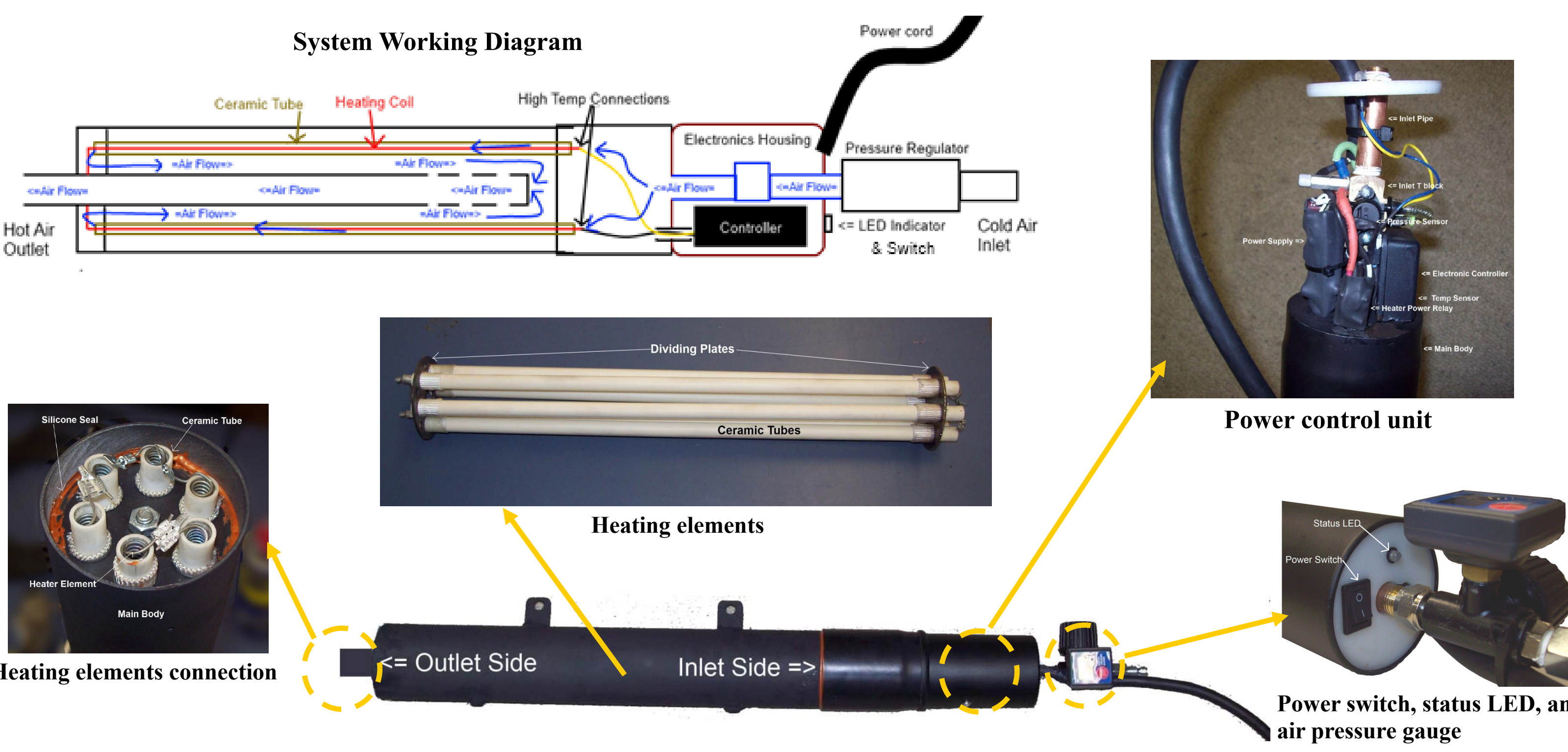
## Introduction & Problems

- Traditional air blasting is less effective in cold weather climates due to de-icing chemicals.
- Labor costs of current crack cleaning/sealing processes are very high.
- Current routing practice is very labor intensive and unsafe for the operators.
- Current working environment is dusty and dangerous due to the debris.
- Current hot air lancing using propane gas is dangerous and overheating the pavement surface.

## Advanced Design of Crack Cleaning Device

### 1. Heat Lance Unit Design

- **Operating Voltage:** 110V-240V (Target 240V)
- **Power rating:** 1152W @ 240VAC
- **Max outlet temp. (expected) :** 1000°F (538°C)
- **Max inlet temp. :** 250°F (121°C)
- **Max operating pressure:** 20 PSI
- **Min operating pressure:** 1 PSI
- **Length:** 30.5" nipple to nipple, body length: 25.5"
- **Diameter:** 3"
- **Weight:** 11.50 LB



### 2. Vacuum Design

- The suction opening is positioned directly behind the rotary attachment at certain angle such that the running attachment will kick debris and particles into the opening of suction hose.
- Relatively larger particles can be collected as well.
- The wider iron guard around the hose opening collects more dust and particles.
- A row of brush is added to the bottom and interior guard to sweep the floor and stop debris from deflected away.
- Specifications: Maximum suction power 7.5" HG (102" H2O); Maximum air flow 210 SCFM

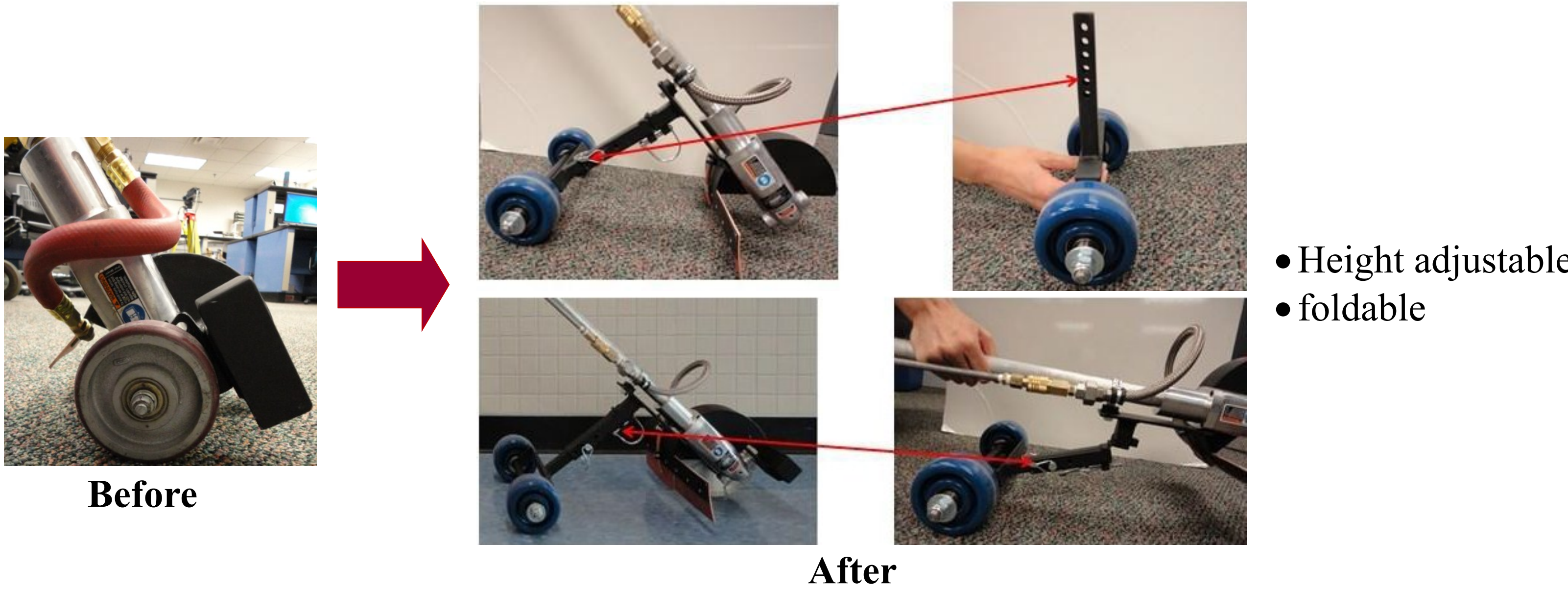


### 3. Ergonomic Shaft Re-design



Comparison of Shaft Configurations (Before-left, After-right)

### 4. Wheel Assembly Re-design



### 5. Air wand Re-design

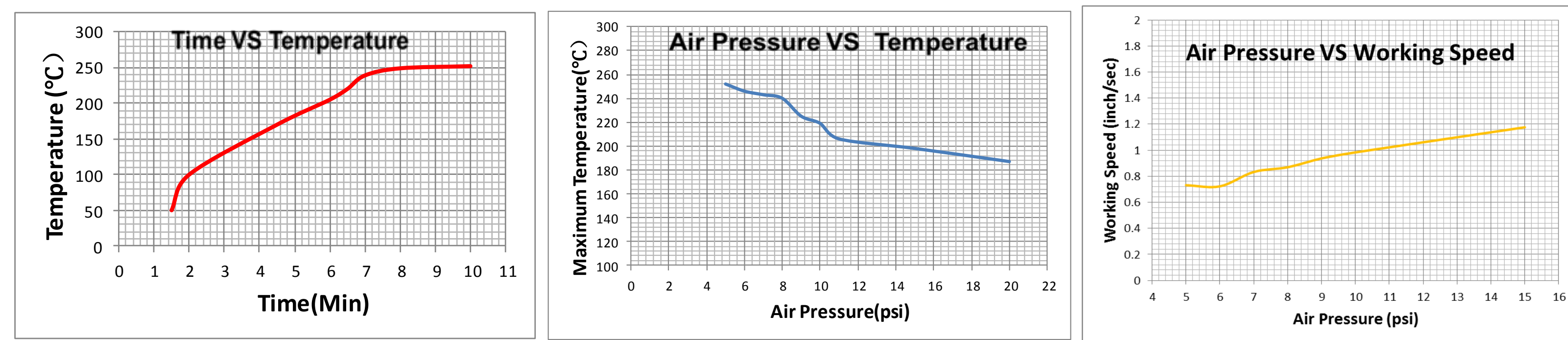
- A detachable air wand is connected to the CCD with easy connection.
- The air wand can be used to clean cracks and pavement surface in two ways.



## Lab Tests

### 1. Heat lance test

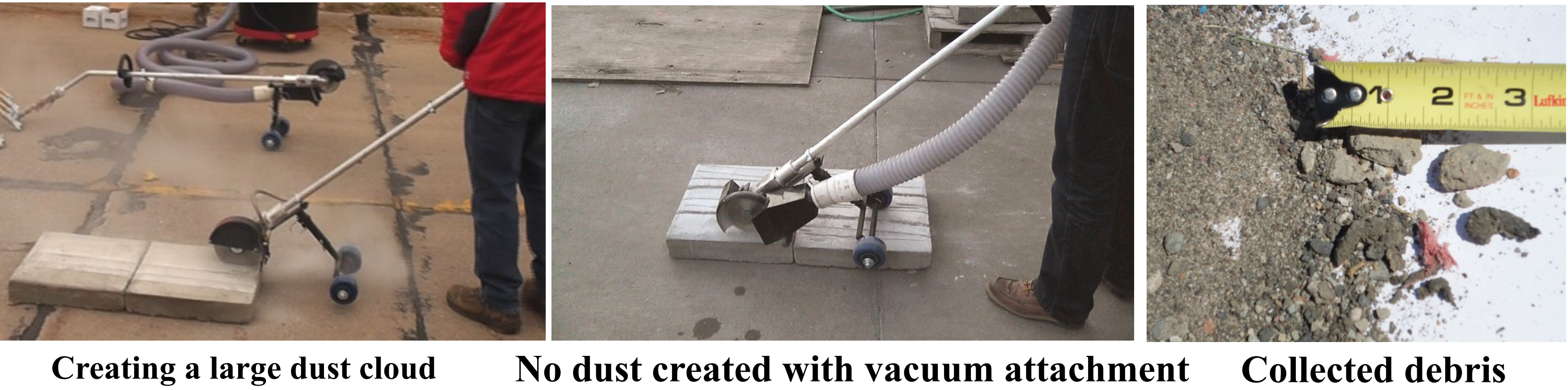
The heat lance was tested outside to evaluate the relationship among air pressure, heated air temperature, and moving speed. The outside air temperature was -1°C (30°F).



#### Test Results:

- 10 minutes to reach the temperature 252°C (486°F).
- The air temperature decreases with the increase of the air pressure.
- Productivity: Up to 15 psi, the working speed was found faster as the air pressure is higher (expecting faster speed with higher pressure)
- \* Our air compressor : 9HP, 4Cycle Engine, CFM @ 100 PSI

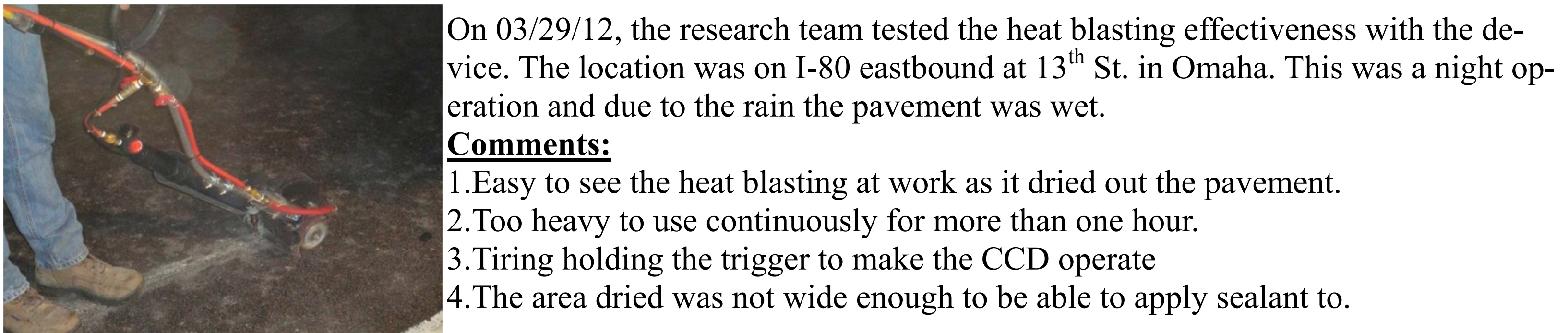
### 2. Vacuum test



- Test vacuum while cutting concrete pavement.
- Without a vacuum unit attached, the running blade yielded a large dust cloud.
- With a vacuum unit attached, the dust was substantially reduced while cutting the concrete surface.

## Field Tests and Demonstration

### 1. Field Test with Nebraska Department of Road (NDOR) District 2



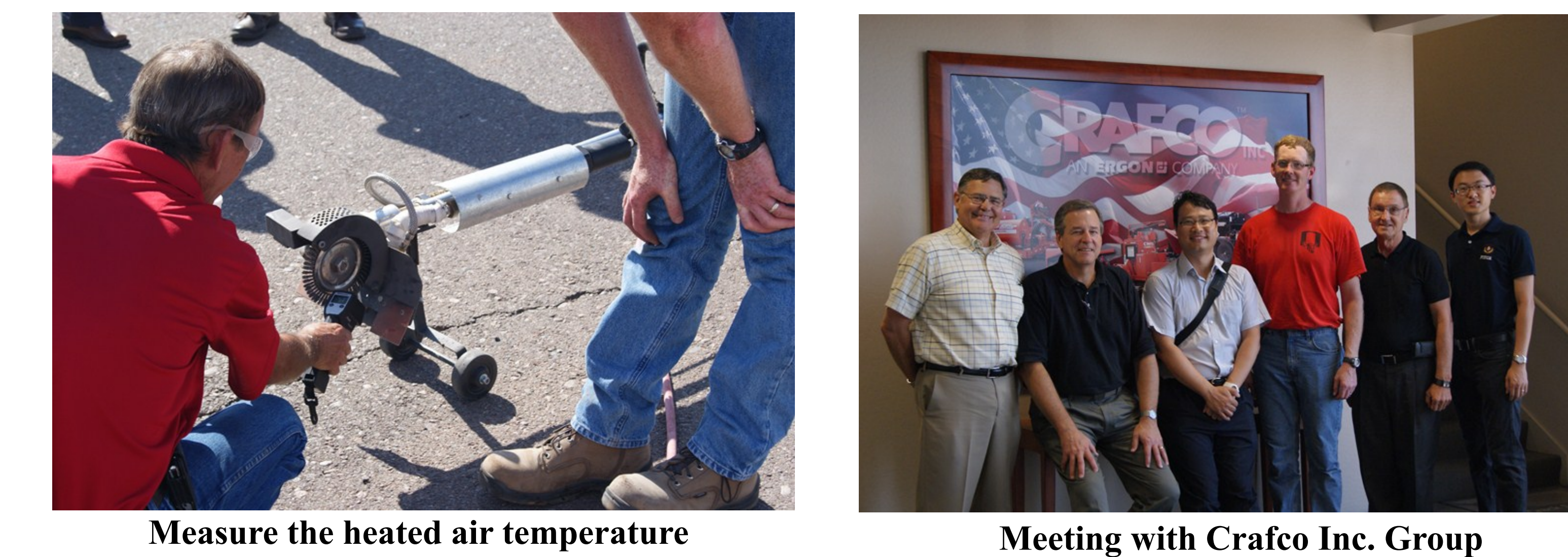
On 03/29/12, the research team tested the heat blasting effectiveness with the device. The location was on I-80 eastbound at 13<sup>th</sup> St. in Omaha. This was a night operation and due to the rain the pavement was wet.

#### Comments:

1. Easy to see the heat blasting at work as it dried out the pavement.
2. Too heavy to use continuously for more than one hour.
3. Tiring holding the trigger to make the CCD operate
4. The area dried was not wide enough to be able to apply sealant to.

### 2. Demonstration at Crafcro Inc.

On 08/02/12, the research team traveled to Crafcro Inc. manufacturing facility to demonstrate the crack cleaning unit in Chandler, Arizona.



### 3. Demonstration at NDOR

In October, two operation and safety training sessions were given to the NDOR crews.

- Outdoor operation of the CCD was performed.
- Vacuum was tested to collect with CCDs.
- All eight NDOR districts will test the units for the entire sealing season (this winter) and provide feedback to the research team afterwards.



## Conclusions

- Very effective solution for routing, hot air blowing, and vacuuming.
- Promising lab & field test results: hot air blowing and vacuuming.
- Positive industry feedback: lightweight, high mobility, endorsed by the state highway maintenance crews
- The Crafcro Inc. shows high interest to commercialize this product.
- Successful demonstrations to NDOR and Crafcro Inc..

## Acknowledgments

A very special thanks to the NCHRP-IDEA program and the Nebraska Department of Roads (NDOR) without their funding this project would not have been possible. (NCHRP-IDEA 159)

