Manhole Frame Adjustment
Problems & Solutions
Acknowledgements

- Infrastructure Canada – NRC, LEED, LCA, LTS
- CIMI – Canada institute for market Intelligence
- Consulate General Canada
- US Government Affairs – APWA
- Burn’s Innovation - 14 Can, 26 US cities interviewed
- Urban Systems - Stantec – AECom – Associated Eng
- SICA
- MMCD
- CPWA - APWA
- BCWWA - AWWA
- City of Kelowna – W&U
Driving Home

- While driving do you avoid manhole covers??
- Problems are world wide
- US statistic – 22 million sanitary manholes; 50% need some form of repair
- Cities with 100,000 people have 14,000 manholes
- 20% manholes need repair due to problems associated with how we adjustment manhole frames
- Poor frame adjustment and methods compound & expand much further than what you see in the road surface!
Problems Completing Adjustments

1. “NO” specification on how to achieve final adjustment
2. Standard drawings not specific to final adjustment

- Frame not designed to be adjustable
- Difficult achieving adjustment – poor methods
- Sticks, stones and washers – poor materials
- Concrete or grout sloughing – poor support
- Injuries to workers, awkward & unstable
- Growing inexperienced & indifferent work culture
- I&I and increased susceptibility to Freeze/Thaw

Current Standards and Specifications >
Click on figure to open
Frames Not adjustable

- Adjustments not conform to the road surface
- Use of poor materials
- Use of poor methods
Worker Problems Adjusting Frames

- Difficult & frustrating; no proper specification or standard
- Difficult achieving accurate adjustment; time consuming
- Inexperienced & indifferent work culture; training needs
- Awkward and heavy with high risk of injury
Problems Placing Concrete

- Concrete and grout slough into manhole opening
- Return to complete grouting between frame and grade ring
- Difficult grouting voids and around poor adjustment materials
- Frame supported by poor materials not concrete
- Adjustment can easily alter during road work & paving
Difficult Methods & Poor Materials Result In Poor Adjustments

- Poor adjustments make paving very difficult
- High – damage to snow plough & frames
- Low – vehicle pounding & structural damage
- Inflow – treatment capacities & environment
- Infiltration – where the frame meets the chimney
- Installed off center - poor access and support
- Drivability – rough and noisy
- Covers being bounced out of the frame
- Trip hazards
- Ultimately results in adjustment failure
- Repair – long term maintenance costs
Poor Adjustment Results In:
Inflow

- Reduced treatment capacity
- Increased pipe cleaning and pump maintenance
- Environment impacts
- Poor drivability
Disappointing New Road

- On-going maintenance problems

PUBLIC PERCEPTION
Poor Adjustments Result In Adjustment Failure

- I&I - asphalt failures and increased maintenance costs
- Sustainability - 50% manholes need repair half way to life expectancy of road surface
- Frame movement – not anchored
- Infiltration between frame and asphalt or grade ring
- H-20 loading?? – point loads and poor structure
- Drivability - vehicle pounding
- Equipment and labour – if these issues were reduced crews could be working on other projects
Adjustment Failure

- Largest contributor to I&I issues
- Largest contributor to road surface failure
- Large contributor to freeze/thaw susceptibility
Poor Concrete Support

- Concrete should be placed homogeneously around and under frame
- Adjustment materials should not impede concrete placement
- Should be provision and requirement for sufficient concrete under frame
Adjustments Not Meet H-20 Load

- Adjustment materials leave point load causing structure damage
- Poor adjustment practices not meet “H” load requirements
- Structure failure most common where the frame meets the chimney
Infiltration From Adjustment Failure

- Severe infiltration where the frame adjustment takes place
History & Why These Problems Exist??

- Adjustment specifications 100 years old
- Adjustment methods 100 years old
- Adjustment specifications, standards and products have not evolved
- Training needs
- Different work culture
- Most technical people not aware of methods
- Adjustment failures have been misunderstood
- People don’t like change
- Who’s responsible – roads or utility??
- Implementing new products and methods is difficult
- Cost
Road Building Technology

The Russell Grader

Improvements!
Manhole Frame & Adjustment Technology 1914, 1970 to 2009

No Improvements!
What's not to understand about weaknesses associated with historical adjustment methods?

Infiltration – do we know exactly where and why before we select a repair method?

Inflow – why?

Expensive technologies and processes only Band-Aids

Rubber and plastic chimney collars, why?

Poly-ethylene spray, why?
What Do We Need?

1. Improved standards
2. Improved specifications
3. Requirement for quality control checks prior to paving
4. “Improved Product” that compliments proper standard & specification

Recommended Standard and Specification >
Click on figure to open
Criteria for the Perfect Product??

- Incorporates any city’s frame
- Provides the ability to achieve accurate adjustment
- Simple to use
- Eliminates corner cutting
- Requires little training
- Adjustable
- Meets “H” load requirements in an adjusted position
- Saves time and money
- Provides concrete support & reduce sloughing
- Exceptional stability
- Eliminate or reduce all maintenance problems such as I&I
- Reduces susceptibility to freeze/thaw
- Provides cost benefit to installation & maintenance
Sustainability
Cost of a Product that:

- Makes life easier
- Improves quality
- Long life cycle
- Re-usable
- Made from recycled material
- Benefits the world
- SAVES MONEY!

PRICELESS!
Basic Business Case

- Based on a city with 14,000 manholes
- Some type of structure failure with 50% of manholes
- 40% frame adjustments do not meet surface tolerance
- 20% adjustments fail or need readjustment
- 20% or 2800 adjustments fail @ $1000 per repair or $1000 per MH for 20 years of crack sealing equates to:
  $2,800,000/14,000 = $200 per MH installed

There are numerous other maintenance problems and costs associated with adjustment procedures!
Innovations – Things to Watch

- Rubber grade rings? – Gimmick!

- Life Saver – Second most expensive ($720 installed), better than shims, effected by temperature and hot asphalt, require large inventory susceptible to corner cutting, opening compromised, (don’t separate) future retro fit expensive, expensive to buy, labour intensive and time consuming.

- Floating casting – Most expensive ($900 installed), install cost with civil and paving crews, labour intensive & heavy, I&I – seal hardens or damaged by crush rock, elevation “critical”, difficult rolling on steep grades/opening compromised, asphalt and base gravel compaction, reacts poorly to asphalt rutting, looses stability as asphalt ages, traffic implications while waiting to pave.

- Set Screw & Support Ring – Least expensive ($650 installed), ensure concrete placed correctly between frame and support ring, thread protection on screws.
Easily Achieve Perfect Adjustment

- SET IT AND FORGET IT!
Reduce Injury & Frustration

- Provides installation & adjustment procedure
- Workers can easily and safely complete adjustments
- Workers have no reason to cut corners
H – Load Requirement

- I&I virtually eliminated
- Reduce susceptibility to freeze/thaw damage
- Strong chimney structure
- Meet H – Load requirement after adjustment complete
- Adjustment should withstand long term vehicle pounding
- Adjustment should out last pavement life cycle
- Adjustment should remain stable during road construction
Sustainable & Reusable

- Faster, easier, less expensive future adjustments
- Reduced repairs throughout the life cycle of a road
- Strong, lasting structure
- Stable! Open roads quicker!
Superior Finish

- Inflow significantly reduced
- Reduce Infiltration; superior structure
- Less asphalt/concrete separation at the frame
- Long lasting structure if the cover drives smooth
- Less public complaints
- Public impressed with new roads
Endorsed by Engineering Firms, Municipal Staff & Contractors

- Field tested
- Endorsed by Workman’s Compensation
- Benefits infrastructure/asset owners and contractors
- Market and engineering analysis – definite need
- Business case confirmed
- Compliments proper standard and specifications