DEPARTMENT OF TRANSPORTATION

Pavement Design Around Utilities – Best Practice

Jeff Stempihar, Principal Investigator
Nichols Consulting Engineers, Chtd.

June 2024

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Final Report 2023RIC09

LRRB
LOCAL ROAD RESEARCH BOARD

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Asphalt concrete pavement surrounding utility structure covers is prone to settlement, cracking, breaking up over time, and potholing, and these distresses are particularly common in wet-freeze climates (e.g., Minnesota). Several factors contribute to their formation, including design requirements, collar material type and cut shape, construction practices, frost heave, and backfill settlement. If not properly maintained, the distressed pavement can lead to ride quality issues and hazards for vehicles and snowplows. Differences in design details and construction practices can result in different performance; however, differences in pavement performance around utility structure covers are not well documented. The main goal of this Minnesota Local Road Research Board (LRRB) project is to fill this knowledge gap by documenting regional agency best practices for adjusting utility covers and patching the surrounding pavement. Information is gathered through a review of existing information, a review of standard details from agencies in and around Minnesota, an agency survey, and follow-up discussions with agencies that are generally satisfied with their practices. No single best practice is identified for design details; however, common themes among agencies include the importance of both inspecting and testing during construction and achieving adequate compaction of all pavement patch layers. This document is developed to assist local transportation agency personnel and engineering consultants in improving design and maintenance of asphalt concrete pavement around utility covers. It highlights successful and unsuccessful regional practices and trends, factors contributing to pavement damage around utility covers, timing of inspections and maintenance, and a framework for evaluating and modifying practice.

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PAVEMENT DESIGN AROUND UTILITIES – BEST PRACTICE

FINAL REPORT

Prepared by:

Sarah Lopez
Jeff Stempihar

Nichols Consulting Engineers, Chtd. (NCE)

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- Bismarck, ND
- Brooklyn Park, MN
- Burlington, ND
- Burnsville, MN
- Chanhassen, MN
- Chaska, MN
- Cloquet, MN
- Detroit Lakes, MN
- Dickinson, ND
- Eden Prairie, MN
- Fargo, ND
- Golden Valley, MN
- Grand Forks, ND
- Hutchinson, MN
- Jamestown, ND
- Minneapolis, MN
- Minot, ND
- Plymouth, MN
- Richfield, MN
- Shakopee, MN
- St. Michael, MN
- Watford City, ND
- Wayzata, MN
- West Fargo, ND
- Williston, ND
- Woodbury, MN
- Eull's Manufacturing, St. Michael, MN
- Madison Metropolitan Sewerage District, Madison, WI
- TKDA, St. Paul, MN
- White Bear Township, MN

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Utility structure covers are typically adjusted to finished grade after either the base course or the surface course of asphalt concrete pavement is placed. In both cases, a relatively small area is removed by sawcut or coring and re-paved after the utility cover has been adjusted. This practice creates an asphalt concrete pavement patch and extra construction joints that are prone to distresses.

Asphalt concrete pavement surrounding utility structure covers (e.g., catch basin inlets, manholes, gate valve covers,) often settles, cracks, or breaks up over time. In addition, potholes frequently form at construction joints between the patch (surrounding the cover) and the roadway pavement as well as at the pavement interface with the utility cover. These pavement distresses (Figure 1) are especially pronounced in cold climates (e.g., Minnesota), can create ride quality issues and hazards for vehicles and snowplows, and often require additional maintenance. They can be attributed to factors such as design requirements, collar material type and cut shape, construction practices, frost heave, and backfill settlement. Differences in design details (e.g., cut shapes, collar material type, frame and cover adjusting materials) and construction practices can result in differences in performance, but pavement performance around utility covers is not well documented, and technology transfer across agencies is difficult.

Figure 1. Examples of common pavement distresses around utility covers (courtesy NCE).

This Minnesota Local Road Research Board (LRRB) project was completed to gain an understanding of regional agencies' best practices for adjusting utility covers and patching surrounding pavements. Information was obtained through a review of existing studies and standard details from agencies in Minnesota and surrounding states, agency surveys, and follow-up discussions.

1.2 DOCUMENT PURPOSE

This document was developed to assist local transportation agency personnel and engineering consultants in improving design and maintenance of asphalt concrete pavement around utility covers. It highlights regional practices and trends, factors contributing to pavement damage around utility covers, successful and unsuccessful regional practices, and timing of inspections and maintenance, and it provides a framework for evaluating and modifying practices. The appendices provide summary notes and key takeaways from discussions with local agencies and an example pavement inspection form.

CHAPTER 2: REGIONAL PRACTICES AND TRENDS

The wet-freeze climate in Minnesota brings with it a unique set of challenges to designing and constructing utility cover adjustments in pavement. Agency standard details from cities in Minnesota and surrounding states with similar climates were reviewed to develop a better understanding of the technologies and practices used to make these adjustments and patch the surrounding pavements. Table 1 provides a summary of the standard detail review. Information from the Maricopa Association of Governments (AzMAG) in Arizona is included because AzMAG suggests a round cut concrete collar, scored radially at quarter-circle points to initiate cracking (Figure 2). A version of the AzMAG detail is used by the City of Flagstaff, Arizona, which experiences extensive freeze thaw cycles.

Table 1. Summary of Utility Structure Cover Adjustment Standard Details

Agency	Revision	Collar Material	Collar Cut Shape	Joint Sealed?	Reinforcement Ring Used?	Adjusting Ring Type	Allowable Adjustment Height	Cover Elevation Relative to Finished Grade
Arizona MAG	2018	Concrete	Round with radial cuts at quarter-circle points	No	Yes	Polypropylene or fiberglass	-	Flush
Chicago, IL	2019	Concrete	Square	Yes	No	Concrete	2” to 8”	-
Coon Rapids, MN	2018	Asphalt	Square for reconstruction, diamond for repairs	No	No	Concrete	2” to 5”	¼” to ½” recessed
Duluth, MN	2013	Concrete	Round	Yes	Yes	HDPE	6” max.	¼” recessed
Eagan, MN	2021	Concrete	-	Yes	Yes	HDPE rings or cast-iron riser or ductile iron riser	3” to 12”	¼” to 3/8” recessed
Fargo, ND	2021	Concrete	Square	-	Yes	HDPE or EPP	-	-
Moorhead, MN	2022	Concrete	Round	-	Yes	HDPE	2” to 8”	¼” recessed
Rochester, MN	2023	Concrete	Round for asphalt concrete, square for concrete	No	Yes	HDPE or concrete	2” to 6”	Flush
St. Cloud, MN	2020	Asphalt	Square	No	No	HDPE	10” max.	¼” recessed
St. Paul, MN	2018	Concrete	Round	No	No	Brick placed radially	0” to 17”	0” to ½” recessed
Whitefish, MT	2019	Concrete	Octagonal	Yes	No	HDPE or concrete	2” to 10”	¼” ± 1/8” recessed

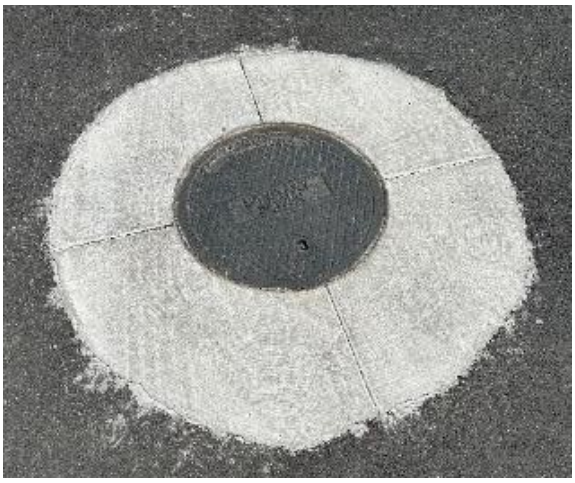

Figure 2. Example concrete collar scored at quarter points to initiate cracking (AzMAG detail) (courtesy NCE).

An electronic survey was distributed in Minnesota and surrounding states through American Public Works Association state chapter mailing lists. The 34 respondents represented 28 local agencies, one engineering consultant, and one utility structure adjustment system manufacturer. Four agencies provided multiple responses with differing information. Approximately 67% of the respondents were from Minnesota, including the two non-agency respondents. One agency was from Wisconsin, and the remaining agencies were from North Dakota. Respondents were asked several questions related to current practices for adjusting utility covers to finished grade as part of pavement rehabilitation and several questions related to performance trends.

During asphalt concrete paving projects, 26 respondents adjust the utility cover assembly prior to paving the final surface lift, while 6 respondents adjust the utility cover assembly after the final surface lift (Figure 3). One "other" response mentioned the addition of steel adjustment rings after each paving lift so that finished pavement does not need to be cut. Another "other" response reported boxing the casting in 6 ft × 6 ft (1.8 m × 1.8 m) concrete after the final surface lift is paved.

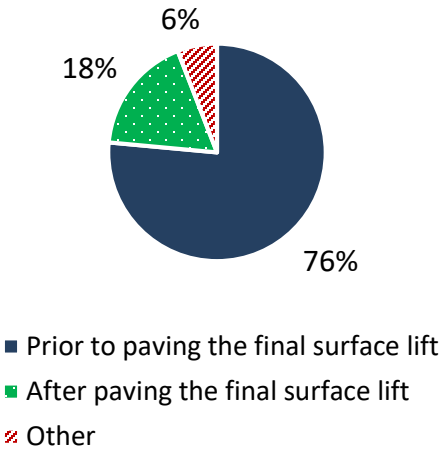

Figure 3. Timing of utility cover adjustment during asphalt concrete paving projects.

Approximately 68% of the respondents reported recessed covers (i.e., lower than finished pavement grade) while approximately 26% stated that covers are flush with the pavement surface (Figure 4). One "other" response stated that covers are flush in concrete and recessed in asphalt, and the second "other" response simply stated "0.25 in." Of the "recessed" covers, 39% are recessed 0.25 in, 26% are recessed 0.50 in, and 13% are recessed 0.38 in. Some respondents reported recess ranges: 0.25 in – 0.5 in (13%), 0 – 0.25 in (5%), and 0 – 0.5 in (4%).

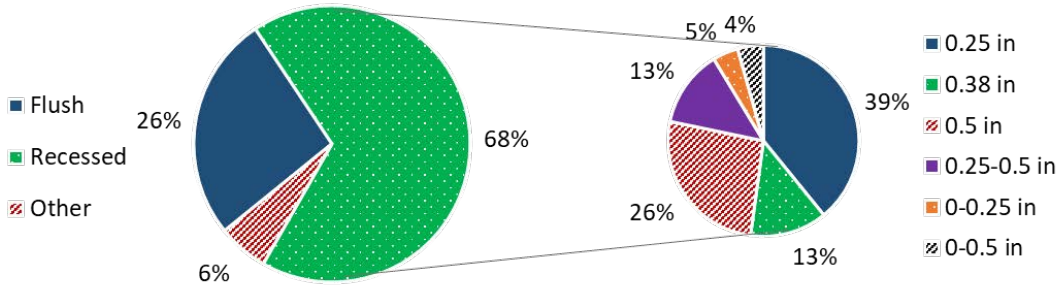

Figure 4. Distribution of elevation adjustment relative to finished grade (left chart) and further breakdown of "Recessed" responses (right chart).

Most respondents (68%) use asphalt concrete for utility collar material (Figure 5). Of these, 74% use a square/diamond collar cut shape, 9% use a round cut shape, and 17% use other cut shapes. Twenty-one percent of respondents use concrete collar material, and of these, 71% use unreinforced concrete and 29% use reinforced concrete (Figure 5).

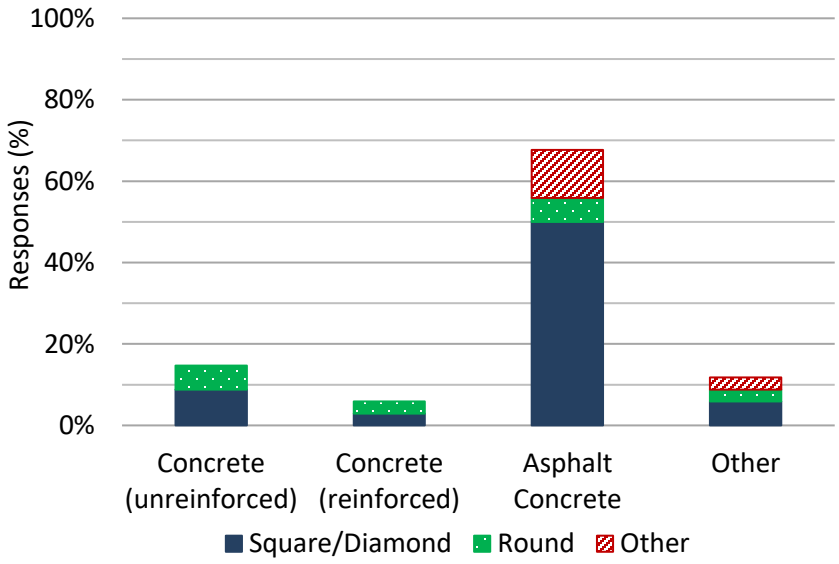

Figure 5. Collar material and cut shape.

Respondents that use concrete as collar material were asked to elaborate on its advantages and disadvantages. The reported advantages included a more stable and durable area around the utility structure cover, smooth transition, better ride quality, and no sharp edges for snow removal equipment to strike. The reported disadvantages included higher cost, construction challenges, and difficulty with later adjustment and repair.

Figure 6 presents the breakdown of responses regarding use of joint sealant, specifications, and frost heave. Most respondents do not use joint sealant between the collar and surrounding pavement. One agency uses tack coat between asphalt lifts and another agency uses fabric between the collar and surrounding pavement. More than half of respondents have specifications for compaction methods for patching around utility covers, and more than half of respondents noted issues with seasonal vertical movement of utility structures.

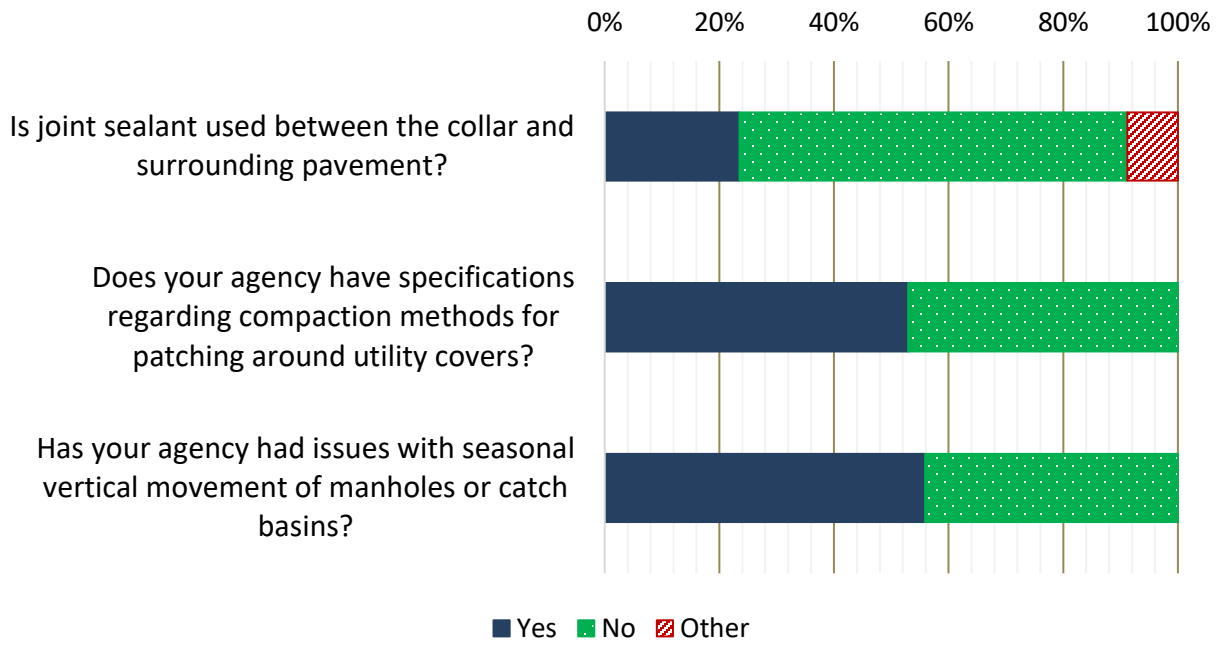

Figure 6. Responses to additional questions.

Methods found to mitigate seasonal vertical movement include:

- Self-leveling “floating” utility structure castings.
- Round cut shape.
- Addressing base material during pavement reconstruction or rehabilitation.
- Recessed utility cover.
- Granular backfill material around the structure.
- Good quality control of compaction around utility structures.

Most agencies assess pavement distress including cracking, settlement, raveling, and potholes via visual inspection. One respondent noted using the U.S. Army Corps of Engineers method.

Five agencies (the Cities of Cloquet, MN, Detroit Lakes, MN, Woodbury, MN, Bismarck, ND, and Fargo, ND) were contacted for more detailed follow-up discussions. These agencies use a variety of utility cover cut shapes, collar materials, repair strategies, and methods to mitigate seasonal vertical utility structure movement. All five reported being satisfied with their current practices. Information from these discussions can be found in Appendix A and is integrated into the following section.

CHAPTER 3: PAVEMENT GUIDANCE AROUND UTILITY COVERS

3.1 FACTORS CONTRIBUTING TO PAVEMENT DAMAGE AROUND UTILITIES

Pavement surrounding utilities is prone to distresses such as cracking, settlement, and potholes (Figure 7). It is important to understand the factors contributing to these distresses to make informed decisions about current and future practices.

In most cases, distresses are the result of a combination of factors including:

- Design details (e.g., cut shape, collar material, utility cover adjustment materials).
- Poor construction practices (e.g., inadequate compaction, lack of testing).
- Backfill settlement over time.
- Climatic factors (e.g., frost heave).
- Traffic loading (if utility cover is in the wheelpath).

Figure 7. Pavement distresses around utility structure covers in Minnesota (courtesy NCE).

3.2 SUCCESSFUL REGIONAL PRACTICES

3.2.1 Collar Material and Cut Shape

When choosing utility collar material and cut shape, no “one size fits all” approach was identified. Factors such as cost, climate, dominant pavement distresses, agency experience, past performance, and material availability should be considered to determine what collar material and cut shape work best for an agency. Many agencies reported success with square/diamond cut asphalt collars, while some reported success with round cut concrete collars. It is important to note that while few agencies use a round cut with a concrete collar, those that do reported success with this method. Figure 8 shows an example of a square cut with asphalt concrete collar and a round cut with concrete collar.

Figure 8. Example of square cut with asphalt collar (prior to paving the surface course) and round cut with concrete collar, after paving the surface course (courtesy NCE).

One concern with the square/diamond cut is that cracking can initiate from planes of weakness that are created at each corner as well as from sawcut overruns into adjacent pavement (Figure 9).

Figure 9. Example of sawcut overrun into adjacent pavement (square patch) (courtesy NCE).

3.2.2 Timing of Cover Adjustment

Utility cover adjustment is typically done either prior to or after paving the final surface lift (Figure 3). Pavement surrounding utility structures is more prone to distress if not raised to grade after paving at least one lift. In fact, one 2004 study showed that over 35% of utility covers that were raised to grade before paving had damaged pavement (Rinne, 2004).

Table 2. Common Timing of Utility Cover Adjustment

Timing of Utility Cover Adjustment	General Order of Steps
After paving the asphalt concrete base course	• Cut out patch. • Adjust utility cover. • Install collar material to asphalt concrete base course grade. • Pave asphalt concrete surface course.
After paving the asphalt concrete surface course	• Cut out patch. • Adjust utility cover. • Install collar material to finished grade. *Note: Success was reported with a round cut and concrete collar. A square/diamond cut was generally not recommended by agencies.*
After paving over the utility cover	• Locate utility cover with GPS coordinates. • Remove patch area by coring or jackhammering. • Adjust utility cover. • Install collar material. *Note: Concrete collar material is typically used with this approach.*
After milling asphalt concrete (Option 1)	• Cut out patch. • Adjust utility cover. • Install collar material. • Pave asphalt concrete surface course.
After milling asphalt concrete (Option 2)	• Install steel utility riser to adjust cover. • Pave asphalt concrete surface course.

3.2.3 Utility Cover Adjustment

Several methods were reported for adjusting utility covers and commercial products are available to help provide a durable and watertight seal. Some agencies noted:

- Use caution with concrete adjusting rings and grout as the grout can fail early.
- Consider non-cementitious adjusting rings (e.g., plastic).
- Steel adjusting risers are an option, especially with mill and overlay projects.

Agencies also stressed the importance of sealing the adjusted portion of the utility cover to help prevent the movement of fines into the structure. The sealing methods reported included using geofabric around the adjusted portion of the structure, casting a concrete collar that encapsulates the entire adjusted portion of the structure, and using commercial products (e.g., plastic adjusting rings).

Some agencies reported success with the use of self-leveling (“floating”) castings in both asphalt concrete and concrete pavements. Floating castings are designed to move with the road surface, staying aligned with finished grade. They do not use a collar and are installed directly into the pavement surface during construction. Figure 10 shows examples of the floating casting concept alongside images of the castings installed in pavement. EJ Group, manufacturers of a “self-level” casting, reports that floating casting can help eliminate frost heave, settlement, localized pavement deterioration, and pavement cracking(EJ Group, 2023). Agencies noted that they can also improve ride quality.

When installed in asphalt pavement, the floating casting consists of two parts: a guide frame and an upper frame. The guide frame keeps the upper frame centered over the utility structure. The upper frame is supported by and moves vertically with the road surface. The casting can be installed in asphalt pavement by paving over the top of it, removing the loose asphalt mix around the casting, lifting the upper frame to finished grade, packing asphalt mix under the lip of the casting upper frame, and seating the upper frame and lid into the pavement with a roller during compaction. When placed in concrete, the assembly also includes a steel sleeve and adjustment brackets to facilitate installation.

Three local agencies surveyed have used floating castings, and all three reported successes with mitigating the effects of frost heave. One of the agencies uses floating castings exclusively, while the other two use them where budgets permit, as the cost of installing these castings is typically higher than more traditional methods.

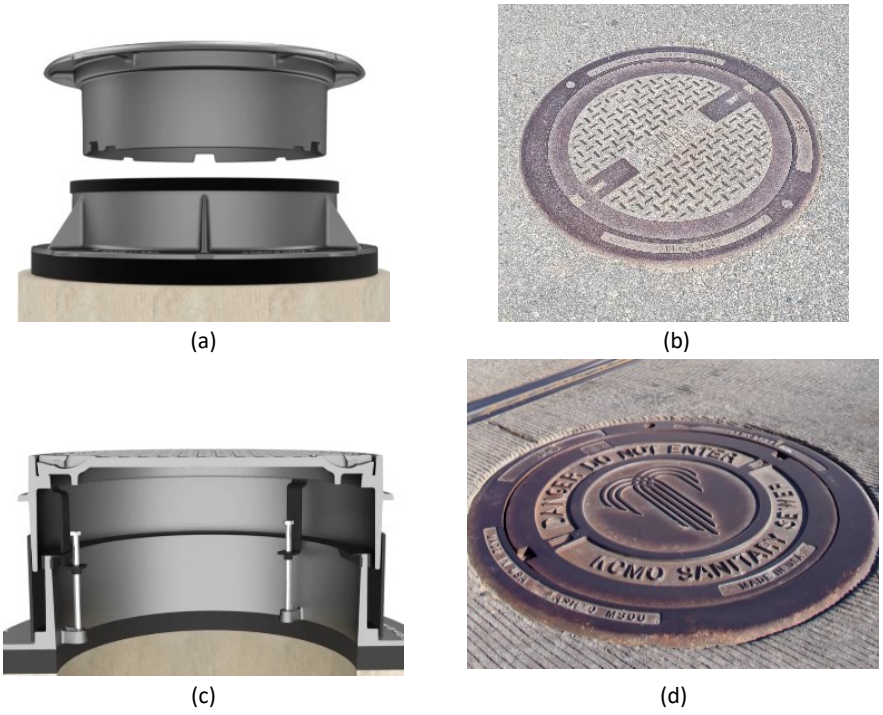

Figure 10. Floating utility structure casting: (a) schematic of assembly for asphalt pavement (ejco.com), (b) assembly placed in asphalt pavement (courtesy City of Fargo, ND), (c) schematic of assembly for concrete pavement (ejco.com), (d) assembly placed in concrete pavement (ejco.com).

Two agencies reported success mitigating the effects of frost heave with a chimney seal (Figure 11). Chimney seals provide a watertight seal between the utility structure casting and the concrete cone supporting it. According to Cretex Specialty Products, the manufacturer of chimney seals used by one of the agencies, chimney seals allow for movement within the confines of the surrounding backfill, providing up to two inches of vertical movement without stretching the material (Cretex Specialty Products, 2023). A watertight seal can help prevent water leaks from intruding into the pavement layer, which may help with frost heave issues or settlement due to migration of fines into the utility structure.

Figure 11. Example of a chimney seal (https://cretexseals.com/product/x-85-external-seal/).

3.2.4 Underlying Material Support

An important element to preventing settlement is to ensure that there is adequate support from underlying material, including subgrade, aggregate base, and backfill. As noted previously, backfill material selection is key. One agency noted that using cement stabilized subgrade and casting the upper portion of utility structures in concrete, which allows the utility structure and subgrade to move monolithically, has mitigated seasonal vertical movement. One agency found the sand cone method to be more accurate and consistent than nuclear density gauge testing when close to the body of the utility structure. Other successful practices noted include:

- Using well-draining granular backfill material around the structure and below gravel sections of the roadway to ensure good drainage and minimize freeze-thaw effects.
- Requiring adequate compaction of the unbound materials.
- Cutting out enough pavement to use proper compaction equipment (e.g., plate compactor).
- Improving inspection and testing when adjusting utility covers and installing collar materials.

One agency provided the following step-by-step construction process for utility cover adjustment and backfill material compaction (Figure 12):

1. Sawcut pavement for utility collar.
2. Loosen unbound material.
3. Excavate unbound material.
4. Expose utility structure.
5. Install and seal adjusting rings.
6. Install casting and lid and wrap with material (e.g., fabric) designed to reduce movement of fines into the structure.
7. Install sand backfill layer (one lift in this case) and compact with 3 passes using a handheld compacter. Perform density testing.

8. Install aggregate base layer and compact. Perform density testing.
9. Prepare area for pavement patch.

Figure 12. Unbound materials compaction sequence as part of utility cover adjustment (courtesy City of Woodbury, MN).

3.2.5 Inspection and Testing

Some agencies reported successfully mitigating pavement issues surrounding utility covers by improving inspection and testing during construction instead of modifying their design approach. Examples include:

- Ensure the utility cover adjustment was performed according to plans and specifications.
- Verify the utility cover adjustment is at the correct grade and cross slope.

- Pay attention to details (e.g., proper sealing, cleaning area before installing patch).
- Conduct density testing on both the backfill material and pavement (patch) to ensure adequate compaction.
- Record the GPS location of utility covers that will be paved over and adjusted later. Check that the location is correctly marked on the pavement to avoid removing pavement from the incorrect area.

3.3 UNSUCCESSFUL PRACTICES

The following were specifically noted as unsuccessful practices:

- Adjusting the utility cover after the final paving lift (unless using a round cut) – typically led to more pavement distresses.
- Using grout with concrete adjusting rings – failed within 5 to 10 years, leading to settlement.
- Using pavement rejuvenators – were ineffective at extending pavement life around covers.
- Testing nuclear density – can be inaccurate when close to the body of a concrete utility structure.

3.4 TIMING OF INSPECTION AND MAINTENANCE

Inspections typically do not focus on the pavement around utility covers, and many agencies only inspect this pavement as part of rehabilitation or reconstruction, or because of public complaint. While it is not always feasible for agencies to conduct dedicated inspections of pavement around utility covers, it can be included as part of a pavement management program. Two agencies surveyed noted that distresses in pavement surrounding utility covers are captured when visual pavement inspections are performed every four years. Agencies can request some detailed inspections on pavement surrounding their utility covers as part of a pavement management system update or can inspect a subset of utility covers (see Appendix B for an example inspection form). This can provide a snapshot of the trends in pavement performance around the utility covers. Alternatively, an agency can implement a public reporting system to alert the agency of larger issues with pavement surrounding utility covers. However, this process will generally only capture issues with failed pavement.

The responding agencies indicated that maintenance on pavement around utilities is typically reactive (i.e., done because of public complaint or snowplow blade damage) rather than proactive. Unless there is an immediate need (e.g., risk for snowplow damage, safety risk), issues with the pavement are typically addressed during the next pavement rehabilitation or reconstruction project. Ideally, maintenance should be proactive rather than reactive, and should include treatments such as crack sealing and patching.

3.5 EVALUATING AND MODIFYING PRACTICE

Evaluating current practice and making changes should follow an iterative process (Figure 13) that allows for agencies to collect feedback from engineers, inspectors, and field personnel before full implementation. It is important to have an internal champion to direct and oversee the process.

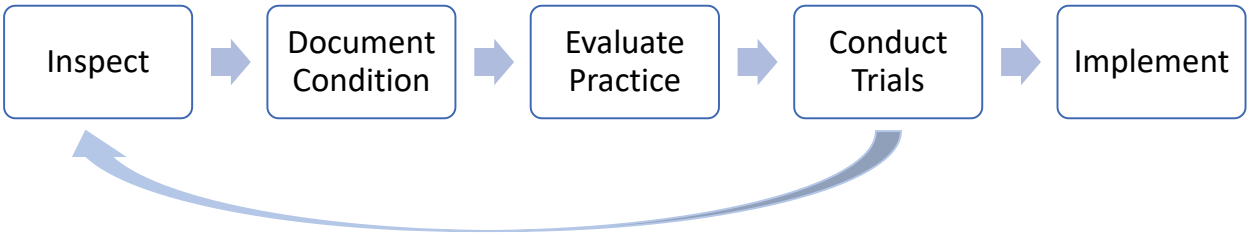

Figure 13. Steps to evaluating and modifying practice.

Inspect: Inspect the current condition of the pavement surrounding utilities and establish a baseline condition. Conduct inspections in a standardized way to accurately establish performance issues and trends (see Appendix B for a sample inspection form). Inspection can be done as part of regular pavement condition surveys or as a standalone inspection effort. It is important to utilize trained personnel to assess pavement conditions. Good quality data will help provide a quantifiable metric that can be used to assess any benefits realized by changes in practice.

Document Condition: Document pavement condition over time and identify trends (e.g., distress versus cut shape or collar material).

Evaluate Practice: Review performance trends. Communicate with other local agencies, learn about their practices, and request their standard details for utility adjustment. Knowledge sharing can lead to innovation and development that may not be achievable through isolated discussions. If considering a new product (e.g., self-leveling cover, chimney seals) talk to the manufacturer and request information from example projects and agency contact information. Contact these agencies directly to get their feedback on the product.

Conduct Trials: Construct trials with new products or processes before full implementation. Go back and inspect, document condition, evaluate, and compare the performance of the trial product or process to current practice.

Implement: Make changes to current practices as warranted. This may include modifying standard details and approving additional products for use. Once these changes are implemented, regularly conduct inspections, and follow the process continually, making changes as necessary.

Table 3 provides a summary of this process.

Table 3. Steps to Evaluating and Modifying Practice.

Step	Details
Inspect	• Develop inspection procedure (e.g., standard process). • Inspect pavement condition around utilities. • Identify predominant distresses (e.g., cracking, settlement).
Document Condition	• Document pavement condition over time. • Identify trends (e.g., distress versus cut shape or collar material).
Evaluate Practice	• Identify successful and unsuccessful practices. • Determine practices that warrant changes. • Evaluate new products or construction processes. • Learn from other agencies. • Request their standard details.
Conduct Trials	• Construct trials (products or processes). • Document experience with these new products or construction processes during the trials. • Re-inspect, document, and evaluate findings.
Implement	• Adopt changes and modify standard details. • Approve products for use. • Monitor performance.

CHAPTER 4: CONCLUSIONS

Asphalt concrete pavement surrounding utility structure covers (e.g., catch basin inlets, manholes, gate valve covers,) often settles, cracks, or breaks up over time. In addition, potholes frequently form at the construction joints between the asphalt concrete patch (surrounding the cover) and the roadway pavement as well as at the pavement interface with the utility cover. These pavement distresses are especially pronounced in cold climates, can create ride quality issues and hazards for vehicles and snowplows, and often require additional maintenance. They can be attributed to factors such as design requirements, collar material type and cut shape, construction practices, frost heave, and backfill settlement.

Differences in design details (e.g., cut shapes, collar material type, frame and cover adjusting materials) and construction practices can result in differences in performance. However, the performance of pavements around utility covers is not well documented, and technology transfer across agencies is difficult.

This Minnesota LRRB project was completed to gain an understanding of and document regional agency best practices for adjusting utility covers and patching the surrounding pavement. Information was obtained through a review of existing studies and standard details from agencies in Minnesota and surrounding states, an agency survey, and follow-up discussions with agencies that were generally satisfied with their practices.

Agencies reported successes with various design and construction practices, and no single best practice was identified for pavement cut shape, collar material, or utility cover adjustment method. Themes that were common among responses were the importance of inspection and testing during construction and the importance of achieving adequate compaction of all pavement patch layers (i.e., subgrade, base, and asphalt concrete).

This document was developed to assist local transportation agency personnel and engineering consultants in improving design and maintenance of asphalt concrete pavement around utility covers. It highlights regional practices and trends, factors contributing to pavement damage around utility covers, successful and unsuccessful regional practices, and timing of inspections and maintenance, and it provides a framework for evaluating and modifying practice.

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APPENDIX A:
AGENCY FOLLOW-UP DISCUSSIONS SUMMARIES AND DETAILS

CLOQUET, MN

Survey Results

Question	Response
When is the utility frame and cover adjusted during asphalt concrete paving projects?	After paving the final surface lift.
What is your standard adjustment elevation for castings relative to finished pavement surface?	Recessed
What is the standard recessed distance (in inches) of the adjusted utility cover below finished grade?	0.25 inch
What collar material does your agency use around an adjusted utility cover as part of pavement rehabilitation?	Concrete (reinforced)
In your experience, what are the advantages of concrete collars, specifically regarding ride, settlement, and future maintenance?	Concrete conforms to the profile of the road cross slope. Improved ride quality if in the wheel path.
In your experience, what are the disadvantages of concrete collars, specifically regarding ride, settlement, and future maintenance?	Constructing concrete collars can be a challenge for inexperienced contractors.
What shape is the collar cut in the pavement to adjust a utility cover?	Round
Has the round cut had an impact on collar performance and/or ride quality, and has testing for ride quality been conducted? Please explain.	Round cut seems to make for smooth transition and good ride quality. There are no sharp edges for snowplows to strike.
Is joint sealant used between the collar and surrounding pavement?	Yes
What are typical pavement distresses observed around adjusted utility covers, and what test method(s) does your agency use to measure pavement distress?	Concrete adjustment is typically made at the same time as road reconstruction, so no focused inspections.
Does your agency have specifications regarding compaction methods for patching around utility covers?	No
Has your agency had issues with seasonal vertical movement of manholes or catch basins?	No
Is there anything else you would like to mention in relation to pavement design around utility covers (e.g., successful practices, challenges)?	Manholes and valves must be located by the contractor with GPS and marked by contractor after paving to find hole in the manhole plate to get the drill arbor started.

Follow-up Discussion

- **Given your agency's current practice, are you satisfied with the performance of the pavement around adjusted utility covers?** Yes. Pavement distresses around the utility covers are minimal.
    - **Any recommended improvements?** No. The key is to have good communication with the contractor.
    - **Design changes being considered?** May use a rubberized crack sealant.
- **Have any other design types (round/square cut) or material types (concrete/asphalt) been used in the past?** Have tried to pave the base layer, cut the manhole cover out of the base layer,

adjust it to finish grade, and pave over the top of the adjusted manhole. Only the round cut has been used.
    - **Reason for change to current practice?** Settlement and cracking around manhole cover with previous method.
    - **What worked/did not work well?** When using the previous method, the manhole collar did not conform to the cross section of the road, and it was a challenge to get the paver to match up with it. Often, it needed to be dug out and readjusted, compromising compaction. The pavement then settled and broke up around the manhole cover.
- **What are the biggest pavement maintenance challenges around these covers?** The biggest challenge is when the contractor places the utility cover too high, and it sticks up above the pavement.
    - **How are repairs handled?** Utility structures are repaired during mill and fill or road reconstruction projects. When a manhole frame and cover is repaired, the base and other aggregate are removed to get to the top of the manhole structure. The top of the collar is then rebuilt, and concrete is placed down to the manhole structure. Public complaints are how manholes needing repair are often identified.
    - **Do you conduct focused inspections at the utility covers?** No.
- **What else can you share about the current practice to inform this project?** Emphasize with the contractor and have language in the specification to remove any material that falls into the manhole or valve so that there are no maintenance issues later, such as dirt in the manhole that causes a sewer backup. Use as accurate a GPS location as possible to properly locate the utility cover center before coring.

Key Takeaways

- A utility cover adjustment with round cut after paving the final surface lift has worked best for the City of Cloquet. It provides a smoother transition between the concrete collar and surrounding asphalt pavement.
- To help mitigate settlement, the pavement base material is removed, and the concrete collar material is placed down to the body of the utility structure (i.e., below the adjustment rings that were installed).
- Good communication with contractors is key to success. Ensure they understand to remove material that falls into the manhole.
- Accurate GPS location is important when locating the manhole prior to coring.
- Rubberized crack sealant is being considered for the future.

DETROIT LAKES, MN

Survey Results

Question	Response
When is the utility frame and cover adjusted during asphalt concrete paving projects?	After paving the base course lift.
What is your standard adjustment elevation for castings relative to finished pavement surface?	Recessed
What is the standard recessed distance (in inches) of the adjusted utility cover below finished grade?	0.375 inch
What collar material does your agency use around an adjusted utility cover as part of pavement rehabilitation?	Asphalt
What shape is the collar cut in the pavement to adjust a utility cover?	Square/Diamond
Is joint sealant used between the collar and surrounding pavement?	No
What are typical pavement distresses observed around adjusted utility covers, and what test method(s) does your agency use to measure pavement distress?	Cracking and raveling due to lack of compaction. Shadow settlement from adjustment made right before paving.
Does your agency have specifications regarding compaction methods for patching around utility covers?	No
Has your agency had issues with seasonal vertical movement of manholes or catch basins?	Yes
What methods have you found to help mitigate seasonal vertical movement of manholes or catch basins?	Floating castings in some cases.

Follow-up Discussion

- **Given your agency's current practice, are you satisfied with the performance of the pavement around adjusted utility covers?** Yes. The current practice is to place base course asphalt lift, raise the casting to the base lift, adjust with metal ring to final lift thickness, and pave the surface lift.
    - **Any recommended improvements?** Floating castings in concrete pavement.
    - **Design changes being considered?** Floating castings in asphalt pavement have been placed on a trial basis.
- **Have any other design types (round/square cut) or material types (concrete/asphalt) been used in the past?** In the past, a square/diamond cut with concrete collar was used.
    - **Reason for change to current practice?** It did not work well in asphalt pavements. There was differential movement between the concrete collar and the surrounding asphalt pavement.
    - **What worked/did not work well?** Inserting metal adjusting rings into the casting prior to paving the surface lift of asphalt concrete has worked well lately. Floating castings have been successful in concrete pavements, although they are expensive. Floating

castings have only been used on a trial basis in asphalt pavements; however, they have not been inspected since installation. There is one that has been in place for 2-3 years.

- **What are the biggest pavement maintenance challenges around these covers?** It is difficult to adjust utility castings to match finished grade, and if they do not match up exactly, it becomes a major source of public complaint. Floating castings could help alleviate this issue. Frost heave and settlement results in distress as well.
    - **How are repairs handled?** They generally occur because of public complaints. The repair strategy depends on the severity of the issue. A paving ring may be used for settlement cases. If the issue is considered low severity, a patch may be done.
    - **Do you conduct focused inspections at the utility covers?** They are inspected as part of construction projects and improvement projects, but they are not inspected as part of a routine pavement condition survey.
- **What else can you share about the current practice to inform this project?** Wherever possible, gate valve boxes and manholes are being placed outside of the wheel path, so there is less of a risk of complaint if they deteriorate. Make sure the contractor cuts a large enough area out of the base course pavement to allow for good compaction equipment (e.g., plate compactor) to recompact the aggregate base around the adjusted casting. Some contractors try to remove a smaller area to save on patching materials, which results in poor compaction around the raised utility cover.

Key Takeaways

- Overall, satisfied with square/diamond cut asphalt collar that is installed after paving the base course. Ensure a large enough area is cut out to allow for proper compaction of patch material.
- Floating castings have been used in concrete pavement and work well but are costly. The City of Detroit Lakes is experimenting with floating castings in asphalt pavement.
- Square/diamond cut concrete collars were unsuccessful.
- Repair strategy depends on severity – patching done for low severity and a metal paving ring may be inserted for settlement issues, followed by patching.
- Whenever possible, utility structures are placed outside of the wheel path.
- The respondent was interested in guidance in the form of different (effective) options for constructing pavement around utility cover adjustments. They also would like to see examples of what has and has not worked.

WOODBURY, MN

Survey Results

Question	Response
When is the utility frame and cover adjusted during asphalt concrete paving projects?	Prior to paving the final surface lift
What is your standard adjustment elevation for castings relative to finished pavement surface?	Recessed
What is the standard recessed distance (in inches) of the adjusted utility cover below finished grade?	0.375 inch
What collar material does your agency use around an adjusted utility cover as part of pavement rehabilitation?	Asphalt
What shape is the collar cut in the pavement to adjust a utility cover?	Square/Diamond
Is joint sealant used between the collar and surrounding pavement?	No
What are typical pavement distresses observed around adjusted utility covers, and what test method(s) does your agency use to measure pavement distress?	Frost heaving, pavement settlement, cracking, and raveling.
Does your agency have specifications regarding compaction methods for patching around utility covers?	No
Has your agency had issues with seasonal vertical movement of manholes or catch basins?	Yes
What methods have you found to help mitigate seasonal vertical movement of manholes or catch basins?	Recessed manhole casting elevation at construction, quality control review of compaction around manholes.
Is there anything else you would like to mention in relation to pavement design around utility covers (e.g., successful practices, challenges)?	The City's standard detail plates and specifications can be found at woodburymn.gov by using the search term "standard detail plates".

Follow-up Discussion

- **Given your agency's current practice, are you satisfied with the performance of the pavement around adjusted utility covers?** Yes, but work quality during construction is key.
    - **Any recommended improvements?** No.
    - **Design changes being considered?** No, rather than changing standards, a lot of effort has been put into improving inspection and quality of work.
- **Have any other design types (round/square cut) or material types (concrete/asphalt) been used in the past?** Concrete has been considered but has been found to lead to settlement or there is a difference in elevation between the concrete collar and the surrounding asphalt pavement. Concrete adjusting rings have been used previously, but now plastic adjusting rings are used.
    - **Reason for change to current practice?** Settlement or "lip" formed between collar and surrounding pavement.

    - **What worked/did not work well?** The concrete adjusting rings did not work well. Groult would fail 5 to 10 years after construction, which led to settlement. Plastic adjusting rings are performing better.
- **What are the biggest pavement maintenance challenges around these covers?** When a mill and overlay is done, the manhole is adjusted by cutting a diamond around the utility cover, patching the base layer, and then paving the overlay over the patch up to the utility cover. If there is a grade issue with the utility cover, a square/diamond shape is recut, and this second patch is prone to settlement and raveling.
    - **How are repairs handled?** If collars are failing, adjustments are made, and the collar patched. Collars are repaired and adjusted as part of any reconstruction project, and this is the preferred method.
    - **Do you conduct focused inspections at the utility covers?** PCI ratings are done once every 4 years, as part of the pavement management program. Distresses around manholes are noted. City does not wait until complaints are called in to address issues

  What else can you share about the current practice to inform this project? The City has tried pavement rejuvenators around manhole covers and gate valves. This was used if any patching was done or if adequate compaction was not achieved to seal the pavement and extend the life around the castings, but it was found to be ineffective.

  Settlement, cracking, or raveling has been correlated to what is done at construction, so there has been a large focus on improved inspection and testing around utility covers at construction.

  Density tests on backfill and on asphalt surrounding the structure are conducted during construction. The sand cone method to assess density of backfill material (under the pavement patch) was found to be more accurate and consistent than nuclear density gauge tests. The nuclear gauge can give inaccurate results close to large concrete structures. Well-draining granular materials are used adjacent to the structures and below the gravel sections of the roadway to ensure good drainage and minimize freeze-thaw movement of the patched pavement around the adjusted utility cover. Some settlement still occurs but the effect is minimized by using well-draining backfill and the city's compaction methods.

Key Takeaways

- The square/diamond cut with an asphalt concrete patch after paving the base lift works well.
- Work quality during construction is a key element to success. A significant amount of effort has gone into improving inspections and the quality of work rather than focusing on changing designs. This has resulted in reduced distress around utility covers.
- Plastic adjusting rings have worked better than concrete adjusting rings.
- Distresses around manholes are noted during the PCI visual inspection every 4 years.
- Pavement rejuvenators have been used but have been shown to be ineffective at extending pavement life around castings.

- Better accuracy and consistency has been found using sand cone method rather than nuclear density gauge testing (when close to the body of a utility structure).
- Utilizing well-draining granular fill adjacent to the structures and below gravel sections of the roadway has been found to ensure good drainage and minimize freeze-thaw effects.

BISMARCK, ND

Survey Results

Question	Response
When is the utility frame and cover adjusted during asphalt concrete paving projects?	Prior to paving the final surface lift.
What is your standard adjustment elevation for castings relative to finished pavement surface?	Recessed
What is the standard recessed distance (in inches) of the adjusted utility cover below finished grade?	0.25 inch
What collar material does your agency use around an adjusted utility cover as part of pavement rehabilitation?	In asphalt reconstruction areas, use unreinforced concrete to 1.5 to 2.0 inches below final surface elevation and the top lift of asphalt paved over concrete patch.
What shape is the collar cut in the pavement to adjust a utility cover?	Square/Diamond
Is joint sealant used between the collar and surrounding pavement?	Yes
What are typical pavement distresses observed around adjusted utility covers, and what test method(s) does your agency use to measure pavement distress?	Cracking due to frost heave. A visual inspection is conducted to measure pavement distress along with laser crack measuring systems to calculate a PCI value, which is entered into PAVER.
Does your agency have specifications regarding compaction methods for patching around utility covers?	Yes
Has your agency had issues with seasonal vertical movement of manholes or catch basins?	Yes
What methods have you found to help mitigate seasonal vertical movement of manholes or catch basins?	Cement stabilization of the subgrade and cast upper portion of manholes in concrete – manhole and subgrade move monolithically.
Is there anything else you would like to mention in relation to pavement design around utility covers (e.g., successful practices, challenges)?	Try to utilize floating castings in concrete pavement. In areas where this is not possible, Cretex 85 chimney seals are used.

Follow-up Discussion

- **Given your agency's current practice, are you satisfied with the performance of the pavement around adjusted utility covers?** Yes.
    - **Any recommended improvements?** No.
    - **Design changes being considered?** The agency has been focused on improving structural integrity of roads, as roads paved prior to 2012 were constructed with inadequate base thickness. Therefore, aside from replacing utility castings when reconstructing a road, there are no planned design changes.
- **Have any other design types (round/square cut) or material types (concrete/asphalt) been used in the past?** The current design is a 6 x 6 foot concrete square/diamond and have not tried

a round cut. Floating castings have been in concrete roadways. The Cretex X-85 chimney seal is used to encapsulate the adjusted frame and cover in cases where floating castings are not used.

  - **Reason for change to current practice?** During road reconstruction, existing manhole castings typically had concrete risers and were subjected to settlement or frost heave. These castings have been replaced with floating manhole castings or are filled completely with concrete and riser rings.
  - **What worked / did not work well?** Simply setting a casting down on a structure and paving around did not work well. Floating castings and chimney seals have worked well.
  -

- **What are the biggest pavement maintenance challenges around these covers?**
  - **How are repairs handled?** Public Works maintains the pavement around utility covers. Typically, a cold mix or DuraPatch is used as a stop-gap measure. Standalone repairs are not made to the pavement around utility covers until the next pavement project.
  - **Do you conduct focused inspections at the utility covers?** Focused inspections are not conducted at the utility covers; however, visual pavement inspections are performed every four years on the street network as part of the pavement management program.

Key Takeaways

- A 6 x 6 foot square/diamond concrete collar is used successfully in asphalt pavements. The concrete patch is installed after paving the base layer of asphalt concrete and the concrete patch is left 1.5 to 2.0 inches below the final surface elevation. The top lift of asphalt is paved over the concrete patch.
- Stop gap maintenance is used to address distresses around utility covers and full repairs are typically done as part of a larger project (e.g., reconstruction).
- Chimney seals and floating castings have worked well. Floating castings are used in concrete pavements, and in cases where they cannot be used, a Cretex X-85 chimney seal is used.
- Focused inspections are not conducted at the utility covers; however, visual pavement inspections are performed every four years on the street network as part of the pavement management program.

FARGO, ND

Survey Results

Question	Response
When is the utility frame and cover adjusted during asphalt concrete paving projects?	Prior to paving the final surface lift.
What is your standard adjustment elevation for castings relative to finished pavement surface?	Flush
What collar material does your agency use around an adjusted utility cover as part of pavement rehabilitation?	Floating or self-leveling casting such as EJ 1205 Self Level
What shape is the collar cut in the pavement to adjust a utility cover?	Floating or self-leveling casting such as EJ 1205 Self Level
Is joint sealant used between the collar and surrounding pavement?	No
What are typical pavement distresses observed around adjusted utility covers, and what test method(s) does your agency use to measure pavement distress?	None
Does your agency have specifications regarding compaction methods for patching around utility covers?	Yes
Has your agency had issues with seasonal vertical movement of manholes or catch basins?	Yes
What methods have you found to help mitigate seasonal vertical movement of manholes or catch basins?	The City previously experienced issues with this but has not seen the same issues after transitioning to floating or self-leveling castings such as the EJ 1205 Self Level for asphalt pavement. For concrete pavement, a floating casting such as Neenah R-1955-1 is used.
Is there anything else you would like to mention in relation to pavement design around utility covers (e.g., successful practices, challenges)?	Use floating or self-leveling castings.

Follow-up Discussion

- **Given your agency's current practice, are you satisfied with the performance of the pavement around adjusted utility covers?** Yes.
    - **Any recommended improvements?** No.
    - **Design changes being considered?** No.
- **Have any other design types (round/square cut) or material types (concrete/asphalt) been used in the past?** Diamond/square cut with concrete collar. Transitioned to the EJ self-level for asphalt pavement and Neenah R-1955-1 for concrete pavement over the past 5-10 years. Round cut with concrete has also been used.
    - **Reason for change to current practice?** Significant settlement.
    - **What worked / did not work well?** EJ self-level and Neenah R-1955-1 have worked well.

- **What are the biggest pavement maintenance challenges around these covers?** With the old round cut manhole design, the manhole structure does not move and everything adjacent settles. It creates issues for public works crews.
    - **How are repairs handled?** Round cut with concrete collar is used only for quick repairs where manholes have been damaged by snowplows. During mill and overlays, the manhole is retrofitted with the self-level casting.
    - **Do you conduct focused inspections at the utility covers?** No, repair is likely a result of public complaints.
- **What else can you share about the current practice to inform this project?** There is a lot less pavement cracking and breaking when using floating castings versus fixed castings. The process for installing the EJ 1205 Self Level casting involves paving the top lift over the top of the casting, removing the loose asphalt concrete mixture, lifting the casting up to finished grade, and packing asphalt mix under the lip of the casting. The roller sets the cover flush while compacting the asphalt concrete.

Key Takeaways

- The City of Fargo transitioned to floating castings 5-10 years ago from concrete square/diamond cut collars and are satisfied with performance. The floating casting is adjusted to final elevation just after paving the final lift and seated into the compacted pavement with the roller.
- The EJ 1205 Self Level is used in asphalt pavement and the Neenah R-1955-1 is used in concrete pavement.
- Round cut concrete collars are used to fix utility covers damaged by snowplows and self-leveling castings are installed during the next major pavement project.

APPENDIX B: EXAMPLE INSPECTION FORM

UTILITY STRUCTURE PAVEMENT CONDITION SURVEY SHEET

Street Name:	Road Classification:
From: To:	Inspector: Inspection Date:

GPS Coordinates:
Utility Cover Type (Circle): Manhole / Catch basin / Gate valve / Other
Collar Material (Circle): Asphalt / Concrete / Other
Collar Shape (Circle): Round / Square / Other

CONDITION	Yes	No	**REPAIR STRATEGY**	Yes	No
Settlement			Crack seal		
Potholes			Patch		
Cracking			Adjustment		
Other (specify)			Other (specify)		
Overall condition	Good / Fair / Poor (Circle)		Additional notes on repair strategy:		
Additional notes on condition:					

GPS Coordinates:
Utility Cover Type (Circle): Manhole / Catch basin / Gate valve / Other
Collar Material (Circle one): Asphalt / Concrete / Other
Collar Shape (Circle one): Round / Square / Other

CONDITION	Yes	No	**REPAIR STRATEGY**	Yes	No
Settlement			Crack seal		
Potholes			Patch		
Cracking			Adjustment		
Other (specify)			Other (specify)		
Overall condition	Good / Fair / Poor (Circle)		Additional notes on repair strategy:		
Additional notes on condition:					