

City of Ramsey
Agenda
Public Works Committee
Tuesday, January 21, 2020
5:30 pm
Lake Itasca Room, 7550 Sunwood Drive NW

1. **Call to Order**
2. **Citizen Input**
3. **Approve Agenda**
4. **Approve Minutes**
 1. Approve the following meeting minutes.
 1. Public Works Committee meeting minutes dated November 19, 2019.
5. **Committee Business**
 1. Receive Overview of Framework for Water Efficiency Grant Program and Consider Recommending Adoption of Resolution #20-018 to Enter into Clean Water Fund Grant Agreement with Metropolitan Council to Receive Grant Funds
 2. Consider City Council Recommendation to Indefinitely Suspend Pavement Sealcoating Program
 3. Consider City Council Recommendation to Accept Feasibility Report for 2020 Pavement Overlay Improvements, Improvement Project No. 20-02
6. **Committee/Staff Input**
 1. Receive Update on Bunker Lake Boulevard Reconstruction - Armstrong Boulevard to Ramsey Boulevard
 2. Staff Updates on Improvement Projects and Items of Interest
 3. Review Future Topics Calendar
7. **Adjournment**

Public Works Committee

4. 1.

Meeting Date: 01/21/2020

Submitted For: Grant Riemer, Engineering/Public Works

By: MaryJo Warner, Engineering/Public Works

Title:

Approve the following meeting minutes.

1. Public Works Committee meeting minutes dated November 19, 2019.

Purpose/Background:

Purpose: To review and approve meeting minutes.

Background: Attached are the meeting minutes for review.

Timeframe:

5 minutes.

Observations/Alternatives:

n/a

Funding Source:

n/a

Recommendation:

To review and approve meeting minutes dated November 19, 2019.

Action:

Motion to approve meeting minutes dated November 19, 2019.

Attachments

November Minutes

Form Review

Inbox	Reviewed By	Date
Mark Riverblood	Mark Riverblood	01/13/2020 03:19 PM
Bruce Westby	Bruce Westby	01/14/2020 01:37 PM
Grant Riemer	Grant Riemer	01/14/2020 01:45 PM
Kurt Ulrich	Kurt Ulrich	01/16/2020 09:57 AM
Form Started By: MaryJo Warner		Started On: 01/13/2020 11:12 AM
Final Approval Date: 01/16/2020		

**PUBLIC WORKS COMMITTEE
CITY OF RAMSEY
ANOKA COUNTY
STATE OF MINNESOTA**

The Public Works Committee conducted a regular meeting on Tuesday, November 19, 2019, at the Ramsey Municipal Center, 7550 Sunwood Drive NW, Ramsey, Minnesota.

Members Present: Chairperson Mark Kuzma
 Councilmember Jeff Menth
 Councilmember Chris Riley

Also Present: Public Works Superintendent Grant Riemer
 Parks and Assistant Public Works Superintendent Mark Riverblood
 City Engineer Bruce Westby

1. CALL TO ORDER

Chairperson Kuzma called the regular meeting of the Public Works Committee to order at 5:36 p.m.

2. CITIZEN INPUT

There was none.

3. APPROVE AGENDA

Motion by Councilmember Menth, seconded by Councilmember Riley, to approve the agenda, as presented.

Motion carried. Voting Yes: Chairperson Kuzma, Councilmembers Menth and Riley. Voting No: None.

4. APPROVE MINUTES

4.01: Approve October 15, 2019, Meeting Minutes

Motion by Councilmember Riley, seconded by Councilmember Menth, to approve the following minutes:

Regular Meeting Minutes dated October 15, 2019

Motion carried. Voting Yes: Chairperson Kuzma, Councilmembers Riley and Menth. Voting No: None.

5. COMMITTEE BUSINESS

5.01: Consider Replacing Monument and Shelter Roof at Rivers' Bend Park and HVAC Replacement at Central Park

Parks and Assistant Public Works Superintendent Riverblood stated that the purpose of this case is to consider a recommendation to City Council for authorization to perform maintenance/replacement activity for two structures at Rivers' Bend Park, and one of three HVAC systems at Central Park's buildings. Funding is request to be allocated from the City's Capital Maintenance Fund (not the Park Trust Fund) and therefore is being brought to the Public Works Committee, because the project funding source is limited, and also to be used for other (non-park) capital maintenance needs of the community. In 2017, the Council expanded the scope of this fund (previously entitled Park Maintenance Fund) to allow use for other non-park capital maintenance needs. The facilities this case discusses may be considered higher priority maintenance items.

Parks and Assistant Public Works Superintendent Riverblood stated that if the Committee recommends replacement of the three items utilizing the Capital Maintenance Fund, staff would proceed to obtain competitive quotes consistent with the City's Purchasing Policy for re-roofing the hex shelter at Rivers' Bend and also the HVAC replacement at Central Park. The HVAC system is anticipated to cost less than \$15,000; the roof replacement to a standing seam steel roof with trim, with sandblasting and sealing the underside and support columns at less than \$18,000. Should the costs be consistent with the estimates, staff will proceed upon City Council ratification of the Public Works Committee recommendation. For the monument replacement at Rivers' Bend, the replacement cost is unknown, as neither the design nor specifications are fully understood at this time. The cost may be between \$8,000 to \$15,000, or more. Staff proposes utilizing the approved sign and streetscape guide and amending these examples to something suitable for the park. This project would subsequently be routed for Council consideration and approval via the Park and Recreation Commission. The Capital Maintenance Fund is proposed for funding in a total amount for the two projects in an amount not to exceed \$33,000. This does not include the park monument sign, which would advance for consideration separately. Staff recommends replacing the HVAC system and roof shelter as described.

Councilmember Riley commented that the monument sign clearly needs to be replaced. He noted that as future signs are replaced, there could then be similar entrance signs installed at those parks for consistency.

Parks and Assistant Public Works Superintendent Riverblood agreed that staff would continue to review parks signs as they are in need of replacement to find something consistent but also appropriate for the scale of the park. He noted that there may be costs savings in bundling the Rivers' Bend Park monument sign with the City monument sign that will be installed at Bunker Lake Boulevard and 47.

Councilmember Menth commented on the possibility of vandalism with a wooden sign.

Parks and Assistant Public Works Superintendent Riverblood referenced a steel sign that was installed at another location and has not experienced any vandalism. He noted that option could be reviewed as well and perhaps that become a standard for community park signs.

Motion by Councilmember Riley, seconded by Councilmember Menth, to recommend to City Council the replacement of the HVAC system at Central Park, and roof shelter at Rivers' Bend Park as discussed, at a not to exceed cost of \$33,000 from the Capital Maintenance Fund.

Motion carried. Voting Yes: Chairperson Kuzma, Councilmembers Riley and Menth. Voting No: None.

Councilmember Riley noted that these are maintenance items for parks that already exist. He stated that there has been discussion that parks are not always as up to date as desired and asked if there are other park projects that should be considered to ensure they are usable and long lasting.

Parks and Assistant Public Works Superintendent Riverblood explained that only so many projects can be managed at one time. He noted that the projects with the highest needs have been brought forward first. He noted that the proposed budget for 2020 includes a \$90,000 line item for trail maintenance in order to keep pace on the needed improvements. He noted that Ford Brook Park is proposed to receive updated playground equipment in 2020.

5.02: Consider Recommending City Council Approval to Solicit Requests for Proposals to Prepare Plans and Specifications for Bunker Lake Boulevard/CSAH 116 Improvements, Improvement Project #20-03

City Engineer Westby stated that the purpose of this case is to consider recommending City Council approval to solicit Requests for Proposals to prepare plans and specifications for Bunker Lake Boulevard/CSAH 116 Improvements, Improvement Project #20-03. In April of 2005, a Joint Powers Agreement (JPA) was executed between the City of Ramsey and Anoka County defining required public works improvements related to the Ramsey Town Center development, now referred to as The COR. Two amendments have been executed since, one in February of 2009, and the other in February of 2012. A copy of the JPA, including the two amendments were included in the case.

City Engineer Westby stated that the required public works improvements, which total slightly more than \$13,000,000 in 2005 dollars, are generally intended to be constructed in four separate phases per the JPA. Individual project cost summaries are included in Schedules A through C. The JPA outlines the requirements of each party as related to the design and construction of the improvements, allowable use and access to County-owned properties and highways, and other terms and conditions. Phase 1 identifies required improvements to Ramsey Boulevard from Highway 10 to 1,000 feet north of Bunker Lake Boulevard including expansion to a four-lane divided highway with turn lanes and signal system modifications at Highway 10, railway crossing upgrades, and signal systems installed at Sunwood Drive and Bunker Lake Boulevard. This was had been completed. Phase 2 identifies required improvements to Armstrong Boulevard from Highway 10 to 1,000 feet north of Bunker Lake Boulevard including expansion

to a four-lane divided highway with turn lanes and signal system modifications at Highway 10, railroad crossing upgrades, and signal systems installed at Sunwood Drive and Bunker Lake Boulevard. This work has been completed. Phase 3 is one of the larger and more costly improvements required by the JPA. This work includes the expansion of Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard to a four-lane divided highway with turn lanes and construction of signal systems at Center Street and Sunwood Drive. This project was estimated to cost \$3,170,109 in 2005. This work has not been completed. It was originally intended to be completed in 2007 based on anticipated development, but was delayed when development slowed in the late 2000's. Phase 4 identifies required improvements to Sunfish Lake Boulevard from Highway 10 to 1,000 feet north of Bunker Lake Boulevard including expansion to a four-lane divided highway with turn lanes and signal system modifications at Highway 10, railway crossing upgrades, and a signal system installed at Bunker Lake Boulevard. This work has been completed.

City Engineer Westby stated that Anoka County Highway Department staff recently informed City staff that they want to expand Bunker Lake Boulevard to a four lane divided highway all the way to Armstrong Boulevard in anticipation of the need for a reliever route due to the work proposed to Highway 10 through the cities of Coon Rapids (adding a third lane to Highway 10 in each direction) and Anoka (the Anoka Solution improvements). Anoka County is starting to explore their right-of-way needs related to expanding Bunker Lake Boulevard between Sunfish Lake Boulevard and Ramsey Boulevard, and asked that the City of Ramey begin designing the required improvements for Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard per the JPA. He stated that in speaking with Economic Development Manager Sullivan, because of the use of TIF it would be recommended to complete the project in 2021. City staff is in the process of developing a Request for Proposals (RFP) to solicit engineering services for the preparation of plans and specifications for improvements to Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard. Staff is prepared to present a draft RFP to the City Council on December 10, 2019, and to request authorization to solicit proposals directly to engineering companies as selected by Anoka County. Staff therefore requests that the Public Works Committee recommend City Council approval of this request.

Chairperson Kuzma asked if the speed would change.

City Engineer Westby confirmed that would be part of the traffic study.

Councilmember Menth asked and received confirmation that the estimated cost of \$5,000,000 would only apply to the section from Armstrong to Ramsey Boulevard.

Councilmember Riley asked why the City would be responsible for paying and improving a County road. He asked if there is something historical that relates to the creation of that JPA.

City Engineer Westby stated that he could review information from the past to determine where that decision came from.

Councilmember Riley stated that he would want to better understand the reasoning for the JPA and why the financing and construction of the County road would fall to the City.

City Engineer Westby stated that he will do his best to find that information in preparation for bringing this case forward to the City Council in the future.

Parks and Assistant Public Works Superintendent Riverblood stated that perhaps part of the discussion should be what would happen if the City did not move forward with this project. He noted that there may be related impacts to the Highway 10 project as this would be a detour route for that project.

City Engineer Westby agreed that would be a concern to him, in that Bunker Lake Boulevard will be a detour route for Highway 10.

Councilmember Riley reviewed some of the answers he would want from the County. He noted that if the City is responsible for building and financing the improvements, he would think the City should have additional say in the allowed access points onto the roadway.

Chairperson Kuzma asked if there is a timeline for this process.

City Engineer Westby replied that the County is hoping to have the City segment and County segment completed by 2022. He noted that while there is no connection to the projects and they can be done independently, it may be helpful to have one segment completed before the other. He confirmed that the item does not have to move forward to the Council on December 10th.

Chairperson Kuzma confirmed the consensus of the Committee for the additional information requested to be brought back to the Committee before considering moving this item forward.

Councilmember Riley noted that once the questions are answered, it may make sense to bid the two segments together as one project, even if the City is funding one segment.

Motion by Councilmember Riley, seconded by Councilmember Menth, to direct staff to gather additional information on the history on the conditions of the JPA and discuss options with Anoka County related to renegotiating the JPA, working together to find efficiencies, and opportunities for an additional access onto Bunker Lake Boulevard.

Motion carried. Voting Yes: Chairperson Kuzma, Councilmembers Riley and Menth. Voting No: None.

6. COMMITTEE / STAFF INPUT

6.01: Update on New PW Campus

Public Works Superintendent Riemer reported that staff visited two sites (Elk River and Chanhassen). He highlighted items that he liked from each of the locations as well as input he received from the staff at those locations. He noted that he will be visited Woodbury the following week. He stated that the draft RFP was sent to the City Attorney today for review and

once approved would be sent out for bids. He hoped that a design team would be brought on in January, noting that it would follow a similar process as the process to select RJM.

Councilmember Menth provided input on electrical services.

Councilmember Riley commented that the underbody wash bay seemed to make sense. He asked if the Ramsey police would use the public works facility for washing.

Public Works Superintendent Riemer commented that if the facilities were available, he would think the police would most likely want to use them.

Councilmember Riley stated that he is confident that staff will be the most knowledgeable on the elements that will be needed.

Parks and Assistant Public Works Superintendent Riverblood stated that he found it useful to go on the tours not only to see the sites in action but also to obtain input from those staff members. He commented that the designated meeting spaces and conference rooms for morning meetings will be helpful. He noted that Chanhassen also uses some of those spaces for voting precincts.

6.02: Staff Updates on Improvement Projects and Items of Interest

City Engineer Westby provided updates on City improvement projects, Anoka County improvement projects, and MnDOT improvement projects.

Regarding the COR Infiltration Basin project, City Engineer Westby discussed the two soil stockpiles on site. One stockpile includes approximately 8,000 cubic yards of clean sand, and the other includes just under 12,000 cubic yards of sandy topsoil. He said the clean sand can be used as structural fill on City-owned properties in The COR, and that Staff is developing plans for such use and that this work can be completed in 2020. He added that the sandy topsoil has very little value to the City since it cannot be used as structural fill and would generally cost more to haul and stockpile elsewhere than it would cost to import new material. It was the consensus of the Committee that the City should retain the stockpile of clean sand for use in further developing The COR, and that staff could continue discussions with the River Walk Village contractor, and/or other contractors or developers, to remove the sandy topsoil stockpile as soon as possible. The consensus of the Committee was that if the topsoil cannot be used in a timely and cost-effective manner to prepare The COR for development, the topsoil may instead be offered to builders, contractors and/or developers at no cost to allow for its removal as soon as possible.

City Engineer Westby provided an update on other items of interest.

Councilmember Riley asked for an update on the sealcoat study.

City Engineer Westby reported that staff has collected data and is tabulating the results to present to the Committee in January.

Chairperson Kuzma noted that a December meeting is not needed.

Motion by Councilmember Menth, seconded by Councilmember Riley, to cancel the December meeting.

Motion carried. Voting Yes: Chairperson Kuzma, Councilmembers Menth and Riley. Voting No: None.

6.02: Review Future Topics Calendar

City Engineer Westby provided a brief review.

7. ADJOURNMENT

Motion by Councilmember Menth, seconded by Councilmember Riley, to adjourn the Public Works Committee meeting.

Motion carried.

The regular meeting of the Public Works Committee adjourned at 6:57 p.m.

Respectfully submitted,

Grant Riemer
Public Works Superintendent

Drafted by Amanda Staple
TimeSaver Off Site Secretarial, Inc.

Public Works Committee

5. 1.

Meeting Date: 01/21/2020

By: Chris Anderson, Community
Development

Title:

Receive Overview of Framework for Water Efficiency Grant Program and Consider Recommending Adoption of Resolution #20-018 to Enter into Clean Water Fund Grant Agreement with Metropolitan Council to Receive Grant Funds

Purpose/Background:

The City of Ramsey has been awarded \$28,000 in grant funds through the Metropolitan Council's 2019-2022 Water Efficiency Grant Program (the "Program") for use in a rebate program. As the name of the Program implies, the purpose of the grant is to implement water efficient technologies to reduce the demand on water supply.

There are two (2) primary financial requirements of the Program. First, the municipality must contribute twenty-five percent (25%) of the grant award, which equates to \$9,340, Second, that rebate recipients must also have a financial contribution (e.g. the grant funds and the City contribution cannot entirely cover the cost of the purchase). Other important eligibility requirements include the rebate recipient being a municipal water customer (this means that anyone on a private well is not eligible), only applicable to replacement devices (meaning that new construction is not eligible), and the rebate is only applicable for the cost of the device and its installation, excluding any owner labor costs.

Timeframe:

Staff estimates 20 minutes for the presentation and questions.

Observations/Alternatives:

While the funds are provided through the Metropolitan Council via the Clean Water, Land and Legacy Amendment, grant recipients are responsible for developing their own program. Staff from the Engineering, Utilities, Community Development and Administration Departments met to discuss the framework for a rebate program. While it was clear that more efficient irrigation controllers would likely provide the biggest water savings, it was acknowledged that that alone would exclude a number of otherwise eligible property owners (all properties that do not have in-ground irrigation systems). Thus, it was agreed to also consider WaterSense labeled toilets as another option for rebates.

During the summer months, the greatest demand for water comes from irrigation. Therefore, replacement of older, clock-timer irrigation controllers with a WaterSense labeled smart controller is one of the eligible rebate options. Additionally, an irrigation audit, which helps ensure an irrigation system is operating efficiently and accurately, conducted by a WaterSense certified irrigation professional, is another eligible rebate option. If residents take full advantage of this part of the Program, it could result in an estimated savings of approximately 1 million gallons of water (based on numbers provided by the Metropolitan Council from the 2015-2017 Water Efficiency Grant Program).

As previously noted, Staff wanted to ensure that any municipal water customer (excluding new construction/new development) had an opportunity to realize both water savings and financial savings. Thus, another option available for those customers is a rebate for the replacement of older toilets with a WaterSense labeled toilet. If residents take full advantage of this part of the Program, it could result in an estimated savings of about 900,000 gallons of water (again, based on numbers provided by the Metropolitan Council from the 2015-2017 Water Efficiency Grant Program).

The rebates would be available on a first come first served basis, as long as funds last (or until the close of the program, which is June 30, 2022). Rebates for an individual device can be up to \$200, and cumulatively, shall not exceed \$500 per metered water supply customer. The water supply customer shall be responsible for the sales tax on the device, thus satisfying the requirement that they have a financial investment in the upgrade.

There is a wide range of price points for qualifying devices (both WaterSense labeled smart controllers and toilets). The intention is to incentivize the water efficiency upgrades significantly by having the rebate cover as much of the device cost as possible while also attempting to spread the rebates out across a number of households. There are a number of these devices that could be entirely covered by the rebate amount; however, there are also eligible devices that greatly exceed the rebate maximum. Thus, the cap on the rebate amount will help spread the funds out to benefit more property owners.

Administration of the rebate program will be coordinated by the Community Development and Engineering Departments, but will also include Finance Staff as well for issuance of the rebates. Per the required Grant Agreement, the City will have to provide quarterly reporting to the Metropolitan Council. Reporting forms will be provided by Metropolitan Council staff and is assumed to include: property address, property type (residential/commercial), device replaced, number of devices, grant amount per device, estimated annual water savings, municipal contribution, and eligible grant amount (rebate amount per device minus municipal contribution).

At their January 13, 2020 meeting, the Environmental Policy Board reviewed this case and provided support with moving forward. They did, however, note a desire for the City to offer a similar program for any property owner, regardless of whether they were a municipal water customer or not. They acknowledged that those on private wells are not eligible for this grant, but if this program is successful, it should be considered a pilot program the City could build and expand upon in the future with the goal for further reducing demand on groundwater.

Alternatives

Alternative 1: Motion to recommend the City Council authorize the execution of the Clean Water Fund Grant Agreement with the Metropolitan Council and accept the \$28,000 Water Efficiency Grant. A Smart Irrigation Rebate Program has been on the Environmental Policy Board's Work Plan since 2017 and in 2019 it was added to the City Council's Strategic Plan. This grant will help accomplish that action from both plans. Furthermore, if this program proves to be valuable and effective, it could serve as a blue print for an expanded program that also includes those on private wells. Staff supports this option.

Alternative 2: Motion to recommend the City Council not execute the Clean Water Fund Grant Agreement and not accept the grant funds. If the City wants to implement any sort of incentive program to reduce the demand on drinking water supply, this action would result in the City fully funding any such program.

Funding Source:

Funding for this program would consist of three sources: \$28,000 from the Water Efficiency Grant from the Metropolitan Council, \$9,340 from the City's Water Fund (this is equivalent to the required 25% municipal contribution), and any rebate participant would cover the sales tax on the purchase of the device (thus satisfying the requirement for the rebate participant to have a financial contribution in the program).

Recommendation:

The Environmental Policy Board (EPB) reviewed this information at their January meeting and recommended City Council adopt Resolution #20-018 to enter into the Clean Water Fund Agreement with the Metropolitan Council to accept the \$28,000 grant to implement a water efficiency rebate program.

Action:

Motion to recommend the City Council adopt Resolution #20-018 to enter into the Clean Water Fund Grant Agreement with the Metropolitan Council and to accept the \$28,000 grant to implement a water efficiency rebate program.

Attachments

[Metropolitan Council Grant Program Guidelines](#)

[City of Ramsey Application](#)

[Metropolitan Council Grant Acceptance Letter](#)

[Clean Water Fund Grant Agreement](#)

[Draft EPB Meeting Minutes Dated January 13, 2020](#)

[Resolution #20-018](#)

Form Review

Inbox	Reviewed By	Date
Tim Gladhill	MaryJo Warner	01/16/2020 04:31 PM
Bruce Westby	MaryJo Warner	01/16/2020 04:31 PM
Grant Riemer	MaryJo Warner	01/16/2020 04:31 PM
Kurt Ulrich	Kurt Ulrich	01/16/2020 04:37 PM
Form Started By: Chris Anderson		Started On: 01/13/2020 08:23 AM
Final Approval Date: 01/16/2020		

Metropolitan Council Water Efficiency Grant Program



Overview

The Metropolitan Council (Council) will implement a water efficiency grant program effective September 30, 2019 to June 30, 2022. Grants will be awarded on a competitive basis to municipalities that manage municipal water systems. The Council will provide 75% of the program cost; the municipality must provide the remaining 25%. Municipalities will use the combined Council and municipality funds to run their own grant or rebate programs.

Grants will be made available in amounts with a minimum of \$2,000 and a maximum of \$50,000. Grantees will be required to provide estimated water savings achieved through this program for Clean Water, Land & Legacy Amendment reporting purposes.

Legislative Directive - Minnesota 2019 Session Law

\$375,000 the first year and \$375,000 the second year are for the water demand reduction grant program to encourage municipalities in the metropolitan area to implement measures to reduce water demand to ensure the reliability and protection of drinking water supplies. Fiscal year 2020 appropriations are available until June 30, 2021, and fiscal year 2021 appropriations are available until June 30, 2022.

Grant Program Goal

The goal of the water efficiency grant program is to support technical and behavioral changes that improve municipal water use efficiency in the seven-county metropolitan area.

Critical Points to Remember

- The applying municipality must be a water supplier
- New construction and new developments are not eligible
- Funds are for rebates or grants only; consulting and city staff time are ineligible
- Combined Council and municipality funds cannot pay for 100% of an eligible activity's cost
- A portion of each eligible activity's cost must be paid by the property owner
- Grant recipients must display the Clean Water, Land and Legacy Amendment logo and the Metropolitan Council logo on program-related web pages and paper communications

Grant Program Structure: Administration and Funding

The Water Efficiency Grant Program will be administered by Metropolitan Council Environmental Services (MCES) and will be funded with \$750,000 appropriated by the 2019 Minnesota Legislature. Grant applications will be reviewed and ranked by the MCES Water Supply Planning Unit staff.

Grants are only for water efficiency programs offering rebates or grants to property owners who are customers of the municipal water supply system and who replace specified water using devices with approved devices that use substantially less water.

Grants will be awarded to municipalities in amounts ranging from \$2,000 to \$50,000 for providing rebates or grants to property owners. Municipalities will be responsible for the design and operation of their rebate or grant program and its details. Grant payments to the municipality will be for 75% of approved program amounts. The municipality must provide the remaining 25% of the program cost. Municipality rebates or grants are eligible for reimbursement on device replacements conducted September 30, 2019 through June 30, 2022.

Here is an example showing the grant funding design:

Metropolitan Council Grant Amount	\$15,000
Municipality Match	\$5,000
Municipality Grant/Rebate Program Total	\$20,000

Eligibility

Per legislative language, the grant program is limited to municipalities in the seven-county metropolitan area.

Municipalities eligible per above must apply to participate and, if approved, sign a standard Council Grant Agreement, before any eligible rebates or grants can be submitted for reimbursement. Agreements shall require that municipalities:

- Entirely pass through grants received (as is being done by MCES)
- Verify purchase of devices to receive grants
- Retain records and cooperate with any audits
- Conduct all communications with property owners and ensure all written communications to property owners include both the Clean Water, Land and Legacy Amendment and the Metropolitan Council's logo
- Provide quantitative information for state reporting purposes

Eligible water efficiency devices consist of the following:

- Toilet replacement with a US EPA WaterSense labeled toilet
- Irrigation controller replacement with a US EPA WaterSense labeled controller
- Clothes washing machine replacement with an US DOE Energy Star labeled clothes washing machine
- Irrigation spray sprinkler body replacement with a US EPA WaterSense labeled spray sprinkler body
- Irrigation system audit by an Irrigation Professional certified by a US EPA WaterSense program

Expenses eligible for reimbursement are the out-of-pocket cost of the device and its installation only, not to include any owner labor costs. In addition, new construction and new developments are ineligible, as this program is intended as a current infrastructure replacement program.

Application Process

- Applicants must be municipal water suppliers
- Municipalities will submit MCES supplied application form by September 30, 2019. Required information includes:
 - the municipality's rebate or grant program design and work plan
 - proposed examples of communications to property owners
 - requested total grant amount
 - estimated annual amount of water saved by the applying municipality

- Application form is available at: <https://metro council.org/Wastewater-Water/Funding-Finance/Available-Funding-Grants.aspx>
- Submit competed application to: brian.davis@metc.state.mn.us
- Metropolitan Council will notify municipalities of grant awards and provide grant agreements by December 2, 2019.

Proposal Selection Criteria

In the event that funds requested exceed funds available, the following criteria will be used to determine the amount granted to a given municipality:

- Municipalities that are supplied 100% with groundwater
- Municipalities with identified water supply issues in Master Water Supply Plan Community Profiles or Local Water Supply Plans
- Municipalities' ratio of peak monthly water use to winter monthly water use
- Municipalities' average residential per capita water use
- The order in which applications are received and until grant funds are completely committed

Funding Process and Reporting Requirements

- Utilizing forms provided by MCES, the following information must be reported on a quarterly basis:
 - Number, type and amount of rebates or grants provided to property owners, along with each property address
 - Estimated annual gallons of water saved per device installation
 - Municipality matching funds disbursed
 - Number of unmet funding requests from property owners, if any
- Upon review and confirmation of the above information, MCES will process a grant payment in the amount of 75% of approved total rebates or grants for the reporting period.
- MCES will provide confirmation of grant balances available upon request and reserves the right to amend grant agreements, in collaboration with grantee municipality, if quarterly reporting indicates rebate or grant programs will not fully utilize grant awards within the grant period.

Qualified Activities

- Toilet replacement with a US EPA WaterSense labeled toilet:
http://www.epa.gov/WaterSense/product_search.html
- Irrigation controller replacement with a US EPA WaterSense labeled controller:
<https://www.epa.gov/watersense/product-search>
- Clothes washing machine replacement with an US DOE Energy Star labeled clothes washing machine:
<https://www.energystar.gov/productfinder/product/certified-clothes-washers/results>
- Irrigation spray sprinkler body replacement with a US EPA WaterSense labeled spray sprinkler body
<https://www.epa.gov/watersense/product-search>
- Irrigation system audit by an Irrigation Professionals certified by a US EPA WaterSense program
<https://www.epa.gov/watersense/find-pro>

Reporting Example

Community	Property Street Address	Property Type	Device Replaced	Cost per Device	# of Devices	Rebate or Grant per Device	Est. Annual Water (Gal) Saved Per Device	Total Rebate or Grant	Municipality Contribution	Eligible Grant Amount
Anytown	652 Silvis St	Residential	Clothes Washer	\$624.60	1	\$150.00	3,000	\$150.00	\$37.50	\$112.50
Anytown	1952 Ingram Way	Residential	Irrigation Controller	\$199.99	1	\$100.00	8,800	\$100.00	\$25.00	\$75.00
Anytown	630 Gibbons Ave	Residential	Clothes Washer	\$599.90	1	\$150.00	3,000	\$150.00	\$37.50	\$112.50
Anytown	4424 Barriger Blvd	Residential	Toilet	\$168.00	1	\$50.00	4,000	\$50.00	\$12.50	\$37.50

Metropolitan Council Water Efficiency Grant Application Form

Applicant Information:

Municipality: _____

Municipal Utility: _____

Mailing Address: _____

Primary Contact Information: Municipality primary authorized representative (all correspondence regarding the Water Efficiency Grant Program should be addressed to individual named below):

NAME: _____

TITLE: _____

STREET: _____

CITY, ZIP: _____

PHONE: _____

EMAIL: _____

Secondary Contact Information: Municipality secondary authorized representative:

NAME: _____

TITLE: _____

STREET: _____

CITY, ZIP: _____

PHONE: _____

EMAIL: _____

Municipal Total Per Capita Water Use (2018): _____ (gallons per person-day)

Municipal Residential Per Capita Water Use (2018): _____ (gallons per person-day)

Municipal Ratio of Peak Month to Winter Month Water Use (2018): _____

Municipality's estimated annual water savings from proposed program: _____ (gallons)

Municipal Utility Grant or Rebate Program Design:

Requested Grant Amount (must equal 75% of total program budget): \$_____

Required Utility Matching Amount (must equal 25% of total program budget): \$_____

Will your program be a grant program or rebate program? _____

Estimated Number of Items:

Item	Estimated Number
Toilets	
Irrigation Controllers	
Clothes Washing Machines	
Irrigation Spray Sprinkler Bodies	
Irrigation System Audits	

Project Work Plan and Schedule:*

Task Description	Responsible Person	Start Date	Completion Date

*** Municipal utility may create own project plan and schedule form**

Communications to Property Owners:

How will your program be advertised (check all that apply):

Newsletter _____

Print Media _____

Email _____

Twitter _____

Website _____

Radio _____

Television _____

Facebook _____

Nextdoor _____

Other Social Media _____

Please attach examples of proposed newsletter, print media, or email communications

Critical Points to Remember:

- The applying municipality must be a water supplier
- New construction and new developments are not eligible
- Funds are for rebates or grants only; consulting and city staff time are ineligible
- Combined Council and municipality funds cannot pay for 100% of an eligible activity's cost
- A portion of each eligible activity's cost must be paid by the property owner
- Grant recipients must display the Clean Water, Land and Legacy Amendment logo and the Metropolitan Council logo on program-related web pages and paper communications

Chris Anderson
City Planner
7550 Sunwood Drive NW
Ramsey, MN 55303

November 18, 2019

The Metropolitan Council is pleased to award the city of Ramsey the amount of \$28,000 as part of our 2019-2022 Water Efficiency Grant Program. The amount of matching funds required from your municipality, based on the grant award above, is \$9,340. The city of Ramsey is one of forty in the Twin Cities Metropolitan Area that applied for and was accepted into this grant program. We are pleased to report that all available grant funds have been awarded and that all applicants will receive an award.

The amount of funds requested totaled \$1,393,527, while the amount of funds available is \$787,600. Because funds requested exceed funds available, a set of ranking factors and an objective scoring system were developed to establish a method to distribute the available funds. A committee of three staff members reviewed the applications and developed this ranking and scoring system. If you are interested in learning more about the ranking factors and scoring system, please contact me at brian.davis@metc.state.mn.us and I will send you a detailed description of this process.

Below are some critical points to remember:

- New construction and new developments are not eligible
- Funds are for rebates or grants only; consulting and city staff time are ineligible
- Grant recipients must display the Clean Water, Land and Legacy Amendment logo and the Metropolitan Council logo on all documents which are intended for public use

The Clean Water, Land and Legacy Amendment is available here: <http://www.legacy.leg.mn/legacy-logo/legacy-logo-download>

To obtain electronic and print versions of the Metropolitan Council logo, please contact me at brian.davis@metc.state.mn.us.

As you prepare your municipality's grant or rebate program, please be aware that the following information must be reported on a quarterly basis, on forms to be provided by the Metropolitan Council:

- Number, type and amount of rebates or grants provided to property owners, along with each property address
- Estimated annual gallons of water saved per installation
- Municipality matching funds disbursed
- Number of unmet funding requests from property owners
- Electronically scanned copies of receipts to verify the cost of eligible devices being reported

Reporting forms and instructions will be made available in early 2020 on our website:
<http://www.metrocouncil.org/Wastewater-Water/Funding-Finance/Available-Funding-Grants.aspx>

Quarterly reporting periods and reporting form due dates are shown below.

Quarterly Period	Reporting Form Due Date
Jan. 1, 2020 – March 31, 2020	April 30, 2020
April 1, 2020 – June 30, 2020	July 31, 2020
July 1, 2020 – September 30, 2020	October 31, 2020
October 1, 2020 – December 31, 2020	January 31, 2021
Jan. 1, 2021 – March 31, 2021	April 30, 2021
April 1, 2021 – June 30, 2021	July 31, 2021
July 1, 2021 – September 30, 2021	October 31, 2021
October 1, 2021 – December 31, 2021	January 31, 2022
January 1, 2022 – March 31, 2022	April 30, 2022
April 1, 2022 – June 30, 2022	July 31, 2022

In early December a Grant Agreement will be mailed to your municipality for your signature. Instructions will be provided in that mailing.

Again, congratulations on your grant award. We look forward to working with you to increase the water efficiency of our region.

Sincerely,



Brian M. Davis, Ph.D, P.G., P.E.
Senior Engineer, Water Supply Planning
Phone: 651-602-1519
brian.davis@metc.state.mn.us



**METROPOLITAN COUNCIL
CLEAN WATER FUND GRANT AGREEMENT NO. SG-13467**

This Clean Water Fund Grant Agreement ("Grant Agreement") is entered into between the Metropolitan Council, a public corporation and political subdivision of the State of Minnesota ("Council") and the City of Ramsey, a municipal corporation ("Grantee").

RECITALS

1. Minnesota Session Laws 2019, 1st Special Session, chapter 2, article 2, section 9, appropriated to the Council funds from the Legacy Amendment's Clean Water Fund ("Clean Water Fund") for State fiscal years 2020 and 2021, to establish a water demand reduction grant program that encourages implementation of water demand reduction measures in municipalities in the seven-county metropolitan area.

2. The Council is authorized by Minnesota Statutes sections 473.129, subdivision 4 to apply for and use grants from the State for any Metropolitan Council purpose and may dispose of the money in accordance with the terms of the appropriation.

3. The Grantee is authorized to receive grants from the Clean Water Fund to protect, enhance and restore water quality in lakes, rivers and streams, to protect groundwater from degradation and protect drinking water sources by encouraging implementation of water demand reduction measures by municipalities in the seven-county metropolitan area to ensure reliability and protection of drinking water supplies.

4. On July 10, 2019, the Council authorized the granting of portions of the appropriation to the Grantees participating in the grant program.

5. The Grantee represents that it is duly qualified and agrees to perform all services described in this Grant Agreement to the reasonable satisfaction of the Council.

GRANT AGREEMENT

1. Term of Grant Agreement.

1.1. **Effective Date.** The effective date of this Grant Agreement is the date this agreement is fully executed.

1.2. **Grant Activity Period.** The first day of the month following the Effective Date through and including the expiration date.

1.3. **Expiration Date.** Upon satisfactory fulfillment of obligations, but in no event later than June 30, 2022.

1.4. **Survival of Terms.** The following clauses survive the expiration, termination or cancellation of this Grant Agreement; 9. Liability and Insurance; 10. Audits; 11. Government Data Practices; 13. Data Availability; 14. Governing Law, Jurisdiction and Venues; 16. Data Disclosure; 18. Future Eligibility.

2. Duties, Representations and Warranties of Grantee and Use of Grant Funds.

2.1. The Grantee agrees to conduct, administer and complete in a satisfactory manner and in accordance with the terms and conditions of this Grant Agreement the program ("Grantee Program") which is described in Grantee's application to Council for assistance under the Council's Clean Water Fund grant program. Grantee's application is incorporated into this Grant Agreement as **Exhibit A**. Grantee agrees to perform the Grantee Program in accordance with the timeline in **Exhibit B** of this Grant Agreement and to undertake the financial responsibilities described in **Exhibit B**. The Grantee has the responsibility and obligation to complete the Grantee Program as described in **Exhibit B**. The Council makes no representation or warranties with respect to the success and effectiveness of the Grantee Program. The Council acknowledges that Grantee Program work may be limited to soliciting participation by its residents and businesses in the Grantee Program and requires additional work by the Grantee only to the extent that residents and businesses choose to participate in the Grantee Program, as described in **Exhibit B**.

The Grant Funds must be entirely passed through and can only be used for authorized rebates or grants for qualifying activities.

2.2. Grantee Representations and Warranties. The Grantee represents and warrants to Council, as follows:

A. It has the legal authority to enter into this Grant Agreement and to conduct and administer the Grantee Program and use the Grant Funds for the purpose or purposes described in this Agreement

B. It has taken all actions necessary for its execution of the Agreement and has provided to Council a copy of the resolution by its governing body authorizing Grantee to enter into this Agreement.

C. It has the legal authority to undertake the Clean Water Fund Grant Program, including the Grantee's financial responsibilities in **Exhibit B**

D. As specified in Exhibit A only Grantee's authorized representative may provide certifications required in this Grant Agreement and submit pay claims for reimbursement of Grantee Program costs.

E. It will comply with all the terms of this Agreement.

F. It will comply with all requirements of Clean Water Funding legislation and appropriations, except for requirements that this Grant Agreement explicitly states will be handled by the Council.

G. It has made no material false statement or misstatement of fact in connection with the Grant Funds, and all of the information it has submitted or will submit to the Council relating to the Grant Funds or the disbursement of any of the Grant Funds is and will be true and correct. It agrees that all representations contained in its application for the Clean Water Fund Grant are material representations of fact upon which the Council relied in awarding this Grant and are incorporated into this Agreement by reference.

H. It is not in violation of any provisions of its charter or of the laws of the State of Minnesota, and there are no material actions, suits, or proceedings pending, or to its knowledge threatened, before any judicial body or governmental authority against or affecting it and is not in default with respect to any order, writ, injunction, decree, or demand of any court or any governmental authority which would impair its ability to enter into this Grant Agreement, or to perform any of the acts required of it in the Agreement.

I. Compliance with the requirements of this Grant Agreement is not prevented by, is a breach of, or will result in a breach of, any term, condition, or provision of any agreement to which it is bound.

J. The Grantee Program will not violate any applicable zoning or use statute, ordinance, building code, rule or regulation, or any covenant or agreement of record relating thereto.

K. The Grantee Program will be conducted in full compliance with all applicable laws, statutes, rules, ordinances, and regulations issued by any federal, state, or other political subdivisions having jurisdiction over the Grantee Program.

L. It will comply with the financial responsibility requirements contained in **Exhibit B**.

M. It will furnish satisfactory evidence regarding these representations if requested by the Council.

3. Time.

Grantee must comply with all time requirements described in this Grant Agreement. In the performance of this Grant Agreement, time is of the essence.

4. Eligible Costs.

Eligible costs are those costs incurred by parties within the jurisdiction of the Grantee for 75% of rebate or grant payments as defined in **Exhibit B**. The Council will not reimburse Grantee for non-eligible costs. Any cost not defined as an eligible cost or not included in the Grant Grantee Program or approved in writing by the Council is a non-eligible cost.

5. Consideration and Payment.

5.1 **Consideration.** The Council will reimburse Grantee for eligible costs performed by the Grantee during the Grant Period as specified in this agreement. The Council bears no responsibility for any cost overruns that may be incurred by the Grantee or sub-recipients of any tier. The initial Grant amount to Grantee under this Grant Agreement is \$28,000.00. The Grantee may be eligible to receive additional Grant amounts or an adjustment in Grant amount in accordance with the procedure in the Grant Amendment Form attached and incorporated as **Exhibit C**. Upon signature by both Grantee and Council on **Exhibit C** this Grant is amended by the amount in **Exhibit C**.

5.2. **Advance.** The Council will make no advance of the Grant Amount to Grantee.

5.3. **Payment.** To receive payment, the Grantee must submit a Reimbursement Request/Progress Report on forms provided by the Council, including electronically scanned receipts to verify the cost of eligible devices reported for each reporting period. Reimbursement Request/Progress Reports must be submitted quarterly, even if there are no eligible costs to report. The Grantee must describe its compliance with its the financial requirements, work completed including specific addresses where work was done, and provide sufficient documentation of grant eligible expenditures and any other information the Council reasonably requests. The Council will promptly pay the Grantee after the Grantee presents to the Council a Reimbursement Request/Progress Report and scanned copies of all receipts verifying the cost for all eligible devices reported and the Council's Authorized Representative accepts the invoiced services.

6. Conditions of Payment.

6.1. For each approved device for which Grantee requests payment, Grantee must certify the following to the Council: (1) the device has been purchased ; (2) Grantee received receipts for the device; (3) the purchase was not performed in violation of federal, Council, or local law, or regulation.

6.2. Conditions Precedent to Any Reimbursement Request. The obligation of the Council to make reimbursement payments is subject to the following conditions precedent:

A. The Council's receipt of a Reimbursement Request/Progress Report for the funds requested, and electronic copies of receipts verifying the cost for all eligible devices for that reporting period

B. If requested by the Council (in form and substance acceptable to the Council), evidence that (i) the Grantee has legal authority to and has taken all actions necessary to enter into this Agreement and (ii) this Agreement is binding and enforceable against the Grantee.

C. There is no Event of Default under this Grant Agreement or event which would constitute an Event of Default but for the requirement that notice be given or that a period of grace or time elapse.

D. The Grantee has supplied to the Council all other items that the Council may reasonably require to assure good fiscal oversight of state's funding through the Clean Water Fund.

7. Authorized Representative.

The Council's Authorized Representative is:

Name: Brian Davis or successor
Title: Senior Engineer
Mailing Address: 390 North Robert Street
St. Paul, MN 55101
Phone: 651-602-1519
E-Mail Address: brian.davis@metc.state.mn.us

The Council's Authorized Representative has the responsibility to monitor the Grantee's performance and the authority to accept the services provided under this grant contract. If the services are satisfactory, the Council's Authorized Representative will certify acceptance on each invoice submitted for payment.

The Grantee's Authorized Representative is:

Name: Chris Anderson
Title: City Planner
Mailing Address: 7550 Sunwood Drive NW
Ramsey, MN 55303
Phone: 763-433-9817
E-Mail Address: canderson@cityoframsey.com

If the Grantee's Authorized Representative changes at any time during this Grant Agreement, the Grantee must immediately notify the Council and within 30 days provide a new City resolution (if such resolution is necessary) specifying the new Representative.

8. Assignment, Amendments, Waiver, and Grant contract Complete.

8.1 Assignment. The Grantee may neither assign nor transfer any rights or obligations under this Grant Agreement without the prior written consent of the Council and a fully executed Assignment Agreement.

8.2 Amendments. Any amendment to this Grant Agreement must be in writing and will not be effective until it has been executed and approved by the appropriate parties.

8.3 Waiver. If the Council fails to enforce any provision of this Grant Agreement, that failure does not waive the provision or its right to enforce it.

8.4 Grant Contract Complete. This Grant Agreement contains all negotiations and agreements between the Council and the Grantee. No other understanding regarding this Grant Agreement, whether written or oral, may be used to bind either party.

9. Liability and Insurance.

9.1 Liability. The Grantee and the Council agree that they will be responsible for their own acts and the results thereof to the extent authorized by law, and they shall not be responsible for the acts of the other party and the results thereof. The liability of the Council is governed by the Minn. Stat. Chapter 466 and other applicable laws. The liability of the Grantee is governed by the provisions contained in Chapter 466 and other applicable laws.

9.2 Relationship of the Parties. Nothing contained in this Grant Agreement is intended or should be construed in any manner as creating or establishing the relationship of co-partners or a joint venture between the Grantee and the Council, nor shall the Grantee be considered or deemed to be an agent, representative, or employee of the Council in the performance of this Grant Agreement, or the Grantee Program.

The Grantee represents that it has already or will secure or cause to be secured all personnel required for the performance of this Grant Agreement and the Grantee Program. All personnel of the Grantee or other persons while engaging in the performance of this Grant Agreement the Grantee Program shall not have any contractual relationship with the Council related to the work of the Grantee Program and shall not be considered employees of the Council. In addition, all claims that may arise on behalf of said personnel or other persons out of employment or alleged employment including, but not limited to, claims under the Workers' Compensation Act of the State of Minnesota, claims of discrimination against the Grantee, its officers, agents, contractors, or employees shall in no way be the responsibility of the Council. Such personnel or other persons shall not require nor be entitled to any compensation, rights or benefits of any kind whatsoever from the Council, including but not limited to, tenure rights, medical and hospital care, sick and vacation leave, disability benefits, severance pay and retirement benefits.

10. Audits.

Under Minn. Stat. § 16C.05, subd. 5, the Grantee's books, records, documents, and accounting procedures and practices relevant to this grant contract are subject to examination by the Council and/or the State Auditor or Legislative Auditor, as appropriate, for a minimum of six years from the termination date of this Grant Agreement.

11. Government Data Practices.

The Grantee and Council must comply with the Minnesota Government Data Practices Act, Minn. Stat. Chapter 13, as it applies to all data provided by the Council under this grant contract, and as it applies to all data created, collected, received, stored, used, maintained, or disseminated by the Grantee under this Grant Agreement. The civil remedies of Minn. Stat. § 13.08 apply to the release of the data referred to in this clause by either the Grantee or the Council. If the Grantee receives a request to release the data referred to in this Clause, the Grantee must immediately notify the Council.

12. Workers' Compensation.

The Grantee certifies that it is in compliance with Minn. Stat. § 176.181, subd. 2, pertaining to workers' compensation insurance coverage. The Grantee's employees and agents will not be considered Council employees. Any claims that may arise under the Minnesota Workers Compensation Act on behalf of these employees and any claims made by any third party as a consequence of any act or omission on the part of these employees are in no way the Council's obligation or responsibility.

13. Data Availability.

To the extent and as requested by the Council, Grantee agrees to comply with Minn. Stat. § 114D.50, subd. 5 requirements for data collected by the Grantee Programs funded with money from the Clean Water Fund that have value for planning and management of natural resources, emergency preparedness and infrastructure investments, including but not limited to the requirement that to the extent practicable, summary data and results of Grantee Programs funded with money from the Clean Water Fund should be readily accessible on the internet and identified as a Clean Water Fund Grantee Program. The Council will put overall summary information on the internet and will encourage the Grantee put its city information on the web. Grantee understands and agrees that Council may list its name and summary information on the internet or in any other Grantor reporting.

Data collected by the Grantee Programs, if any, funded with money from the Clean Water Fund that have value for planning and management of natural resources, emergency preparedness, and infrastructure investments must conform to the enterprise information architecture developed by the Office of MN.IT Services. Spatial data must conform to geographic information system guidelines and standards outlined in that architecture and adopted by the Minnesota Geographic Data Clearinghouse at the Minnesota Geospatial Information Office. A description of these data that adheres to the Office of MN.IT Services geographic metadata standards must be submitted to the Minnesota Geospatial Information Office to be made available online through the clearinghouse and the data must be accessible and free to the public unless made private under chapter 13. To the extent practicable, summary data and results of the Grantee Program funded with money from the clean water fund should be readily accessible on the Internet and identified as a Clean Water Fund Grantee Program.

14. Governing Law, Jurisdiction, and Venue.

Minnesota law, without regard to its choice-of-law provisions, governs this Grant Agreement. Venue for all legal proceedings out of this grant contract, or its breach, must be in the appropriate state or federal court of competent jurisdiction in Ramsey County, Minnesota.

15. Termination.

The Council may cancel this Grant Agreement at any time, with or without cause, upon 30 days' written notice to the Grantee. Upon termination, the Grantee will be entitled to payment for services prequalified and satisfactorily performed before the termination notice.

16. Data Disclosure.

Under Minn. Stat. § 270C.65, subd. 3, and other applicable law, the Grantee consents to disclosure of its federal employer tax identification number, and/or Minnesota tax identification number, already provided to the Council, to federal and state tax agencies and Council personnel involved in the payment of Council obligations. Grantee will require compliance with this Section 16 by Grantee's subrecipient of Grant funds and shall submit evidence of such compliance to Council as requested.

17. Notices.

In addition to any notice required under applicable law to be given in another manner, any notices required hereunder must be in writing and must be personally served or sent by email or United States mail, to the business address of the party to whom it is directed. The business address is the address specified below or such different address as may be specified, by either party by written notice to the other:

To the Grantee at:

Name: Chris Anderson
Title: City Planner
Mailing Address: 7550 Sunwood Drive NW
Ramsey, MN 55303
Phone: 763-433-9817
E-Mail Address: canderson@cityoframsey.com

To the Council's Authorized Representative at:

Name: Brian Davis or successor
Title: Senior Engineer
Mailing Address: 390 North Robert Street
St. Paul, MN 55101
Phone: 651-602-1519
E-Mail Address: brian.davis@metc.state.mn.us

18. Miscellaneous.

18.1 Report to Legislature. As provided in Minn. Stat. § 3.195, the Council must submit a report on the expenditure and use of money appropriated under the Clean Water Fund to the legislature by January 15 of each year. The report must detail the outcomes in terms of additional use of Clean Water Fund resources, user satisfaction surveys, and other appropriate outcomes. The grantee agrees to provide to the Council by January 1 of each year a report on any user satisfaction surveys it has related to this Grantee Program, and other appropriate outcomes of the Grantee Program as prescribed in Section 18.3 of this Agreement.

18.2 Supplement. The funds granted under this agreement are to supplement and shall not substitute for traditional sources of funding. Grantee certifies to the Council that there was and is no

traditional Grantee sources of funding for the City to help fund one-fourth of the subject water efficiency rebate or grant work.

18.3 Measurable Outcomes. If requested by the Council, Grantee agrees to demonstrate compliance with the following: A Grantee Program or program receiving funding from the Clean Water Fund must meet or exceed the constitutional requirement to protect, enhance, and restore water quality in lakes, rivers and streams and to protect groundwater and drinking water from degradation. A Grantee Program or program receiving funding from the Clean Water Fund must include measurable outcomes, as defined in section 3.303, subdivision 10, and a plan for measuring and evaluating the results. A Grantee Program or program must be consistent with current science and incorporate state-of-the-art technology. All information for funded Grantee Program work, including the proposed measurable outcomes, must be made available for publication on the web site required under Minn. Stat. § 3.303, subdivision 10, as soon as practicable and forwarded to the Council and the Legislative Coordinating Commission under the provisions of Minn. Stat. § 3.303, subd. 10. The Grantee must compile and submit all information for funded Grantee Programs or programs, including the proposed measurable outcomes and all other items required under section 3.303, subdivision 10, to the Council and, if requested by the Council, the Legislative Coordinating Commission as soon as practicable or by January 15 of the applicable fiscal year, whichever comes first.

18.4 Minn. Stat. § 16B.98. Grants funded by the Clean Water Fund must be implemented according to section 16B.98 and must account for all expenditures.

18.5 Benefit to Minnesota Waters. Money from the Clean Water Fund may only be spent on Grantee Programs that benefit Minnesota waters.

18.6 Website. If the Grantee has information on its website about the water efficiency grant program under Minn. Stat. § 114D.50, the Grantee will when practicable in accordance with Minn. Stat. § 114D.50, subd. 4 (f) prominently display on the Grantee's website home page the Legacy logo accompanied by the phrase "Click here for more information." When a person clicks on the Legacy logo image, the website must direct the person to a web page that includes both the contact information that a person may use to obtain additional information, as well as a link to the Council's and Legislative Coordinating Commission Website required under section 3.303, subdivision 10.

18.7 Future Eligibility. Future eligibility for money from the Clean Water Fund is contingent upon the Grantee satisfying all application requirements related to Council's fulfillment of Minn. Stat. § 114D.50 as well as any additional requirements contained in 2019, 1st Special Session, chapter 2, article 2, section 9.

18.8 Prevailing Wages. The Grantee agrees to comply with all of the applicable provisions contained in chapter 177 of the Minnesota Statutes, and specifically those provisions contained in Minn. Stat. §§ 177.41 through 177.435, as they may be amended, modified or replaced from time to time with respect to the Grantee Program. By agreeing to this provision, the Grantee is not acknowledging or agreeing that the cited provisions apply to the Grantee Program.

18.9 Disability Access. Where appropriate, Grantee of clean water funds, in consultation with the Council on Disability and other appropriate governor-appointed disability councils, boards, committees, and commissions, should make progress toward providing greater access to programs, print publications, and digital media for people with disabilities related to the programs the recipient funds using appropriations made in this agreement.

18.10. General Provisions.

- (i) Grants. The Grantee shall implement this Grant Agreement according to Minnesota Statutes, section 16B.98, and shall account for all expenditures of funds.
- (ii) Lawsuit. This Grant shall be canceled to the extent that a court determines that the appropriation illegally substitutes for a traditional source of funding.
- (iii) Termination Due to Lack of Funds. Grantee recognizes that Council's obligation to reimburse Grantee for eligible Grantee Program costs is dependent upon Council's receipt of funds from the State of Minnesota appropriated to Council under 2019 Session Laws, 1st Special Session, Chapter 2, Article 2, Section 9. Should the State of Minnesota terminate such appropriation or should such funds become unavailable to Council for any reason, Council shall, upon written notice to Grantee of termination or unavailability of such funds, have no further obligations for reimbursement or otherwise under this Grant Agreement. In the event of such written notice, Grantee has no further obligation to complete the Grantee Program as required by this Grant Agreement.

19. Default and Remedies.

19.1 Defaults. The Grantee's failure to fully comply with all of the provisions contained in this Grant Agreement shall be an event of default hereunder ("Event of Default").

19.2 Remedies. Upon an event of default, the Council may exercise any one or more of the following remedies:

- a. Refrain from disbursing the Grant.
- b. Demand that all or any portion of the Grant already disbursed be repaid to it, and upon such demand the Grantee shall repay such amount to the Council.
- c. Enforce any additional remedies the Council may have at law or in equity.

IN WITNESS WHEREOF, the parties have caused this agreement to be executed by their duly authorized representatives.

METROPOLITAN COUNCIL

By: _____
Regional Administrator, successor, or delegate

Date: _____

GRANTEE:

The Grantee certifies that the appropriate person(s) have executed the grant contract on behalf of the Grantee as required by applicable articles, bylaws, resolutions, or ordinances.

By: _____

Printed Name and Title

Date: _____

EXHIBIT A

(Application from community)

Metropolitan Council Water Efficiency Grant Application Form

Applicant Information:

Municipality: City of Ramsey
Municipal Utility: City of Ramsey Water Utility
Mailing Address: 7550 Sunwood Drive NW, Ramsey, MN 55303

Primary Contact Information: Municipality primary authorized representative (all correspondence regarding the Water Efficiency Grant Program should be addressed to individual named below):

NAME: Chris Anderson
TITLE: City Planner
STREET: 7550 Sunwood Drive NW
CITY, ZIP: Ramsey, MN 55303
PHONE: 763-433-9817
EMAIL: canderson@cityoframsey.com

Secondary Contact Information: Municipality secondary authorized representative:

NAME: Bruce Westby
TITLE: City Engineer
STREET: 7550 Sunwood Drive NW
CITY, ZIP: Ramsey, MN 55303
PHONE: 763-433-9825
EMAIL: bwestby@cityoframsey.com

Municipal Total Per Capita Water Use (2018): 130 (gallons per person-day)
Municipal Residential Per Capita Water Use (2018): 79 (gallons per person-day)
Municipal Ratio of Peak Month to Winter Month Water Use (2018): 4.34
Municipality's estimated annual water savings from proposed program: 3,000,000 (gallons)

Municipal Utility Grant or Rebate Program Design:

Requested Grant Amount (must equal 75% of total program budget): \$ 50,000.00

Required Utility Matching Amount (must equal 25% of total program budget): \$ 16,667.00

Will your program be a grant program or rebate program? Rebate

Estimated Number of Items:

Item	Estimated Number
Toilets	100
Irrigation Controllers	100
Clothes Washing Machines	
Irrigation Spray Sprinkler Bodies	
Irrigation System Audits	5

Project Work Plan and Schedule:*

Task Description	Responsible Person	Start Date	Completion Date
Obtain recommendations from Environmental Policy Board and Public Works Committee to seek Water Efficiency grant funds Obtain City Council authorization to seek Water Efficiency grant funds	City Planner City Engineer	8/19/19	9/24/19
Establish/develop rebate program	City Planner City Engineer Utilities Supervisor Asst. Public Works Superintendent	9/1/19	12/31/19
Develop marketing campaign through outlets including Ramsey Resident newsletter, Facebook/social media, develop website content, and QCTV spots.	City Planner Communications and Event Coordinator	10/1/19	12/31/19
Program administration, which would include intake, review, and processing of customer invoices/receipts, coordinating rebates (utility billing credits), ongoing promotion of grant program.	Engineering Administrative Asst. Finance Staff Communications and Event Coordinator	1/1/20	6/30/22
Quarterly reporting	City Planner Engineering Administrative Asst.	4/1/20	7/1/22

* Municipal utility may create own project plan and schedule form

Communications to Property Owners:

How will your program be advertised (check all that apply):

- Newsletter
- Print Media
- Email
- Twitter
- Website
- Radio
- Television
- Facebook
- Nextdoor
- Other Social Media

Please attach examples of proposed newsletter, print media, or email communications

Critical Points to Remember:

- The applying municipality must be a water supplier
- New construction and new developments are not eligible
- Funds are for rebates or grants only; consulting and city staff time are ineligible
- Combined Council and municipality funds cannot pay for 100% of an eligible activity's cost
- A portion of each eligible activity's cost must be paid by the property owner
- Grant recipients must display the Clean Water, Land and Legacy Amendment logo and the Metropolitan Council logo on program-related web pages and paper communications

EXHIBIT B

Clean Water Fund Grant Program Overview & Goal, Structure, and Qualified Activities (should anything herein be contradicted by the Agreement language, the Agreement terms prevail).

Overview

The Metropolitan Council (Council) will implement a water efficiency grant program effective September 30, 2019 to June 30, 2022. Grants will be awarded on a competitive basis to municipalities that manage municipal water systems. The Council will provide 75% of the program cost; the municipality must provide the remaining 25%. Municipalities will use the combined Council and municipality funds to run their own grant or rebate programs.

Grants will be made available in amounts with a minimum of \$2,000 and a maximum of \$50,000. Grantees will be required to provide estimated water savings achieved through this program for Clean Water, Land & Legacy Amendment reporting purposes.

Legislative Directive - Minnesota 2019 Session Law

\$375,000 the first year and \$375,000 the second year are for the water demand reduction grant program to encourage municipalities in the metropolitan area to implement measures to reduce water demand to ensure the reliability and protection of drinking water supplies. Fiscal year 2020 appropriations are available until June 30, 2021, and fiscal year 2021 appropriations are available until June 30, 2022.

Grant Program Goal

The goal of the water efficiency grant program is to support technical and behavioral changes that improve municipal water use efficiency in the seven-county metropolitan area.

Critical Points to Remember

- The applying municipality must be a water supplier
- New construction and new developments are not eligible
- Funds are for rebates or grants only; consulting and city staff time are ineligible
- Combined Council and municipality funds cannot pay for 100% of an eligible activity's cost
- A portion of each eligible activity's cost must be paid by the property owner
- Grant recipients must display the Clean Water, Land and Legacy Amendment logo and the Metropolitan Council logo on program-related web pages and paper communications

Grant Program Structure: Administration and Funding

The Water Efficiency Grant Program will be administered by Metropolitan Council Environmental Services (MCES) and will be funded with \$750,000 appropriated by the 2019 Minnesota Legislature. Grant applications will be reviewed and ranked by the MCES Water Supply Planning Unit staff.

Grants are only for water efficiency programs offering rebates or grants to property owners who are customers of the municipal water supply system and who replace specified water using devices with approved devices that use substantially less water.

Grants will be awarded to municipalities in amounts ranging from \$2,000 to \$50,000 for providing rebates or grants to property owners. Municipalities will be responsible for the design and operation of their rebate or grant program and its details. Grant payments to the municipality will be for 75% of approved program amounts. The municipality must provide the remaining 25% of the program cost. Municipality rebates or grants are eligible for reimbursement on device replacements conducted September 30, 2019 through June 30, 2022.

Here is an example showing the grant funding design:

Metropolitan Council Grant Amount	\$15,000
Municipality Match	\$5,000
Municipality Grant/Rebate Program Total	\$20,000

Eligibility

Per legislative language, the grant program is limited to municipalities in the seven-county metropolitan area.

Municipalities eligible per above must apply to participate and, if approved, sign a standard Council Grant Agreement, before any eligible rebates or grants can be submitted for reimbursement. Agreements shall require that municipalities:

- Entirely pass through grants received (as is being done by MCES)
- Verify purchase of devices to receive grants
- Retain records and cooperate with any audits
- Conduct all communications with property owners and ensure all written communications to property owners include both the Clean Water, Land and Legacy Amendment and the Metropolitan Council's logo
- Provide quantitative information for state reporting purposes

Eligible water efficiency devices consist of the following:

- Toilet replacement with a US EPA WaterSense labeled toilet
- Irrigation controller replacement with a US EPA WaterSense labeled controller
- Clothes washing machine replacement with an US DOE Energy Star labeled clothes washing machine
- Irrigation spray sprinkler body replacement with a US EPA WaterSense labeled spray sprinkler body
- Irrigation system audit by an Irrigation Professional certified by a US EPA WaterSense program

Expenses eligible for reimbursement are the out-of-pocket cost of the device and its installation only, not to include any owner labor costs. In addition, new construction and new developments are ineligible, as this program is intended as a current infrastructure replacement program.

Application Process

- Applicants must be municipal water suppliers
- Municipalities will submit MCES supplied application form by September 30, 2019. Required information includes:
 - the municipality's rebate or grant program design and work plan
 - proposed examples of communications to property owners
 - requested total grant amount
 - estimated annual amount of water saved by the applying municipality
- Application form is available at: <https://metrocouncil.org/Wastewater-Water/Funding-Finance/Available-Funding-Grants.aspx>
- Submit completed application to: brian.davis@metc.state.mn.us
- Metropolitan Council will notify municipalities of grant awards and provide grant agreements by December 2, 2019.

Proposal Selection Criteria

In the event that funds requested exceed funds available, the following criteria will be used to determine the amount granted to a given municipality:

- Municipalities that are supplied 100% with groundwater
- Municipalities with identified water supply issues in Master Water Supply Plan Community Profiles or Local Water Supply Plans
- Municipalities' ratio of peak monthly water use to winter monthly water use
- Municipalities' average residential per capita water use
- The order in which applications are received and until grant funds are completely committed

Funding Process and Reporting Requirements

- Utilizing forms provided by MCES, the following information must be reported on a quarterly basis:
 - Number, type and amount of rebates or grants provided to property owners, along with each property address
 - Estimated annual gallons of water saved per device installation
 - Municipality matching funds disbursed
 - Number of unmet funding requests from property owners, if any
- Upon review and confirmation of the above information, MCES will process a grant payment in the amount of 75% of approved total rebates or grants for the reporting period.
- MCES will provide confirmation of grant balances available upon request and reserves the right to amend grant agreements, in collaboration with grantee municipality, if quarterly reporting indicates rebate or grant programs will not fully utilize grant awards within the grant period.

Qualified Activities

- Toilet replacement with a US EPA WaterSense labeled toilet:
http://www.epa.gov/WaterSense/product_search.html
- Irrigation controller replacement with a US EPA WaterSense labeled controller:
<https://www.epa.gov/watersense/product-search>
- Clothes washing machine replacement with an US DOE Energy Star labeled clothes washing machine:
<https://www.energystar.gov/productfinder/product/certified-clothes-washers/results>
- Irrigation spray sprinkler body replacement with a US EPA WaterSense labeled spray sprinkler body
<https://www.epa.gov/watersense/product-search>
- Irrigation system audit by an Irrigation Professionals certified by a US EPA WaterSense program

<https://www.epa.gov/watersense/find-pro>

Reporting Example

Community	Property Street Address	Property Type	Device Replaced	Cost per Device	# of Devices	Rebate or Grant per Device	Est. Annual Water (Gal) Saved Per Device	Total Rebate or Grant	Municipality Contribution	Eligible Grant Amount
Anytown	652 Silvis St	Residential	Clothes Washer	\$624.60	1	\$150.00	3,000	\$150.00	\$37.50	\$112.50
Anytown	1952 Ingram Way	Residential	Irrigation Controller	\$199.99	1	\$100.00	8,800	\$100.00	\$25.00	\$75.00
Anytown	630 Gibbons Ave	Residential	Clothes Washer	\$599.90	1	\$150.00	3,000	\$150.00	\$37.50	\$112.50
Anytown	4424 Barriger Blvd	Residential	Toilet	\$168.00	1	\$50.00	4,000	\$50.00	\$12.50	\$37.50

EXHIBIT C Revision #

METROPOLITAN COUNCIL ENVIRONMENTAL SERVICES

**2019 CLEAN WATER FUND WATER EFFICIENCY GRANT PROGRAM
GRANT AMENDMENT FORM**

NOTICE TO GRANTEE: Submission of this form is required to modify your city's agreement with Metropolitan Council Environmental Services (MCES) 2019 Clean Water Fund Water Efficiency Grant program (Grantee Program).

After determination of your city's initial grant amount, completion and submission of this form is necessary when 1) you are requesting additional grant funds to meet unexpected rebate or grant demand, or 2) when your city has determined that the previously approved program's rebate or grant demand will not be met, requiring less grant funds than anticipated when the agreement was signed.

The process for modifying your agreement is as follows:

1. Your City's designated authorized representative submits 2 signed copies of Exhibit C to MCES, with an attachment itemizing requests for changes to prior granted amounts.
2. Upon receipt of signed Exhibit C, MCES Program Administrator obtains Council authorized signatures that modifies the agreement and returns a fully signed copy of Exhibit A indicating new grant amount to City's designated authorized representative.

Instructions: Indicate the date of your change request in #1 box. Indicate the number of this particular change request in #2 box (and in box at top of page – must match). Enter the current grant agreement amount (as MCES approved) in #3 box. If you wish to increase your municipality's grant amount, enter the amount you are requesting in #4 box. If you wish to decrease your grant amount due to less demand than anticipated, enter the amount in #5 box. Enter in #6 box the amount derived from adding #3 to #4 or derived from subtracting #5 from #3.

Grant Agreement #

1. Date of change request:

2. Change request number:

3. Current Grant Agreement Amount (as MCES approved):

4. Increase due to request for additional funding:

5. Decrease due to less demand:

6. Amended Grant Agreement Amount requested:

CITY NAME: _____

I request the above changes (sign with title and date):

MCES PROGRAM ADMINISTRATOR APPROVAL (signature and date):

COUNCIL AUTHORIZED SIGNATURE AND DATE

Questions may be directed to the MCES Authorized Representative:

Brian Davis
MCES Senior Engineer
390 Robert Street North
St. Paul, MN 55101-1805
Phone: (651) 602-1519
Email: brian.davis@metc.state.mn.us

5.02: Overview of Framework for Water Efficiency Grant Program

City Planner Anderson presented the staff report. He stated that the City of Ramsey has been awarded \$28,000 in grant funds through the Metropolitan Council's 2019-2022 Water Efficiency Grant Program for use in a rebate program. As the name of the program implies, the purpose of the grant is to implement water efficient technologies to reduce the demand on water supply.

City Planner Anderson stated that there are two primary financial requirements of the program. First, the municipality must contribute 25 percent of the grant award, which equates to \$9,340. Second, that rebate recipients must also have a financial contribution. Other important eligibility requirements include the rebate recipient being a municipal water customer, only applicable to replacement devices, and the rebate is only applicable for the cost of the device and its installation, excluding any owner labor costs.

Councilmember Musgrove asked if there would be a provision in the application that would require a 30-day waiting period once opened to the public. She stated that in searching smart sense devices, there is a wide range of pricing available. She stated that requiring residents to only pay tax is not a big commitment and asked if it would make more sense to require residents to pay an additional amount (such as \$20 or \$25) to ensure that they are being smart with their purchases, rather than the resident choosing higher priced items simply because this program is paying the cost.

Chairperson Valentine stated that it an interesting question as there is a science to figuring out how big the rebate should be in order to attract participants. He stated that his concern would be that if the rebate is not enough, residents may not choose to participate.

Board Member Hiatt stated that he thought he read that there is a maximum rebate per device, which is \$200.

City Planner Anderson agreed that there is a wide range of prices and staff attempted to make the program as attractive as possible but also creating the opportunity for as many residents to participate as possible. He used the example of toilets, noting that there is a wide variety available for \$200 or less, while there is a wide variety available above \$200. He stated that there would be a device maximum of \$200, with a household maximum of \$500. He stated that this could also be used as a pilot for the City to implement its own program in the future, if desired.

Board Member Hiatt stated that this money will greatly help with the cost for the devices, but the homeowner would also be responsible for labor costs to install the new devices. He commented that the \$500 maximum per household would help to serve the intent desired by Councilmember Musgrove. He noted that half of the City would not be eligible for the program as they are not connected to municipal water services. He hoped that the City could also investigate options for those residents that are not connected to City services in the future.

Board Member Fetterley stated that she would suspect that the majority of devices purchased will be irrigation upgrades, which will cost significantly more than \$200. She stated that this information will all be distributed to the public and did not see the purpose of a waiting period as

it will already take time for residents to complete research and find the appropriate devices and contractors.

Councilmember Musgrove stated that Councilmembers, Commissioners, Board Members, and City staff have a head start on the availability of grant funds from the program, which would put them at advantage so to speak. She explained that her thinking was perhaps to provide the same amount of notice to residents.

City Planner Anderson stated that as the structure of the rebate program is finalized there will be a number of public promotions completed to notify the public. He stated that staff could incorporate a start date for applications if desired.

Chairperson Valentine agreed that it would be fair to have public notice. He noted that there would also be a seasonal concern with irrigation uses.

Board Member Covart asked if a public notice stating that the grants funds would be available in 30 days from the publication would suffice the intent of Councilmember Musgrove. She referenced audit services, which would not be covered under this grant, but noted that service would be available to those on private wells as well and is something the City could look at for a future program.

Motion by Board Member Hiatt and seconded by Board Member Bernard to recommend that the City Council adopt Resolution #20-018 to enter into the Clean Water Fund Grant Agreement with the Metropolitan Council and to accept the \$28,000 grant to implement a water efficiency rebate program.

Motion carried. Voting Yes: Chairperson Valentine, Board Member Hiatt, Bernard, Covart, Fetterley, and Moore. Voting No: None. Absent: None.

Councilmember _____ introduced the following resolution and moved for its adoption:

RESOLUTION #20-018

RESOLUTION TO ENTER INTO A CLEAN WATER FUND GRANT AGREEMENT WITH THE METROPOLITAN COUNCIL TO RECEIVE A WATER EFFICIENCY GRANT

WHEREAS, the City of Ramsey owns and maintains a municipal water supply system which is essential to the quality of life, health and welfare of City residents and businesses; and

WHEREAS, the City of Ramsey currently relies on groundwater as the sole source of its municipal water supply system; and

WHEREAS, the City of Ramsey is planning to construct two new municipal water supply system groundwater wells to accommodate planned growth in the next ten years; and

WHEREAS, Minnesota Statutes 473.1565 directs the Metropolitan Council to undertake planning activities that emphasize conservation, inter-jurisdictional cooperation, and long-term sustainability; and

WHEREAS, the Metropolitan Council received an allocation of \$787,600 from the Clean Water Funds to assist local units of government by helping property owners pay for water saving audits and/or more water efficient appliances to conserve water; and

WHEREAS, the primary objective of the Water Efficiency Grant Program is to assist local units of government to conserve water to ensure long-term groundwater sustainability; and

WHEREAS, this grant program is consistent with the goals and objectives of the City's Strategic Action Plan; and

WHEREAS, the City has the capability to adequately fund its local cost share for this grant program through the water enterprise fund; and

WHEREAS, on September 24, 2019, the Ramsey City Council authorized staff to apply for grant funding up to \$50,000; and

WHEREAS, the City of Ramsey submitted an application for grant funds to offer rebates for WaterSense labeled smart irrigation controllers, irrigation audits, and WaterSense labeled toilets for water supply customers; and

WHEREAS, the Metropolitan Council received grant applications totaling \$1,393,527; and

WHEREAS, the City of Ramsey was one of forty (40) communities accepted into the grant program with a grant allocation of \$28,000; and

WHEREAS, to accept the grant funds, the City of Ramsey must enter into a Clean Water Fund Grant Agreement with the Metropolitan Council.

NOW THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF RAMSEY, ANOKA COUNTY, STATE OF MINNESOTA, as follows:

1. That the Ramsey City Council hereby authorizes the execution of the Clean Water Fund Grant Agreement with the Metropolitan Council and to accept the \$28,000 grant allocation for a water efficiency rebate program.

The motion for the adoption of the foregoing resolution was duly seconded by Councilmember _____, and upon vote being taken thereon, the following voted in favor thereof:

and the following voted against the same:

and the following abstained:

and the following were absent:

Whereupon said resolution was declared duly passed and adopted by the Ramsey City Council this the 28th day of January, 2020.

Mayor

ATTEST:

City Clerk

Public Works Committee

5. 2.

Meeting Date: 01/21/2020

By: Bruce Westby, Engineering/Public Works

Title:

Consider City Council Recommendation to Indefinitely Suspend Pavement Sealcoating Program

Purpose/Background:

Purpose:

The purpose of this case is to consider a recommendation to the City Council to indefinitely suspend the City's annual pavement sealcoating program.

Background:

Since 2015, the City of Ramsey has budgeted \$500,000 each year for the purpose of cracksealing and sealcoating between 13 and 23 miles of City streets annually. Prior to 2015, cracksealing and sealcoating was generally completed on a less frequent basis based on availability of funding.

The purpose of sealcoating is to protect existing bituminous pavement from damage caused by stormwater runoff, ultraviolet rays from the sun, and petroleum deposits left by vehicles using the streets. In addition, a small amount of oil in the sealcoat emulsion is absorbed by the underlying pavement, helping to rejuvenate up to the top quarter-inch of pavement.

In the spring of 2019, Staff began observing significant damage to the underlying pavement of several streets sealcoated since 2015. Staff has since been monitoring streets sealcoated since 2015 to document the scope and severity of observed pavement stripping issues, and to explore the root cause(s) of pavement stripping observed in Ramsey. Pictures of damage caused by pavement stripping under sealcoats on several streets in Ramsey are attached.

Numerous cities across the Twin Cities metro area have experienced pavement stripping issues under sealcoats over the last decade or more, including cities in the northwest metro. Since last spring, Staff has discussed pavement stripping issues experienced by numerous metro area cities, including those cities that have been experiencing this issue the longest, with the goal of better understanding the cause(s) of pavement stripping, how to cost-effectively repair damaged pavement, and if reasonable alternatives to sealcoating exist.

Attached to this case is a summary of Staff's research into pavement stripping, which includes findings and practices of other metro area cities, general comments and/or observations received from other cities and from sealcoat practitioners and experts, as well as conclusions and recommendations reached by pavement stripping research reports completed by the Minnesota Local Road Research Board (LRRB). The LRRB was established in 1959 through state legislation with the goal of improving the quality of Minnesota's transportation systems through grassroots research efforts. Copies of LRRB Technical Reports #2013-08 and #2017-35 are attached for reference.

In summary, Staff is concerned that continuing the current sealcoat program without first identifying the root cause(s) for pavement stripping is likely to result in additional damage to streets moving forward. Instead, Staff would like to indefinitely suspend the sealcoating program while continuing to monitor the scope and severity of the pavement stripping observed to date on City streets, to continue researching the sealcoat practices and findings of other metro area cities and alternative treatments to sealcoating, and to determine how to best repair City streets previously damaged by pavement stripping. Given the degraded condition of streets in Business Park 95, significant repairs are likely needed this year.

Timeframe:

Staff estimates 15 minutes will be sufficient to present this case and respond to questions.

Observations/Alternatives:

Alternative #1– Motion to recommend that the City Council indefinitely suspend the City’s annual sealcoating program.

Alternative #2 – Motion of other.

Funding Source:

The City annually budgets \$500,000 for crack sealing and sealcoating projects. Staff recommends that the City continue to complete crack sealing projects at an estimated amount of up to \$200,000 annually. Based on discussions at this evening’s Public Works Committee meeting, Staff will develop recommendations for repairing streets previously damaged by pavement stripping, and for implementing alternative pavement maintenance practices to sealcoating, and proposes to present the recommendations at the February Public Works Committee meeting.

Recommendation:

Staff recommends providing a recommendation to the City Council to indefinitely suspend the City’s annual sealcoating program for reasons noted herein.

Action:

Motion to recommend that the City Council indefinitely suspend the City’s annual sealcoating program.

Attachments

[LRRB Rpt 2013-08](#)

[LRRB Rpt 2017-35](#)

[Unity St in BP 95 North of McKinly](#)

[Unity St in BP 95 North of 140th Av](#)

[McKinley St in BP 95 West of Radium St](#)

[Sodium St and Radium St Intersection](#)

[Tungsten St and Sodium St Intersection](#)

[Pavement Stripping Research Summary](#)

Form Review

Inbox	Reviewed By	Date
Grant Riemer	Grant Riemer	01/16/2020 12:39 PM
Kurt Ulrich	Kurt Ulrich	01/16/2020 04:05 PM
Form Started By: Bruce Westby		Started On: 01/14/2020 08:06 AM
Final Approval Date: 01/16/2020		



Stripping of Hot-Mix Asphalt Pavements under Chip Seals

Minnesota
Department of
Transportation

**RESEARCH
SERVICES**

Office of
Policy Analysis,
Research &
Innovation

Thomas J. Wood, Primary Author
Office of Materials and Road Research
Minnesota Department of Transportation

April 2013

Research Project
Final Report 2013-08



Your Destination... Our Priority



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(Please request at least one week in advance).

Technical Report Documentation Page

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16. Abstract (Limit: 250 words) The higher costs of hot-mix asphalt pavement are causing more agencies to choose pavement preservation techniques to maintain their pavements. Some agencies have experienced stripping of the asphalt surface under chip seals, this distress appears to occur mostly in urban areas on curb and gutter streets. The main objective of the study was to determine what causes the stripping and to develop test methods to determine if the street will strip prior to placement of the chip seal. Both field and lab methods were used. Research focused on determining air voids, permeability, and density of the samples. Once these were determined, correlations were developed to determine the conclusions.			
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19. Security Class (this report) Unclassified	20. Security Class (this page) Unclassified	21. No. of Pages 60	22. Price

Stripping of Hot-Mix Asphalt Pavements under Chip Seals

Final Report

Prepared by:

Thomas J. Wood
Melissa K. Cole

Office of Materials and Road Research
Minnesota Department of Transportation

April 2013

Published by:

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395 John Ireland Boulevard, MS 330
St. Paul, Minnesota 55155

This report documents the results of research conducted by the authors and does not necessarily represent the views or policies of the Minnesota Department of Transportation. This report does not contain a standard or specified technique.

The authors and the Minnesota Department of Transportation do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to this report.

Acknowledgements

Many thanks are given to the Local Road Research Board for funding the project.

Thanks also to the Technical Advisory Panel (TAP), MnDOT bituminous office, and cities of Brooklyn Center, Eden Prairie, and Woodbury, and numerous other cities for all their help with this project. Without it the project could not have been completed.

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Executive Summary

Stripping of hot-mix asphalt (HMA) under chip seals on urban streets has been an issue for years. This project studied the issue to determine what causes the stripping and how to deal with the stripping. Low density or high air voids appear to be the main cause of the stripping. Lab testing validated the theory that HMA mixes not prone to stripping will strip if not properly compacted. Better construction methods are recommended.

Chapter 1. Introduction

Objectives of Research and Methodology

This report represents task 6 – Draft Final Report of Local Road Research Board (LRRB) project number 904, Minnesota State Planning and Research project number MPR 10-(042) study entitled, “Stripping of Hot-Mix Asphalt Pavements under Chip Seals”.

The objectives of this research project were to determine why some streets suffer from stripping of the hot-mix asphalt (HMA) pavement after placement of asphalt chip seal. Using this data we will recommend how to determine if streets will suffer from stripping prior to chip sealing. Also recommendations will be made on how to improve performance of streets starting with paving of the asphalt pavement.

The research efforts were made up of the following tasks:

- Task 1 Survey Cities and Counties to determine the extent of the stripping under chip seals.
- Task 2 Develop and modify existing test methods to determine if the HMA in place on streets is prone to stripping.
- Task 3 Core and test the cores from City streets.
- Task 4 Review past and present construction methods of cities for asphalt paving streets.
- Task 5 Analyzed the test results from cores.
- Task 6 Draft final report
- Task 7 Final Report
- Task 8 Implementation Plan

Background: Stripping Under Chip Seal Distress

For more than twenty years, Cities have experienced pavement deterioration of the upper 0.5 to 1.0 inch of HMA pavements under chip seals. The distress causing this is stripping of the asphalt layer directly beneath the chip seal (Figures 1 and 2). This distress starts as a small blister and becomes enlarged to the size of a small pothole; at which time the chip seal delaminates off of the asphalt pavement.

With the high cost of asphalt, the use of pavement preservation treatments has grown rapidly as agencies preserve their roadway system. Most of the incidents of this distress have been located on urban curb and gutter streets. If the distress is localized small patch will restore the street. However, as the area of deterioration expands a thin mill and overlay may be required to restore the street. This distress may lead to an expensive maintenance problem.



Figure 1: Stripping of asphalt pavement under chip seal.



Figure 2: Asphalt deterioration under chip seal.

Chapter 2. Research Methodology

Task 1

In this task surveys were sent to Cities and Counties using the Survey Monkey™ tool to determine the extent of the stripping under chip seals in Minnesota. See Appendix A for a copy of the Interim Report for Task 1 submitted in November 2010. This report includes all the questions asked and results of the survey. Sixty-six responses were received.

More than 60 percent of the respondents stated their agency was experiencing stripping under chip seal. Based on these findings and interviews with select cities the next step was to determine the cause of the stripping problems. One observation made was that streets suffering from stripping issues had density variability. Areas close to the stripped areas had high air voids. When coring, complete cores in the areas with low density and high air voids were not able to be obtained as they fell apart. Based on preliminary field sampling the following hypothesis was developed: **Low density may cause asphalt paving mixes to stripping to strip because of this low density and high air voids.**

Task 2

This task looked at stripping test methods and selected tests to determine if stripping can be determined. To test the laboratory methods selected, a level 3 super pave mix that has been proven to not be prone to stripping was selected. The HMA samples were compacted at three (3) levels of air voids (density), 7, 10, and 14 percent air voids. Based on these tests the higher the air voids or lower density the HMA suffered more stripping tendencies. This finding supports the hypothesis that low density and air voids may cause stripping.

Task 3

In Task 3 we cored and tested the cores from city streets experiencing stripping. A group of streets were selected to be sampled for lab testing to validate findings from Task 2 and determine what causes stripping of the chip seals on streets.

Efforts were made to develop field test requirements that could be performed to determine if the street is a good candidate for a chip seal, i.e. will not strip 2-4 years after placement. The Nuclear Density Tester (NDT) and NCAT Field Permeameter were used on streets without a chip seal. Lab testing on the cores taken from both streets with and without a chip seal included the following; air voids (ASTM T269, T166 & T209) and lab permeability (ASTM PS 129-1).

The data from the city's streets correlates with the finding in Task 2. As air voids increased and density decreased the chance of stripping also increased. The best method to check for variability in density in the pavement is NDT. A second hypothesis that was brought forward was the one could fog seal the street with light application of asphalt emulsion and that it would stop water infiltration into the mat but would allow water vapors to escape similar to TYVEK® house wrap does for homes.

Using cores from a two (2) year old fog seal and the lab permeability (ASTM PS 129-1) test method it was demonstrated that fog seal did not allow water in liquid state to infiltrate the HMA but allowed water in a vapor state to escape. (See Appendix C).



Figure 3: Nuclear density tester.

Task 4

In Task 4 current methods used by cities to construct their streets was reviewed. These methods were compared to MnDOT's standard specifications for paving. During discussion with agency personnel one fact that relates to density became apparent. Most cities were using ordinary compaction to obtain density. Ordinary compaction, when executed properly should yield good density of the pavement. However, one issue with ordinary compaction is that contractor and agency personnel must ensure that all areas of the pavement receive proper number of rolling passes at proper temperature of asphalt mixture. When streets have variable widths and curves are present it is more difficult to ensure the rolling pattern is consistent throughout asphalt pavement placement. MnDOT recommends using specified density methods. With specified density the agency will take cores randomly from pavement to verify that proper density has been achieved (see Appendix D).

Task 5

Analysis of the data collected in Task 3 was discussed and presented in Task 5. Using the different methods outline above, it was shown that all the test methods correlated. The data showed that streets had high variability in density from 7 to 12 percent air voids in areas close stripped areas. In the areas with severe stripping cores were not able to be retained for testing. This was due to the cores breaking into many pieces after pulling the core from the pavement. Nuclear density testing showed great amount of variability in the mix weight per cubic foot from

areas of not stripping to areas suffering from stripping. One street had weight from 145 lbs. per cubic foot in areas of the street with no issues to a low of 117.3 lbs. per cubic foot in areas suffering from stripping. For field evaluation of streets the nuclear density tester is the fastest and easiest to use of method tested. After discuss with experts from around the country it is recommend to not chip seal a street if the variability in density varies more than 6 lbs. per cubic foot as measured with nuclear density tester. (See appendix E)

Task 6 and 7

Task 6 and 7 was developing the draft final report and a final report of the findings from Tasks 1-5.

Task 8

Task 8 will develop a draft implementation outline for the Research Implementation Committee (RIC) to use. Three (3) main recommendations for the outline are:

1. Present finding of study at many conferences.
2. Include data about variability of density into bituminous training classes offered by MnDOT to help insure better constructions methods are followed.
3. Develop a handout to inform agencies about the stripping under chip seal issues and recommendation on preventing this distress.

Chapter 3. Conclusions and Recommendations

Conclusions

The stripping of the HMA pavement after application of chip seal is caused by areas of high air voids or low density. The lack of proper compaction allows water to permeate into the HMA and cause pavement to strip. This also occurs in HMA that are not prone to stripping. A cause for lack of uniform density is the use of the ordinary compaction method. For ordinary compaction to work, inspections must ensure all areas of the pavement receive proper compaction efforts at the correct temperature for the mat.

Recommendations

It is recommended that agencies use specified density methods to ensure proper uniform compaction of the HMA paving. An observation by a city's personnel was when the city switched to specified density the same Contractor brought two 20- to 25-ton steel rollers and a 20- to 25-ton pneumatic roller instead of one 6- to 8-ton steel roller they used in the past when ordinary compaction was specified. The cost of the HMA was the same per ton. Areas that need more research into are what effects recycled asphalt (RAP) now used in wear course have on stripping.

There are currently three options for existing streets with low density and high air voids variability. These options are as follows:

1. Do nothing and allow the street to fail prematurely.
2. Chip seal earlier in pavement life to try to keep pavement structure as dry as possible to limit moisture damage. From the surveys in Task 1, it appears that chip sealing the pavement within the first 1-4 years of life helped to limit the stripping issues.
3. Fog seal pavement with a CSS-1h diluted to one part water and one part emulsion.

Appendix A: Task 1 Report

**Minnesota Local Road Research Board (LRRB)
Investigation No. 010-042**

Stripping of Hot Mix Asphalt Pavements under Chip Seals

Interim Report

Submitted to the LRRB technical advisory panel in fulfillment of:
Task 1 on November 9, 2010

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Introduction: In recent years, Mn/DOT has received reports of stripping, or deterioration, of the upper ½ to 1 inch of hot mixed asphalt (HMA) pavements under chip seal surface treatments. This distress (Figure 4) usually starts out as a small blister and develops to small potholes, at which point the chip seal delaminates from the pavement. These distresses can become an expensive maintenance problem. These distresses could also impede the deployment of cost saving preventive maintenance (PM) treatments if the treatments are viewed as the cause of the distresses.



Figure 1. Early stage of HMA deterioration under a chip seal (251 Reid).

This report represents task 1 of the Minnesota Local Road Research Board (LRRB) project number 2010-042, entitled, “Stripping of Hot Mixed Asphalt Pavements under Chip Seals”. The overall goal of this research project is to determine the underlying cause of the stripping distresses, identifying which pavements are at greatest risk and implement risk mitigation strategies that include improved specifications and practices. The main purpose of this task report was to identify the extent of the problem among local government entities.

Minnesota cities and counties were asked to complete an online survey, using the Survey Monkey™ tool, describing their experience with the stripping under chip seal distress. Appendix A is a draft of the survey that was used to populate Survey Monkey™. The survey opened for response in early September and received 66 responses.

Findings and Observations: The survey responses show that the problem of stripping of the HMA under a chip seal happens in over 60% of the agencies that responded. The first chip seals were applied when the streets were between four (4) and eight (8) years of age. The distress seems to appear between two (2) to four (4) years after chip seal application. Note that 60 percent of respondents reported that they did not have un-chip sealed roadways the same age as the chip sealed roadways. The ninth question asked for comments. Appendix A lists all the comments received. Below are a few selected comments.

“As a rule of thumb, we will seal coat a street twice over a 15 to 20 year period prior to mill and overlay. Stripping more common after second seal coat.”

“We have one road we sealed when it was only a year old and the stripping has not occurred on that road yet.”

“So far this has only shown up in our first recycled asphalt wear courses installed from 1996 to 1998. We have heard that there was a problem with the Mn/DOT formula that hopefully has been corrected.”

“We think this is occurring in pavements put down in the early 1990’s where they first started to use RAP in the mix.”

Recommendations for next task: Based on the information from the survey, the research should to study the types of HMA mixes used to determine if some types, or blends, of HMA and recycled asphalt pavement (RAP) are more prone to stripping. Density may also be a contributing factor.

Appendix A: Survey Results

Question 1: asked the name of the Agency fill out survey.

Question 2: **Does your city use chip sealing as a Preventive Maintenance treatment?** 60 responded Yes, and 6 responded No.

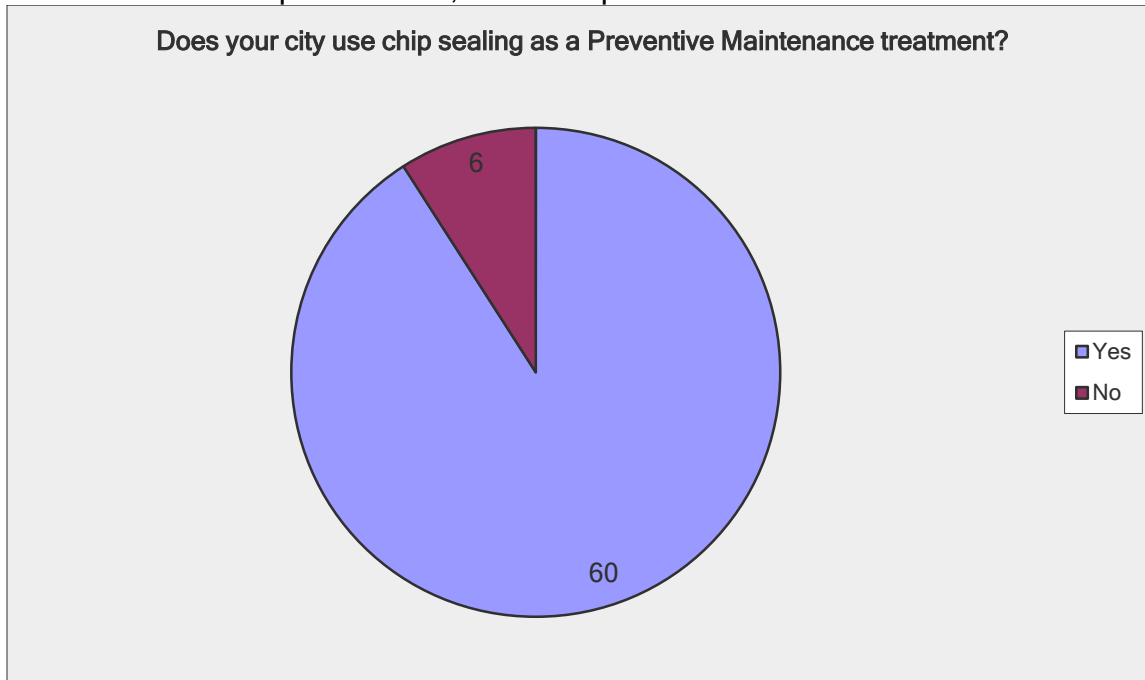
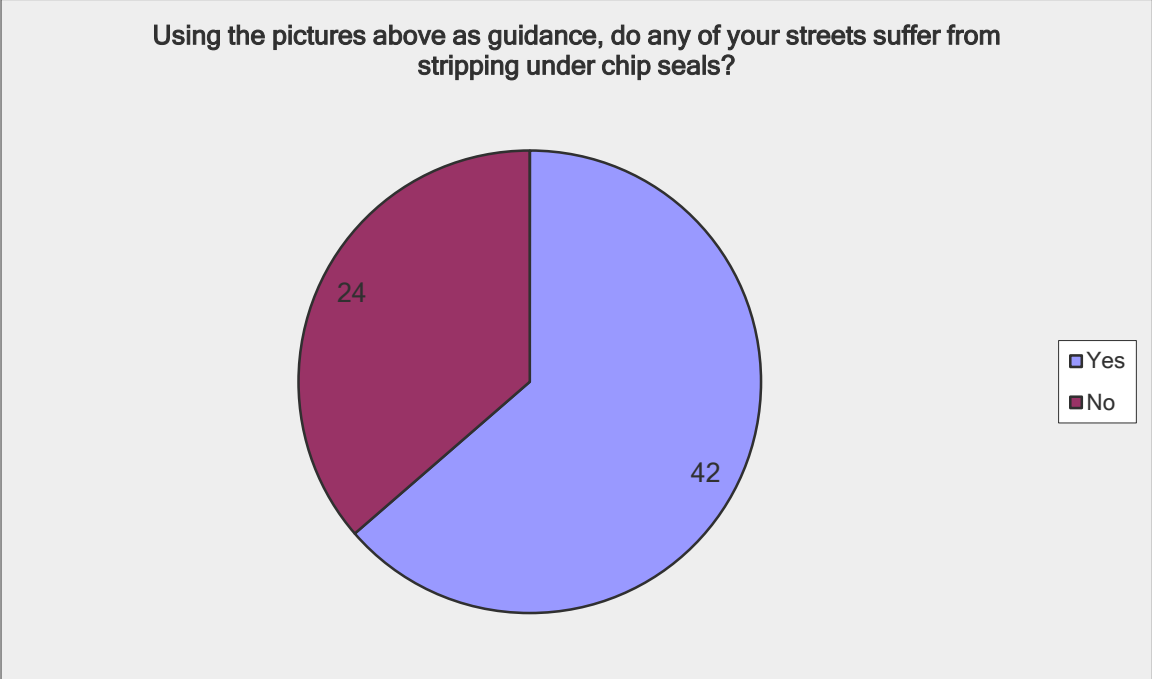


Figure 2 Picture used in survey

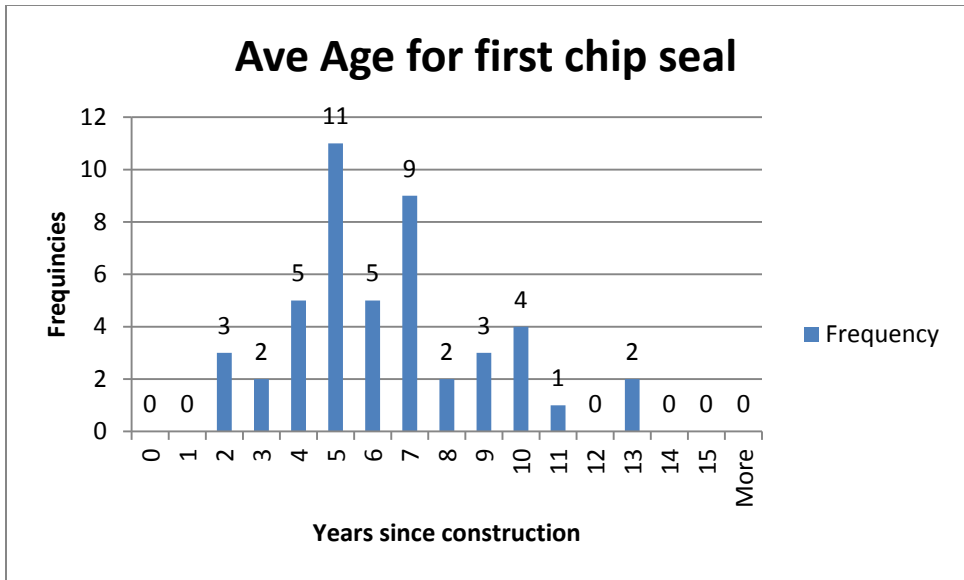
Question 3: **Using the pictures (Figure 2) above as guidance, do any of your streets suffer from stripping under chip seals?** 42 agencies reported yes and 24 reported No



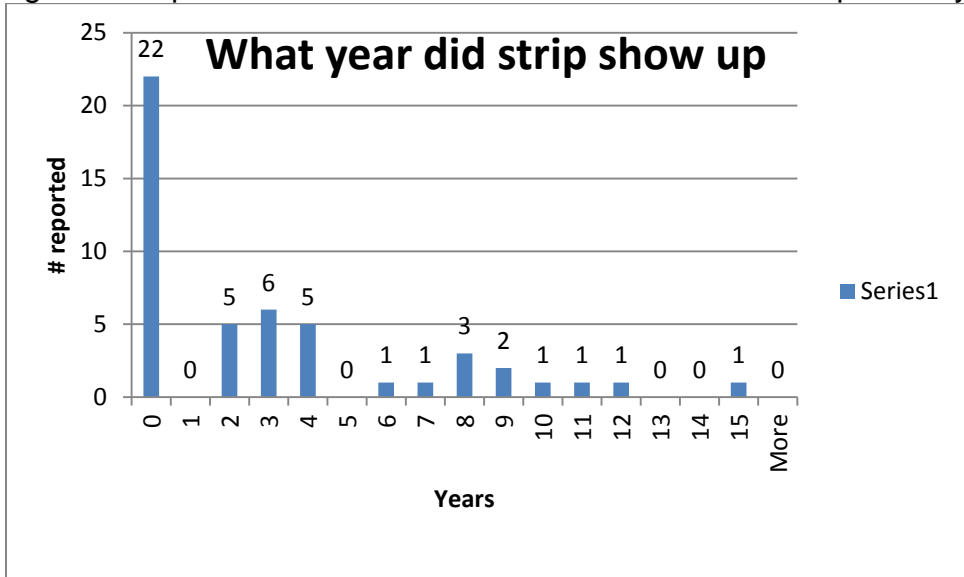
Question 4: **What percentage of streets does it happen on?** 40 out of 66 supplied answer to this question. See below histogram for breakdown of data. Most of the agencies reported a percentage but four (4) reported in format that did not give an answer easily converted to percentage.



Question 5: **On average, what is the age of the street when the first chip seal is placed?** 52 responded to question see histogram for data below. Five (5) agencies reported in a different format which could not be captured by the histogram.



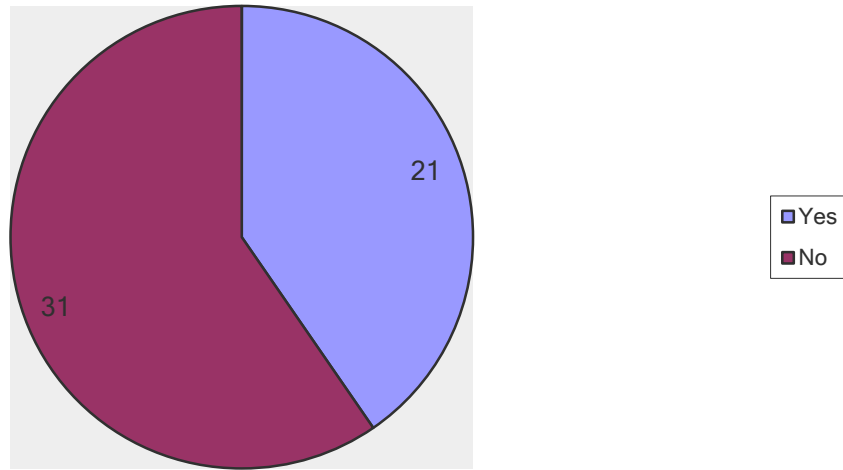
Question 6: **How long after the chip seal is placed does the stripping problem show up?** 52 responded to this question, see histogram below for data. Three (3) agencies reported in different format which could not be captured by the histogram.



The responders that listed year zero have not seen any damage to their streets.

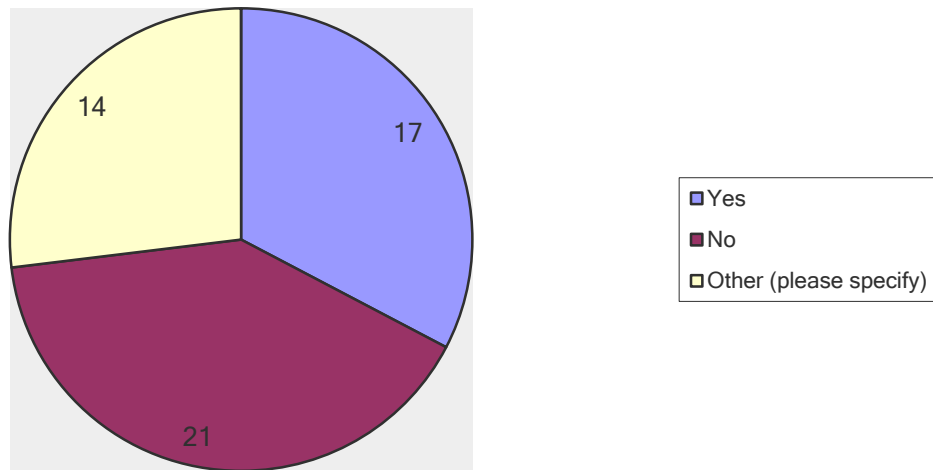
Question 7: **Does your city have any streets that are the same age where some have been chip sealed and some have not?** 52 responded. 21 replied yes and 31 replied no.

Does your city have any streets that are the same age where some have been chip sealed and some have not?



Question 8: **Does your city have complete construction records for street construction that suffer from these distresses?** 17 replied yes, 21 said no, and 14 replied with other answers.

Does your city have complete construction records for street construction that suffer from these distresses?



Question 9: **Are there any comments or additional information that you need or would like to share?** 16 responded with additional comments or information. See comments below.

- *I'm going to pass this on to my Public Works guys, as they have noticed this problem for several years. I will have them reply too, as they can offer more*

details. I would encourage everyone that this study include street maintenance personnel (field people) in addition to City engineers/Public Works Directors (office people).

- *As a rule of thumb, we will seal coat a street twice over a 15 to 20 year period prior to mill and overlay. Stripping more common after second seal coat.*
- *We have one road we sealed when it was only a year old and the stripping has not occurred on that road yet*
-
- *You know all our comments about the chip seal material on sticking to our truck engines and tranny's...*
-
- *The City has been very consistent over the last 10 years or more about seal coating and keeping up with the 5 year timing. To date we have not noticed any problems with the surface coat below the chip seal.*
- *We use MC oil and no emulsifiers which helps prevent this from happening.*
- *Our experience is limited to stripping on 61 wear course roads, we haven't seen other significant stripping issues on other roads.*
- *We have attributed the problem more to the wear course being chip sealed than the chip seal itself*
- *Maplewood, like other metro cities is dealing with this issue and there are a number of state aid roadways with this problem.*
- *We are currently formulating an approach to fix these streets since it is very difficult to patch the great number of thin failures areas.*
- *According to our Street Superintendent the issue could be a result of using trap rock which is left for only 2-3 days before being swept up.*
- *Streets with pea rock left down for 2-3 weeks such as North Saint Paul and Lake Elmo don't seem to be having the failures.*
- *We have not seen this problem in Faribault County.*
- *Marshall County has not completed a chip seal.*
- *So far this has only shown up in our first recycled asphalt wear courses installed from 1996 to 1998. We have heard that there was a problem with the Mn/DOT formula that hopefully has been corrected.*

- *In response to the question seven, we have not determined the ages for all occurrences of this type of stripping. We have however, noted that the stripping occurs in certain areas, where presumably the pavement is of approximately same age and sealing is also conducted at the same time (sealing is performed on an area basis). We seal streets on an 8-year cycle, and do not perform “early sealing” on new pavement after 2-3 years as some cities do. This program was initiated in the early 80s. We have started to examine the practice of early sealing, and would like to determine whether this would be more effective for our City.*
- *We think this is occurring in pavements put down in the early 1990’s where they first started to use RAP in the mix.*
- *Just a quick glance revealed two areas with most noticeable stripping were built around 1994- 1999 and mostly likely had two seal coat applications to date. Also these are areas of clay soils.*
- *Most problems appear where there are just thin overlays.*
- *One of the segments is approximately 15 years and the problem is pretty much continuous for the 10 mile segment. The problem is occurring in the center of lane and appears as a stripping problem created in the original mix placement. Possibly a segregation problem created by the paver during placement.*

Appendix B: Task 2 Report

Stripping of Hot-Mix Asphalt Pavements under Chip Seals

Development of a Methodology to Assess Potential at Risk Streets

LRRB 10-0142, 2010-042 Interim (Task 2) Report

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April 2011

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or policies of the Minnesota Department of Transportation at the time of publication. This report does not constitute a standard, specification, or regulation.

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The bituminous trial mix lab is gratefully acknowledged for their assistance in preparing and testing the bituminous mixtures. The TAP is gratefully acknowledged for their technical guidance.

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Executive Summary

This report represents task 2 of the Minnesota Local Road Research Board (LRRB) project number (Investigation) 2010-042, entitled, “Stripping of Hot Mixed Asphalt Pavements (HMA) under Chip Seals”. The goal of this specific task report is to identify, or develop a methodology that can be used to assess potential at-risk streets before they are treated with a surface treatment. The preliminary methodology being investigated by the research team involves testing the in-place pavement for air void content, or permeability (either in-situ or laboratory). If the pavement is found to have excessive permeability and/or air void content, then caution should be exercised before placing a chip seal surface treatment; a fog seal surface treatment may be more appropriate. These recommendations are preliminary and need to be validated with more testing of laboratory and plant produced (in-place) pavement mixtures in accordance with the work plan.

Based on previously completed forensic investigations, and survey responses the research team has hypothesized that low density (high-interconnected air voids) are a contributing factor to the observed stripping distresses. Thus, the experimental plan investigated the influence of various air void contents (7, 10 and 14%) on a mixture’s susceptibility to moisture induced damage. The mixtures susceptibility was tested with: permeability tests, Mn/DOT modified Lottman, Asphalt Pavement Analyzer (APA) tested under wet and dry conditions, and a modified Iowa Boiling Test.

Permeability testing indicated that the mixtures became significantly more permeable when the air void content was near 14%. The Lottman test did not show any visual evidence of stripping and all tensile strength ratios (TSR) were above 70%. However, the mixtures with the highest air void content had the lowest TSR at 74% and the mixture with the lowest air void content had the highest TSR at 84%. The change in air void content had the most dramatic influence on tensile strength values; a doubling of the air voids from 7% to 14% corresponded with a reduction of 52% and 58% in the dry and wet tensile strengths respectively. APA test results were mixed as the greatest difference in rutting rates between ‘wet’ and ‘dry’ testing conditions were at the 10% and 7% air void contents; the mixture with 14% air void content showed little difference. None of the mixtures showed signs of visual stripping. In the modified Iowa boiling test, the specimens with 14% air voids lost an average of 12.2% of their initial weight and the specimens with 7% air voids lost an average of 3.4% of their initial weight. In addition, empirical observations after the test showed that the specimen with the higher air voids (14%) was much less intact than the comparable specimens with lower air voids (7%).

There was no test that explicitly showed asphalt stripping away from mixtures with higher air voids; however, the results of the laboratory testing did indicate that the higher voids do contribute to reduced pavement durability through reduced strength, increased susceptibility to rutting and increased permeability. The permeability and the modified Iowa Boiling test results indicate that pavements with higher air void contents may be more susceptible to moisture induced damage than pavements constructed with the proper amount. These factors will also reduce the life of a chip seal that’s placed on top of a compromised pavement. Future testing within this project will entail conducting the same tests (permeability, Mn/DOT modified Lottman, wet and dry APA, and modified Iowa Boiling) but on sealed specimens of varying density to more closely simulate field conditions. In addition, the research team intends to modify the laboratory Permeameter to examine whether or not moisture (from the bottom) can penetrate a chip seal or a fog seal surface treatment.

Chapter 1. Introduction

Objectives of Report and Research

This report represents task 2 of the Minnesota Local Road Research Board (LRRB) project number (Investigation) 2010-042, entitled, “Stripping of Hot Mixed Asphalt Pavements (HMA) under Chip Seals”. The overall goal of this research project is to determine why stripping distresses are observed in the underlying HMA pavements of some streets and not others. Identify which pavements are at greatest risk and implement risk mitigation strategies that include improved specifications and practices. The goal of this specific task report is to identify, or develop a methodology that can be used to assess potential at-risk streets before they are treated with a surface treatment. This methodology (in the form of a laboratory test) is designed to provide guidance on the susceptibility of the proposed pavement section to the stripping under chip seal distress, which would allow agencies to make informed decisions on the application of preventive maintenance (PM) treatments.

Stripping Under Chip Seal Distress

This problem has been observed for more than twenty years; however recently, Mn/DOT has received increased reports of stripping of the upper ½ to 1 inch of hot mixed asphalt (HMA) pavements under chip seal surface treatments. This stripping distress (Figure 1.1) usually starts out as a small blister and develops to small potholes, at which point the chip seal delaminates from the pavement. These stripping distresses can become an expensive maintenance problem.



Figure 1.1. Early stage of HMA deterioration under a chip seal (251 Reid).

The distress appears to be limited to local, low speed roads (30 - 40 miles/hour) with curb and gutter and Task 1 of this research project (1) surveyed local agencies and found that (60% of 66 respondents) have this problem. Due to the relative widespread nature of the phenomenon the study will not focus on material specific causes of the stripping, such as aggregate/asphalt incompatibility. The focus of the study will be on the stripping phenomenon as it relates to the pavement structure as a whole, specifically, it is theorized that pavements with poor drainage, low density and traffic action are at an increased risk of stripping when a chip seal is applied. The basis for this theory is that many observed cases have been local streets (with presumably higher density) and curb and gutter (no edge drains for water to escape).

Review of Published Literature

The vast majority of the literature found focused on a “microscopic” investigation of the problem, namely the properties/performance of the asphalt and aggregate, or the mixture as a whole. The following paragraph is an excerpt from Kiggundu and Roberts (2), “Hubbard states

that stripping effects have been observed since the advent of paving with bituminous. Since this phenomenon has been detected, there have been numerous technical papers, articles, and presentations. Stripping is a complex problem to which there is no definitive, qualitative and quantitative solution towards understanding and predicting the stripping potential of HMA. There currently are a number of hypothesized mechanisms, including: detachment, displacement, spontaneous emulsification, film rupture, pore pressure, and hydraulic scouring. There are a number of postulated theories, which include: mechanical interlock, chemical reaction, molecular orientation, or Interracial phenomenon, none of which are universally accepted.”

Aschenbrener (3) reported on several pavements in Colorado which required complete rehabilitation at less than two years old and often less than one year old. The pavements designed to be a rut resistant composite pavement that used a plant mixed seal coat placed over an HMA layer; however the underlying HMA layer experienced severe moisture damage as shown below.

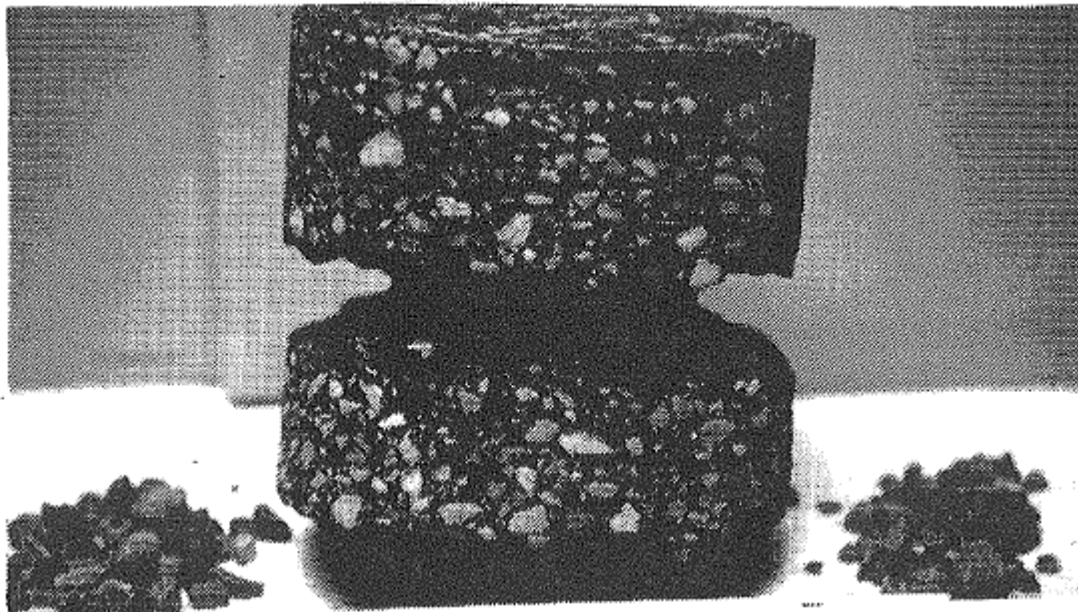


Figure 1.2. A Core showing Stripping below the surface (3)

Although the plant mixed seal coat was reported a contributing factor, the HMA mixtures were also deemed to be susceptible to moisture induced damage (the only reason to explain the rapid failures), and it was observed, through analysis of weather conditions, that the failures occurred during high levels of precipitation during the hottest part of the summer. The severe moisture damage did not correspond to freezing conditions. The failures were attributed to high temperatures, high moisture and high traffic.

Kandhal and Rickards (3) was another reference that discussed the stripping problem in context of the pavement system and not in isolation. The researchers presented case histories of premature stripping of asphalt overlays due to stripping. The researchers observed that, “In each of the observed cases, saturation was the cause of the problem; stripping was the outcome.” They also noted that, “If subsurface drainage of the pavement is inadequate, moisture and/or moisture vapor can move upwards due to capillary action and saturate the asphalt courses.” The researchers hypothesized that, “In addition to high air void content, there are three essential ingredients to promote stripping: the presence of water, high stress and high temperature.” Furthermore, the researchers argued that if the concept of mat “breathing” (ingress of moisture

balanced by the egress of moisture in the form of water vapor) wasn't true, there would be substantially more stripping problems.

The current investigation is concerned with stripping of generally older pavements with chip seals applied 'late' (>7 years) in the pavement's service life. So, it is interesting to note that stripping almost universally occurs from the bottom up, or at the interface of two layers outward, so, based on this, it is logical to be concerned with the application of a chip seal over an HMA pavement, as the new pavement is now a "lower layer". In addition, section 7 (surface treatments) of the Texas DOT Pavement Design Guide (5) recommends testing HMA mixtures for susceptibility to stripping before the application of a chip seal because, "A surface treatment will generally seal off the vertical escape of moisture migrating upward out of a pavement which can set up accelerated stripping in the existing HMA layer beneath the seal". The sealing off of the vertical escape of moisture will not increase the pavement's stripping susceptibility if there isn't moisture, in other words if the moisture can escape through the sides (edge drains), or if the moisture is intercepted with a permeable base layer. Thus this implies that the stripping mechanisms of the pavement were already in-place, merely accelerated by the presence of the chip seal surface treatment.

Texas currently, as of 2011, has two standard methods for testing moisture susceptibility of HMA mixtures:

1. Placing a 200g sample of prepared HMA, no more than one aggregate thick in a beaker which is immersed in boiling oil
2. Modified Lottman Test which involves comparing the Tensile Strength Ratio of moisture conditioned specimens with that of non-conditioned specimens.

Aschenbrener and McGennis () reported on using the boiling water test and seven versions of the modified Lottman test (AASHTO T 283) to predict the stripping of materials extracted from twenty sites of known field (stripping) performance. They reported that two levels of severity for conditioning laboratory samples correlated well with what was observed in the field; the most severe conditioning cycle included a 30-minute vacuum (610 mm HG) saturation a 15 hour freeze, followed by a 16 hour soak in a high temperature water bath, the milder conditioning consisted of: 55-80% saturation and no freeze, followed by a 16 hour soak in a high temperature water bath. They recommended the severe conditioning for mixtures placed under high traffic, high temperature, high moisture and possibly freeze conditions and milder laboratory conditioning for mixtures placed on low traffic sites. They went further, stating that it is critical that the conditioning in the laboratory (vacuum saturation, freeze, hot-water soak) be equal, or greater than the severity expected in the field. The authors did not recommend the boiling test as it is a very severe test that does not consider important factors of: gradation, void structure, or permeability, all of which influence field performance related to moisture susceptibility.

Chapter 2. Laboratory Testing and Evaluation

Introduction

There is no one test that is universally accepted as an indicator of stripping potential, some tests worked well on some materials and not on others. One of the goals of this project is to provide a test(s) that can be performed relatively inexpensively and provide results quickly and accurately. With this in mind, excessive conditioning, such as multiple freeze-thaw cycles in the Lottman test, is not being considered. Preference was given to accepted tests and methodologies which could be implemented/performed with little investment.

In addition, an experimental plan was formulated based upon recent data findings from forensic investigations of local streets. These forensic investigations revealed that pavements with stripping problems also seemed to have high in-place air voids. All of them had in-place voids greater than 10%, up to as high as 14%, other samples were unable to be tested due to disintegration of the core during the coring operation. This led the researchers to hypothesize that reduced density would lead to an increased susceptibility of the pavement to experience moisture induced damage.

The hypothesis was tested by utilizing the current standard employed by Mn/DOT (Lottman test with Mn/DOT modified conditioning), experimenting with the Asphalt Pavement Analyzer (APA), or rutting test conducted on saturated and dry specimens as well as a new method proposed by the researchers that involves immersing a sample into boiling water for a pre-determined period of time (referred to as the modified boiling test)".

Laboratory Procedure and Test Results

Laboratory Permeameter (Karol-Warner flexible wall Permeameter)

The laboratory testing was conducted on a level 3 SuperPave mixture, derived from a relatively common Minnesota job mix formula. This mixture has not been observed to be susceptible to stripping problems. The samples were sampled from the field and prepared in the laboratory by trained Mn/DOT personnel using a SuperPave gyratory compactor. The mixture had 30% RAP content, with 4.8% new asphalt binder and it conformed to Mn/DOT's gradation requirements.

Permeability testing was accomplished using the laboratory Permeameter (Figure 2.1), also known as the Karol-Warner flexible wall permeameter. The coefficient of water permeability, k was found using the relationship described in Figure 2.1.

The coefficient of permeability provides an indication of the ease with which water can pass through the specimen, higher values indicate that it's easier for water to flow through the specimen and lower values indicate that it's more difficult for water to flow through the specimen. According to the Mn/DOT pavement design manual, permeability for class 5 aggregate base is approximately 4.8 inches per day (in/day) and drainable bases have permeability values between 3,600 to 12,000 in/day.

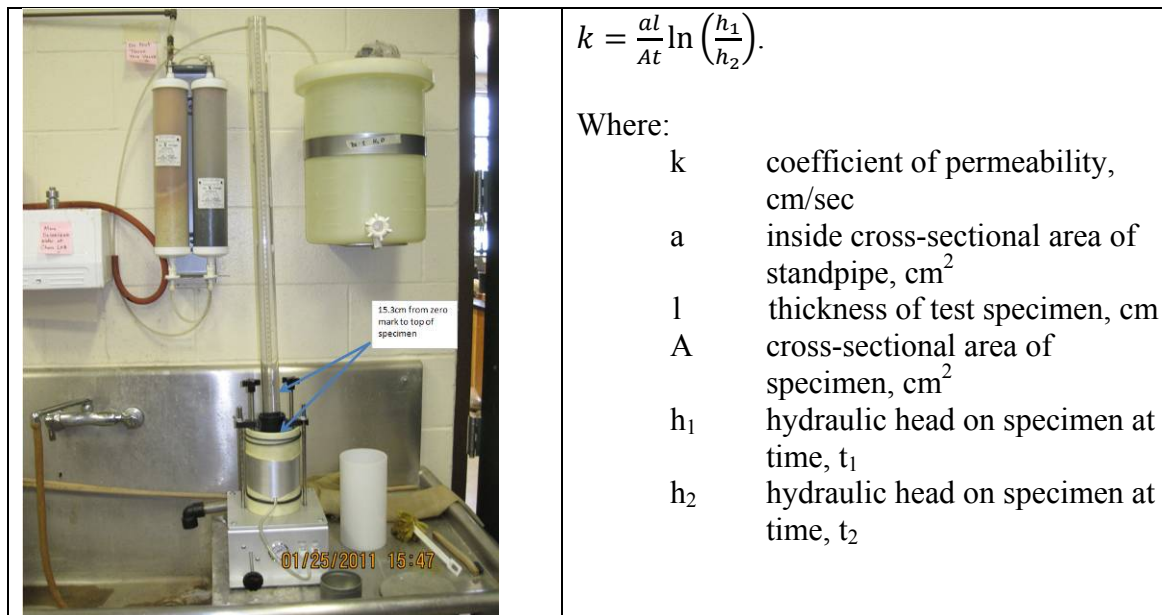


Figure 2.1. Laboratory Permeameter (Left) and Permeability Calculation (Right)

Figure 2.2 shows the graphical relationship between permeability and air voids. As the air voids are increased greater than 9.6%, the permeability increases dramatically. Although the permeability of the mixture with 13% air voids is still much lower than that of permeable bases, it is still approximately six times more permeable than class 5 aggregate base. This relationship was also found by Cooley, Brown and Maghsoodloo (2001) who reported that coarse, dense graded SuperPave mixtures with a nominal maximum aggregate size of 3/4" (19.0 mm) became excessively permeable at approximately 5.5% in-place air voids, which corresponded to a field permeability value of 40.82 in/day. They also observed that permeability appeared to increase exponentially with in-place voids (Figure 2.3).

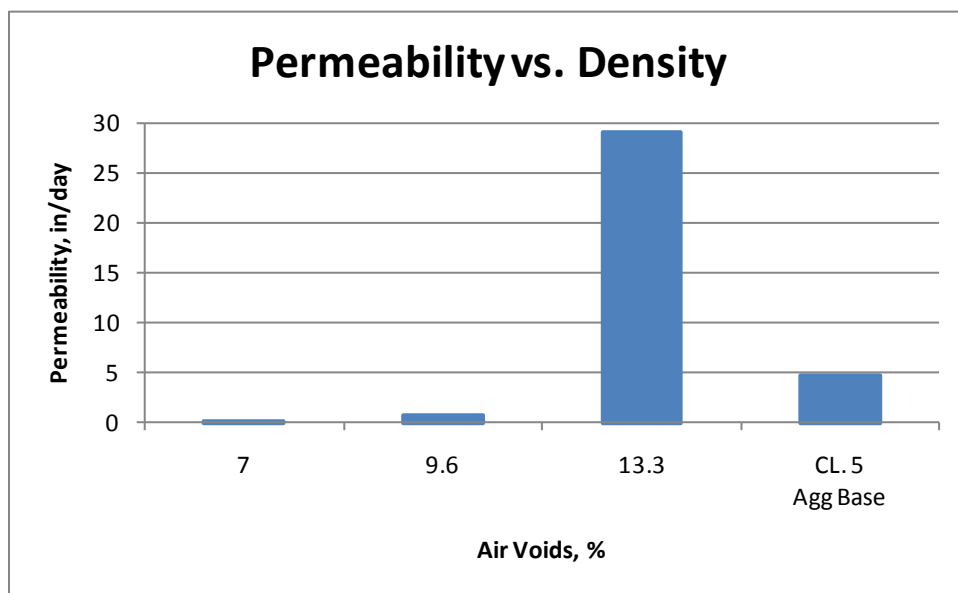


Figure 2.2. Permeability vs. Air Voids

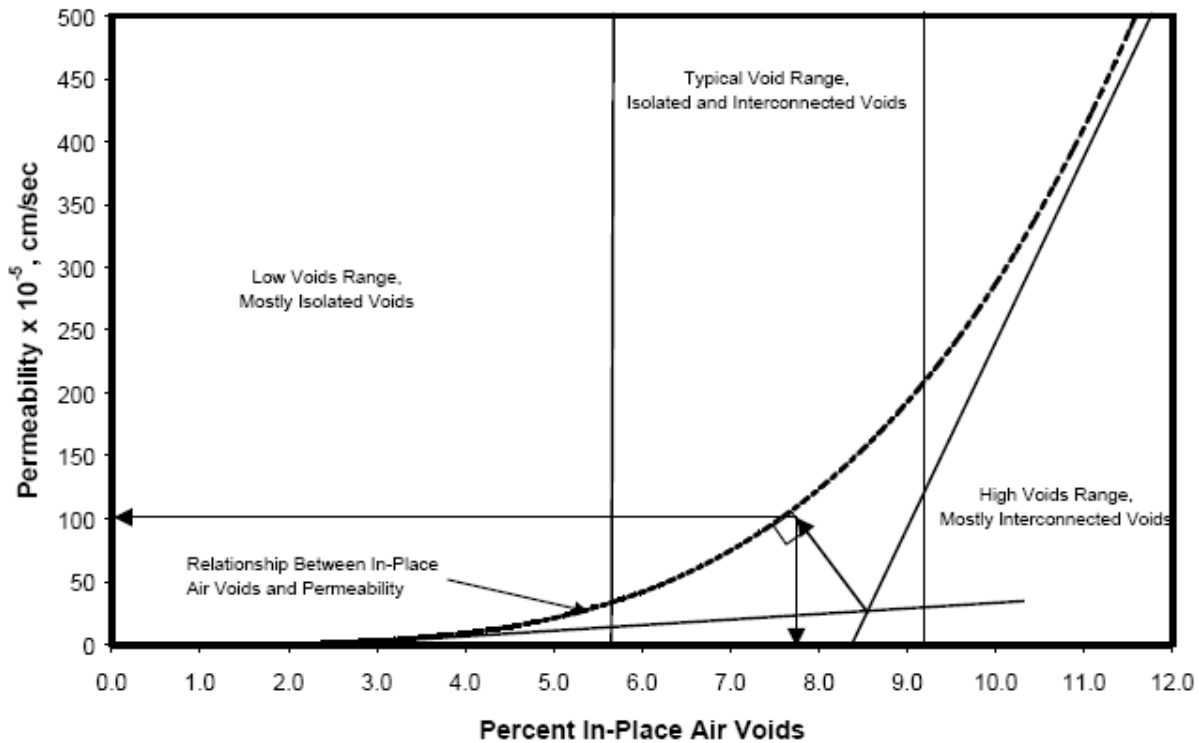


Figure 2.3. Permeability vs. In-Place Air Voids (Cooley Jr., Brown and Maghsoodloo, 2001).

Lottman Test (Mn/DOT Modified)

The moisture sensitivity was ascertained by performing modified Lottman tests in accordance with ASTM D 4867, Mn/DOT modified (See Appendix A). The moisture sensitivity was gauged by comparing splitting tensile test (Figure 2.4) results of control, or non-moisture conditioned specimens (dry strength) against those of moisture conditioned specimens (wet strength). The ratio of the wet strength to the dry strength represents the tensile strength ratio, or TSR. The generally accepted minimum threshold value for TSR is 70%.

Figure 2.5 shows the TSR values vs. the air void content of the mix. All three TSR values are above the 70% criterion; however, the increase in air voids appears to correspond with a decrease in the TSR, which suggests reduced resistance to moisture induced damage. In addition, the apparent relationship appears to suggest that a mixture with 17% air voids, would have a TSR value of 70%. Figure 2.5 compares the visual appearance of the ‘wet’ and ‘dry’ specimens after testing. From this figure, there does not appear to be a relationship between air void content and stripping potential as all three sets appear to be relatively the same.



Figure 2.4. Lottman Testing

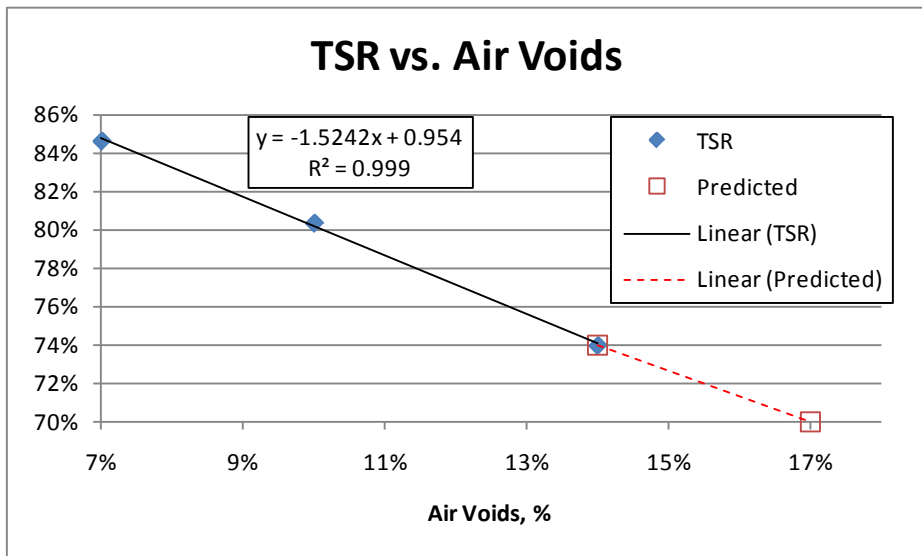


Figure 2.5. Tensile Strength Results (TSR) vs. Air Voids

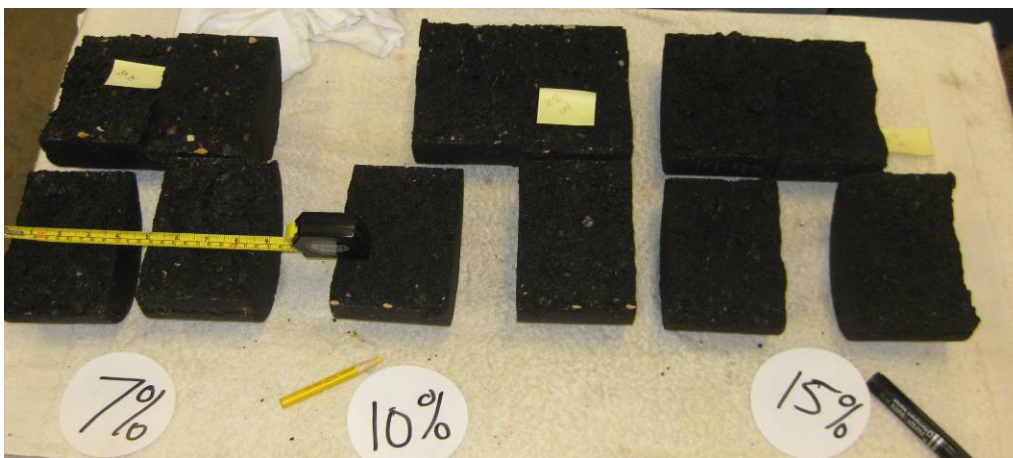


Figure 2.6. Visual Examination of TSR specimens

Figure 2.7 shows the dry and wet tensile strength values of the three mixtures. There is a much more noticeable impact on these strength values due to the increase of air voids than there was on the TSR. Generally speaking, a doubling of the air voids from 7 to 14 corresponds with a reduction of 52% and 58% in the dry and wet tensile strengths respectively. These reduced strength values could be expected to contribute to a less durable pavement. It should also be considered that the tests were conducted on newly prepared mixtures; pavements in the field degrade and loose strength and durability over time. A pavement that has initial TSR value near the borderline, will most likely reach a compromised state sooner than one that has a higher initial TSR value.

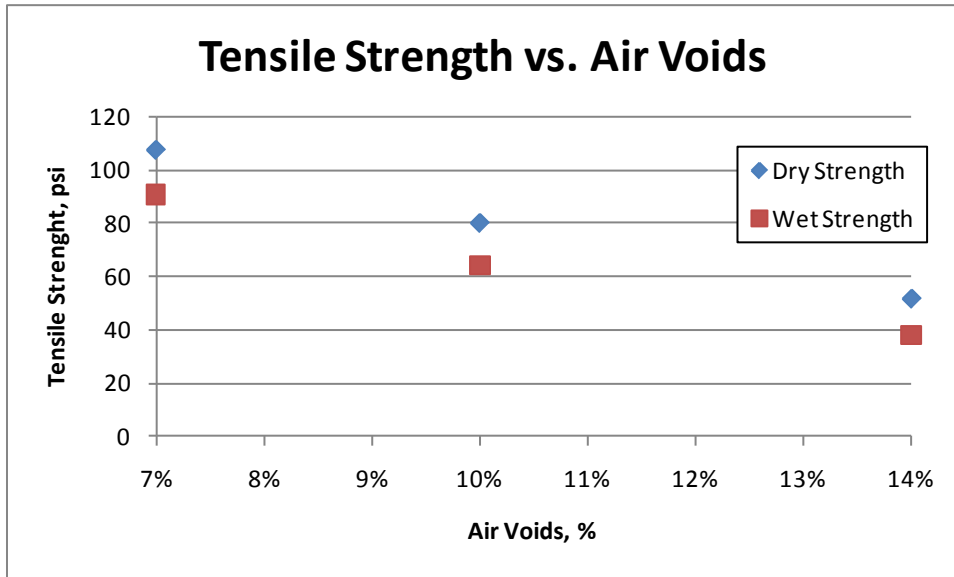


Figure 2.7. Tensile Strength vs. Air Voids

Asphalt Pavement Analyzer (APA) Test “Wet” (Mn/DOT Modified).

The asphalt pavement analyzer (APA) device, as shown in Figure 2.8, was used to experimentally evaluate the mixture’s susceptibility to rutting. The “dry” test consisted of applying 8,000 cycles of 100 lbf strokes to the lab-compacted gyratory specimens at 137 °F (58°C), which is approximately equivalent to 1,000,000 ESALS. The “wet” test consisted of applying a number of cycles until the mixture reached a set rutting value while immersed in water. A mixture’s susceptibility to rutting is typically dependant upon the binder (content and stiffness) as well as the gradation of the mixture and air void content. Higher rut depths indicate a softer mixture where lower rut depths indicate a stiffer mixture; typical level three mixtures evaluated by Mn/DOT have rut depths between 6 – 10mm.



Figure 2.8. Asphalt Pavement Analyzer (APA), or Rut Tester

This test was performed under dry and wet (submerged) conditions. The wet APA was intended to simulate the three factors identified in the literature search as contributing to the stripping phenomenon: presence of water (saturation), high stress and high temperatures. Figure 2.9 and Figure 2.10 show the rut depth vs. the number of applied cycles for the wet and dry tests respectively. Table 2.1 shows the average rutting rate in mm per hour (mm/hr) for the three air void contents in the two different testing conditions (wet and dry). For consistency purposes the average rutting rate (measured rutting/number of cycles) was computed based upon the same number of cycles for both testing conditions, the test conditioned that governed the number of cycles appears as bold in the table.

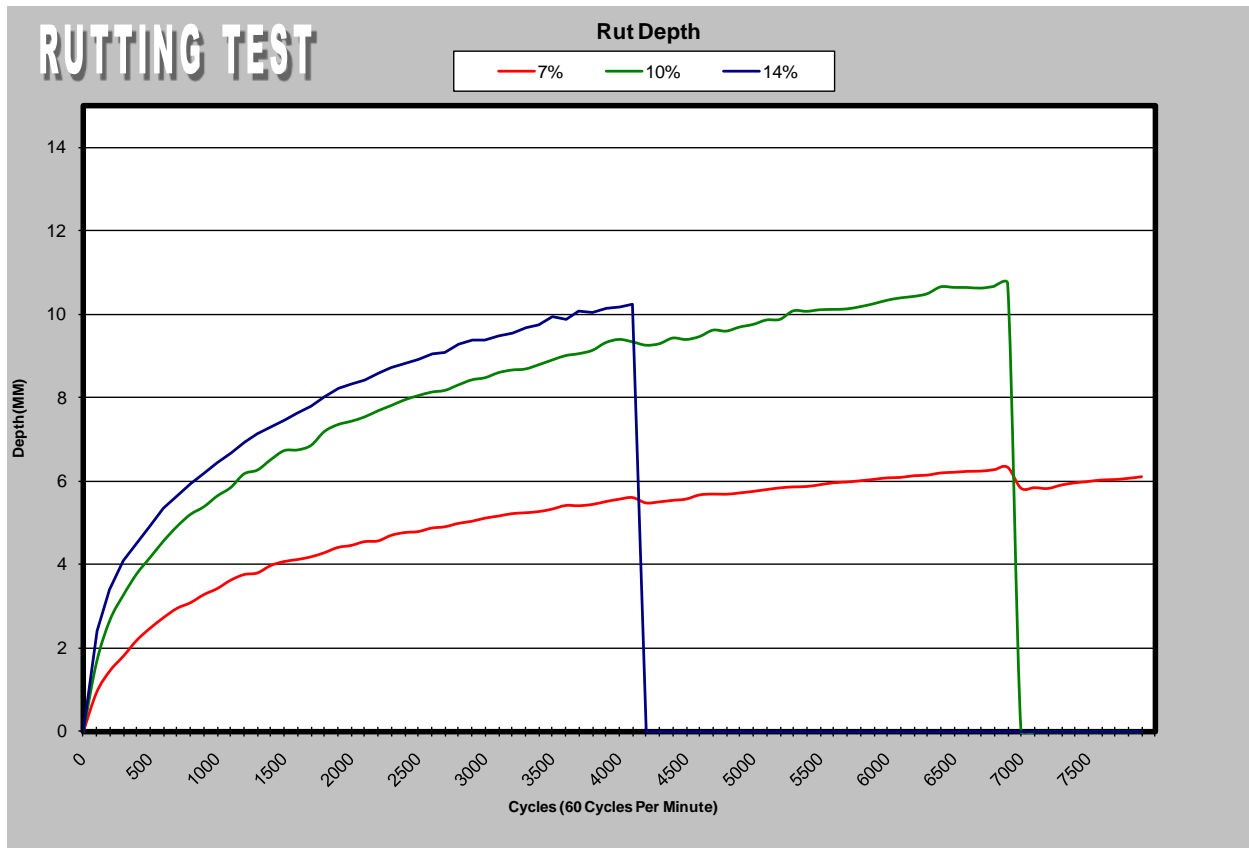


Figure 2.9. Asphalt Pavement Analyzer (APA) Test Results of Dry Test

Table 2.1. Average Rutting Rates (mm/hr)

AV	Test	Cycles	Rutting (mm)	Avg. Rate (mm/hr)	% Difference
7	wet	8,000	7.275	3.27	16.5
	dry	8,000	6.164	2.77	
10	wet	6,965	8.92	4.61	19.3
	dry	6,965	10.822	5.59	
14	wet	3,404	9.799	10.36	0.2
	dry	3,404	9.781	10.34	

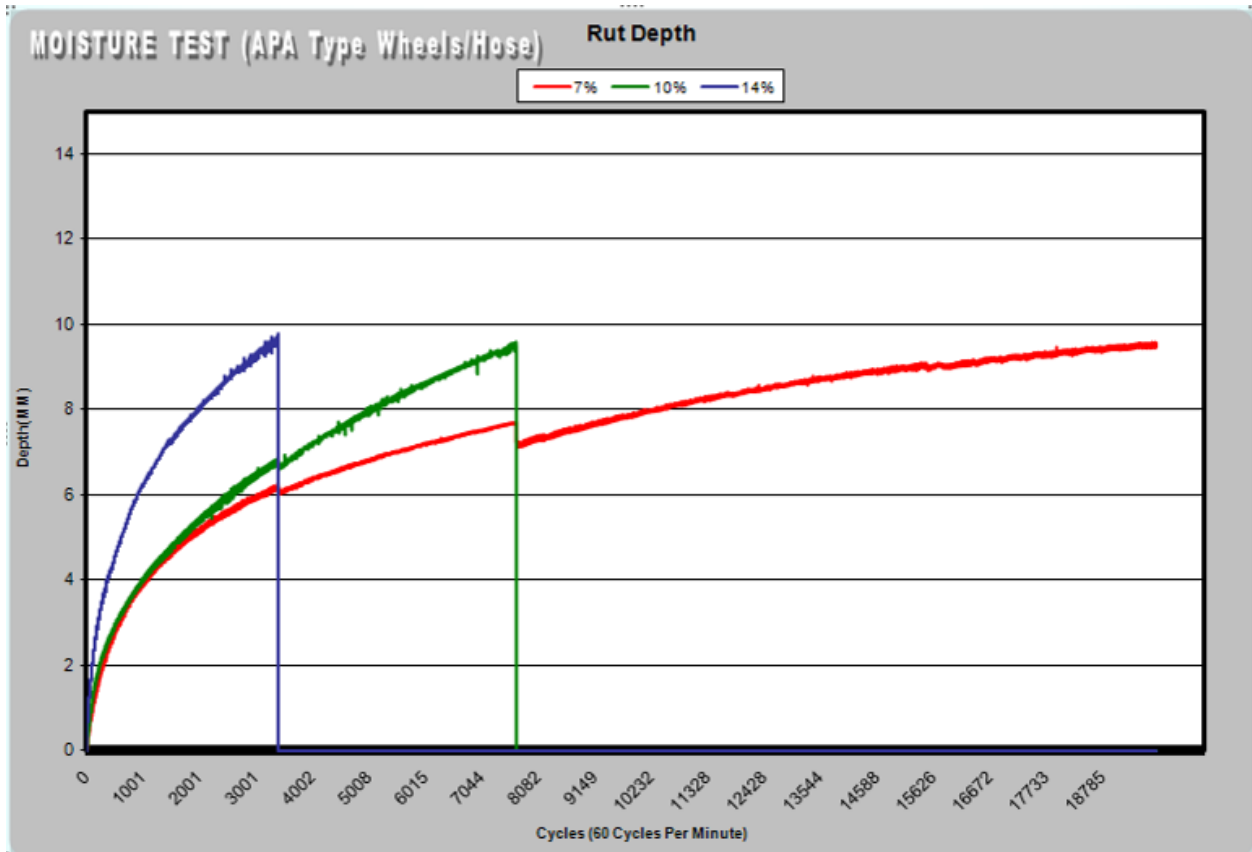


Figure 2.10. Asphalt Pavement Analyzer (APA) Test Results of Wet Test

The mixtures with the higher air void contents rutted at a faster rate than those with smaller air void contents. The greatest difference in rutting rates between ‘wet’ and ‘dry’ testing conditions were at the 10% and 7% air void contents; the mixture with 14% air void content showed little difference. After testing in the wet condition the specimens were broken open and examined for any visual evidence of stripping (Figure 2.11); there was no visual evidence of stripping among any of the test specimens, although there did appear to be some evidence of stripping where the hose interfaced with the mixture surface.



Figure 2.11. Visual Examination of APA ‘wet’ specimens

Modified Boiling Test (Proposed by Research Team)

One half of the sample left over from the dry indirect tensile strength tests was used in the modified Iowa boiling test. A total of four samples were tested, two that had the highest air voids (14%) and two that had the lowest air voids (7%). These samples were weighed, placed in a pot of boiling water for 6 minutes, allowed to cool and reach an air dried state and the final weight was measured. Neither of the specimens showed any visual cues of stripping (asphalt removed from aggregate particles) as the before test condition (Figure 2.12) looked similar to the after test condition (Figure 2.13).

However, the specimens with 14% air voids lost an average of 12.2% of their initial weight and the specimens with 7% air voids lost an average of 3.4% of their initial weight. In addition, empirical observations after the test showed that the specimen with higher air voids was much less intact than the comparable specimens with lower air voids (Note the distorted shape in Figure 2.13). The 14% air void specimens crumbled after the test and had to be handled very delicately and the 7% air void specimens were still intact and could be handled 'normally'.

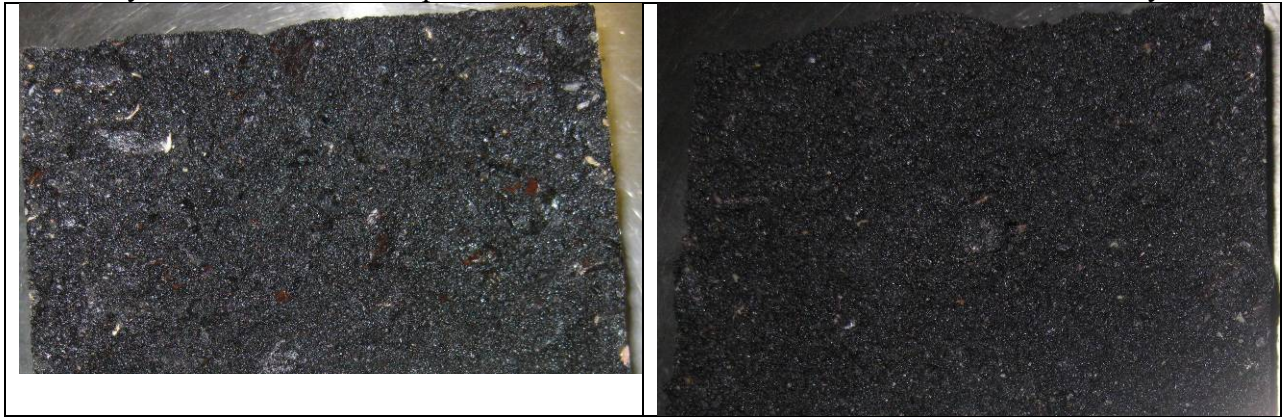


Figure 2.12. 7% and 14% Air Void Specimens (left and Right) *before* Modified Boiling Test

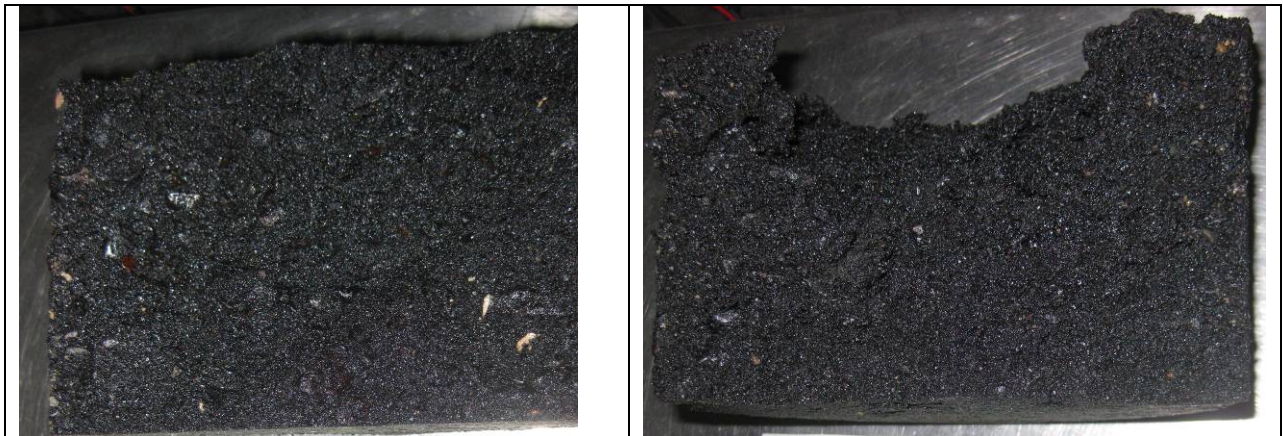


Figure 2.13. 7% and 14% Air Void Specimens (left and Right) *after* Modified Boiling Test

Chapter 3. Conclusions

This report represents task 2 of the Minnesota Local Road Research Board (LRRB) project number (Investigation) 2010-042, entitled, “Stripping of Hot Mixed Asphalt Pavements (HMA) under Chip Seals”. The goal of this specific task report is to identify, or develop a methodology that can be used to assess potential at-risk streets before they are treated with a surface treatment. Based on previously completed forensic investigations, and survey responses the research team has hypothesized that low density (high-interconnected air voids) are a contributing factor to the observed stripping distresses. Thus, the experimental plan investigated the influence of various air void contents (7, 10 and 14%) on a mixture’s susceptibility to moisture induced damage. The mixtures susceptibility was tested with: permeability tests, Mn/DOT modified Lottman, Asphalt Pavement Analyzer (APA) tested under wet and dry conditions, and a modified Iowa Boiling Test.

Permeability testing indicated that the mixtures became significantly more permeable when the air void content was near 14%. The Lottman test did not show any visual evidence of stripping and all tensile strength ratios (TSR) were above 70%. However, the mixtures with the highest air void content had the lowest TSR at 74% and the mixture with the lowest air void content had the highest TSR at 84%. The change in air void content had the most dramatic influence on tensile strength values; a doubling of the air voids from 7% to 14% corresponded with a reduction of 52% and 58% in the dry and wet tensile strengths respectively. APA test results were mixed as the greatest difference in rutting rates between ‘wet’ and ‘dry’ testing conditions were at the 10% and 7% air void contents; the mixture with 14% air void content showed little difference. None of the mixtures showed signs of visual stripping. In the modified Iowa boiling test, the specimens with 14% air voids lost an average of 12.2% of their initial weight and the specimens with 7% air voids lost an average of 3.4% of their initial weight. In addition, empirical observations after the test showed that the specimen with the higher air voids (14%) was much less intact than the comparable specimens with lower air voids (7%).

There was no test that explicitly showed asphalt stripping away from mixtures with higher densities; however, the results of the laboratory testing did indicate that the higher air voids do contribute to reduced pavement durability through reduced strength, increased susceptibility to rutting and increased permeability. The permeability and the modified Iowa Boiling test results indicate that pavements with higher air void contents may be more susceptible to moisture induced damage than pavements constructed with the proper amount. These factors will also reduce the life of a chip seal that’s placed on top of a compromised pavement. Future testing within this project will entail conducting the same tests (permeability, Mn/DOT modified Lottman, wet and dry APA, and modified Iowa Boiling) but on sealed specimens of varying density to more closely simulate field conditions. In addition, to the research team intends to modify the laboratory Permeameter to examine whether or not moisture (from the bottom) can penetrate a chip seal or a fog seal surface treatment.

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Appendix C: Task 3 Report



Chapter 2. Minnesota Department of Transportation

Chapter 3. Memo

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TO: Tom Tesch

DATE: July 17, 2012

SUBJECT: Task 3 memo for LRRB 904 Stripping Under Chip Seal Study

This memo will document what was completed in Task 3 of the LRRB Research Project INV. 904 *Stripping of Hot-Mix Asphalt Pavements under Chip Seals*. Task 3 was to test cores from city streets to test the hypothesis developed in Task 2. The hypothesis states that areas of low density or high air voids in the asphalt pavements are the major contributing factor to stripping of the Hot Mix Asphalt (HMA) after a chip seal has been placed.

Numerous streets were reviewed and three (3) cities were picked for study, Brooklyn Center, Eden Prairie and Woodbury. These cities were selected based on a significant amount of streets having stripping issues. Selection of streets to evaluate and the evaluation procedures are described below.

First a visual review with City Street Department personnel was conducted. Based on this review, areas were selected for further evaluation. On the streets that had previously received a chip seal, the following methods were used for evaluation. A nuclear density gauge was used to perform a nuclear density test (NDT). The gauge was placed on pavement close to the area of stripping ensuring uniform contact from gauge and the street. Two (2) readings were taken at 90° to each other (Figure 1). Then the gauge was placed as close to the stripped area as possible that showed no sign of damage. Two (2) more tests were performed similarly as previously described. This process continued until the complete paving pass had been tested. Then cores were cut at same location as the NDT readings (Figure 2)



Figure 14 Nuclear Density Gauge

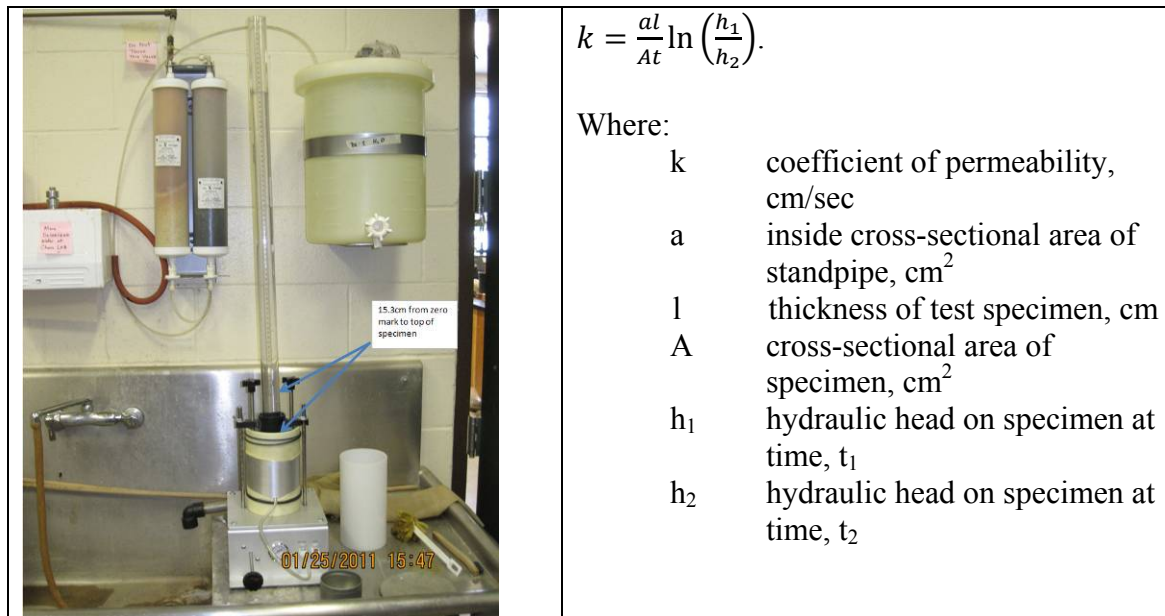


Figure 15 Coring at NI location

The cores were then taken to the MnDOT Materials Lab. The chip seal was sliced off the samples, then air voids (ASTM T269, T166 & T209) and permeability were measured using the Flexible Wall Permeameter ASTM PS 129-01.

The streets that did not have a current chip seal were evaluated using the nuclear density gauge to measure density, then field permeability with NCAT Field Permeameter tester, sample coring, lab permeability ASTM PS 129-1 and in place air voids same as chip sealed streets.

Non chip sealed streets were evaluated in hopes of determining a method to predict the possibility of stripping of the street after it was chip sealed. Task 5 will analyze the data collected develop recommendations on how to evaluate existing streets for a chip seal.



$$k = \frac{al}{At} \ln \left(\frac{h_1}{h_2} \right).$$

Where:

- k coefficient of permeability, cm/sec
- a inside cross-sectional area of standpipe, cm²
- l thickness of test specimen, cm
- A cross-sectional area of specimen, cm²
- h₁ hydraulic head on specimen at time, t₁
- h₂ hydraulic head on specimen at time, t₂

Figure 16 Lab Permeameter

Conclusions:

Field testing: Based on ease of use and quick results, the nuclear density gauge is the best test method to used test and evaluates a large number of locations. The negative to this method of evaluation is the gauge requires a trained and licensed operator and has special storage requirements. The NCAT Field Permeameter tester is a slow test taking over 20 minutes to complete on test location in field. The result can vary from operator to operator. Some pavement surfaces are more difficult to seal the tester to which can give false readings. One interesting observation was that in areas of stripping under chip seal, we had difficulty in obtaining cores. The action of the core barrel and water in many cases completely destroyed the remaining pavement. Areas close to site of destroyed cores had air voids up to 11% this leads us to believe that areas with worst stripping have even higher voids. See figure 4 & 5 below.



Figure 17 Destroyed cores



Figure 18 Pavement in area of stripping

Figure 6 is graph of some of the data obtained for field samples. Base on the information gathered both NDI and Lab permeability correlate and are acceptable tools to determine variability in density.

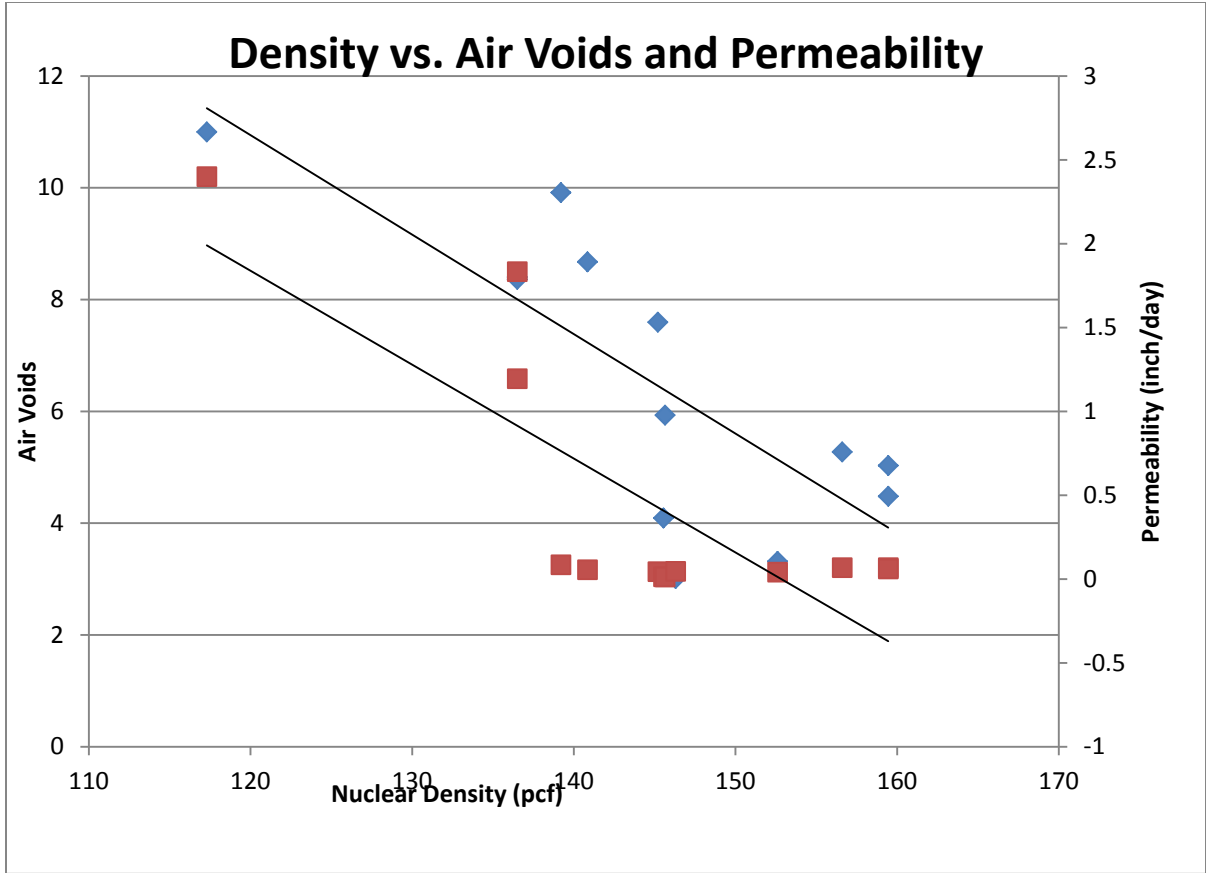


Figure 19 Graph comparing Density vs. Air Voids & Permeability

The results from different test methods will be discussed in-depth in Task 5.

Appendix D: Task 4 Report



Chapter 4. Minnesota Department of Transportation

Chapter 5. Memo

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TO: Tom Tesch T.L.

DATE:

SUBJECT: Task 4 for LRRB 904 Stripping Under Chip Seals

In Task 4 we will discuss the different construction practices used for streets among many Cities. Some of the areas discussed are the following: history of the MnDOT HMA specification, type of mixes used, construction methods.

Hot Mix Asphalt (HMA) Mixtures History in Minnesota

Please see below for a brief history of the HMA specifications:

- Specification 2331 (Pre 1988)
- Specification 2340 (1988)
- Specification 2340 Modified (1997)
- Specification 2350 (1998)
- Specification 2360 (1998)
- Combined 2350/2360 (2003)

2331

MnDOT Specification 2331 was the standard HMA specification prior to 1988. In this specification the MnDOT designed the mixes for the contractor, process control and acceptance testing was performed by MnDOT. The Contractor's only role was to produce and place the HMA mix.

2340

MnDOT Specification 2340 was implemented as a quality management specification in 1988 and modified in 1997. This specification addressed problems with rutting, flushing, and raveling. In this specification, the Contractor was responsible for the mix design and the Quality Control (QC) testing. Air voids was used as the primary acceptance criteria.

2340 was modified in 1997 to include new mixture quality measurements. These were Voids in Mineral Aggregate (VMA) and Tensile Strength Ratio (TSR) testing. TSR testing is a measure of moisture susceptibility in the HMA.

2350/2360

The Minnesota Department of Transportation (MnDOT) adopted Super-Pave mix designs (MnDOT Specification 2360) in 1998. Some cities continue to use older mix methods such as MnDOT Specification 2331, 2340, and 2350. The table below gives a brief comparison between old specification 2340 and the newer Super Pave 2360 mixes:

2340 Mixes	2360 Super Pave
Crushing	
Type 31 No crushing requirement	Level 2 30% + 4
Volumetric	
Air Voids	Air Voids
	4%
	VMA*
	AFT**
No TSR***	TSR Required
Compaction	
Ordinary Compaction	Max Density
Modified specified	Higher Requirements

* Void in mineral aggregate

**Asphalt Film Thickness

*** Tensile Strength Ration (TSR) - Stripping Test

Crushing:

Requiring minimum amount of crushed aggregates increases the structural stability of the HMA. This allows resistance to the traffic loadings without rutting occurring. During the 1980's rutting in HMA pavements was common due to the lack of crushed aggregates.

Air Voids

Air voids requirement for Super Pave mixes (2360) are stricter than the older 2340 mixes. Some of the volumetric for 2360 deal with voids in mineral aggregate which insures proper density and amount of asphalt without issues of rutting and flushing that 2340 mixes had.

Asphalt Film Thickness (AFT)

In late 1980's, to help reduce the rutting in the HMA the asphalt binder content was decreased, creating drier HMA mixes. The theory was that the drier mix would be more stable. However, the drier mixes were more susceptible to stripping, cracking, and other forms of water damage. These problems did not occur as frequently in the 1970's and the early 80's as it did later in the 80's.

AFT is a requirement to help insure proper amount of asphalt in the HMA to deal with durability issues. AFT came about to make sure that high Recycled Asphalt Pavement (RAP) used in new HMA have enough new asphalt to perform properly.

TSR

TSR is tested to determine how likely the HMA is to suffer water damage. Since this study is looking at stripping i.e. water damage. It is recommended that TSR be tested on all new HMA projects.

General Discussion

In discussion with some of the HMA Contractors and mix Suppliers, normally they see little to no cost differences between 2340 mixes and 2360 level 2. This can be explained because suppliers are do the quality control (QC) testing for 2360 mixes daily as it is the current specification. QC testing for 2340 mixes is not, thus some extra time is needed from the supplier to review the older specification. Suppliers are also producing 2360 Level 2 & 3 mixes on most other jobs throughout their area, i.e. county and state occurring at the same time and using the similar mix designs, increases the plant production rates.

Based on finding from samples and testing in Task 3, it is apparent that variability in density is a major factor in stripping under chip seal. Air voids ranged from 5% in great performing streets to over 11% on streets that are showing severe stripping.

In Task 2 it was demonstrated that an asphalt mixture that has not had issues with stripping when properly constructed would strip when the air voids were greater than 8%. This shows that a better job of compaction during construction the asphalt pavement is needed. Ordinary compaction when done properly would not have had these issues. If the test strip was properly constructed and represented the true condition of the paving job then uniform density would have been achieved. The main issue with the ordinary compaction method is lack of enforcement of the established rolling pattern. The inspector needs to be present at all times to ensure that the pavement receives proper number of passes with the roller and to make sure the temperature of the mix is with in the specified requirements during compaction. The benefit of maximum density is the ability of the agency to test density in areas that may not meet minimum requirements.

Many of the projects that were looked at as part of this study were originally constructed in the 1990's. At this time the 2340 specification was the current specification and required ordinary compaction methods. See Appendix A for bituminous specifications from the City of Brooklyn Center from the time the streets studied were constructed and also the cities current bituminous specification.

One city that switched from ordinary compaction to maximum density stated that the asphalt pavement was the same price. The contractor used two 20 to 25 ton double drum steel roller and a pneumatic roller when maximum density was specified. Prior to specification using the maximum density contractor on an ordinary compaction job had only one 6 to 8 ton roller on the job.

Recommendations

1. Switch from 2340 mixture requirements to 2360 level 2 or 3 as need for traffic.
2. Use specified density for compaction
 - a. The use of the MnDOT's incentive program is optional.
3. Pay close attention to areas that are difficult to pave and compact.
 - a. Sharp radius, skewed intersections, cross streets etc...
4. Spend more time and effort on inspection of paving
5. If doing a mill and over lay then the existing street should be cored to determine quality of base course before designing project.
6. Chip seal earlier in pavement life.

Additional Needs for Research

1. Bond strength of tack coat bond strength
 - a. In coring many streets as part of this project, the lack of bonding of base course to wear course of HMA is very apparent.
 - b. It is hypothesized that the lack of strong bond reduces the durability of the wear course because it is independent of the underlying layers, causing movement between layers. This movement could increase the stripping effect.
2. Study priming granular base materials before paving to waterproof bottom of the asphalt pavements.
3. Develop quick setting fog sealing product.
 - a. Lab testing done as part of this study shows that a fog seal will keep water out but still all water vapors to migrate out of the HMA.
4. Study using lower air voids design mixes
 - a. Maybe as low as 1 to 2%
5. Use softer based asphalt binder
 - a. PG -34

Appendix E: Task 5 Report



Chapter 6. Minnesota Department of Transportation

Chapter 7. Memo

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DATE: September 20, 2012

SUBJECT: Task 5 for LRRB 904 Stripping Under Chip Seals

Background

Analysis of the data collected in Task 3 will be discussed and presented in Task 5. It was shown in task 3 that all the tests, permeability, air voids, and density, correlated. The data showed that streets had high variability in density from 7 to 12 percent air voids in areas close to the stripped areas.

In the areas with severe stripping cores were not able to be retained for testing. This was due to the cores disintegrating into many pieces after pulling the core from the pavement. Nuclear density testing showed great amount of variability in the mix density from areas of not stripping to areas suffering from stripping. One street had the density varied from 145 lbs/ft³ in areas of the street with no issues to a low of 117.3 lbs/ft³ in areas experiencing stripping. For field evaluation of streets the nuclear density tester is the fastest and easiest to use of method tested. After discuss with experts from around the country it is recommend to not chip seal a street if the variability in density varies more than 6 lbs. per cubic foot as measured with nuclear density tester.

Data

Figure 1 shows that that when comparing the density to either air voids or lab permeability, the correlation is similar. This indicates density, air voids, and lab permeability are correlated to each other. As density increased and lab permeability and air voids decreased, less stripping was observed.

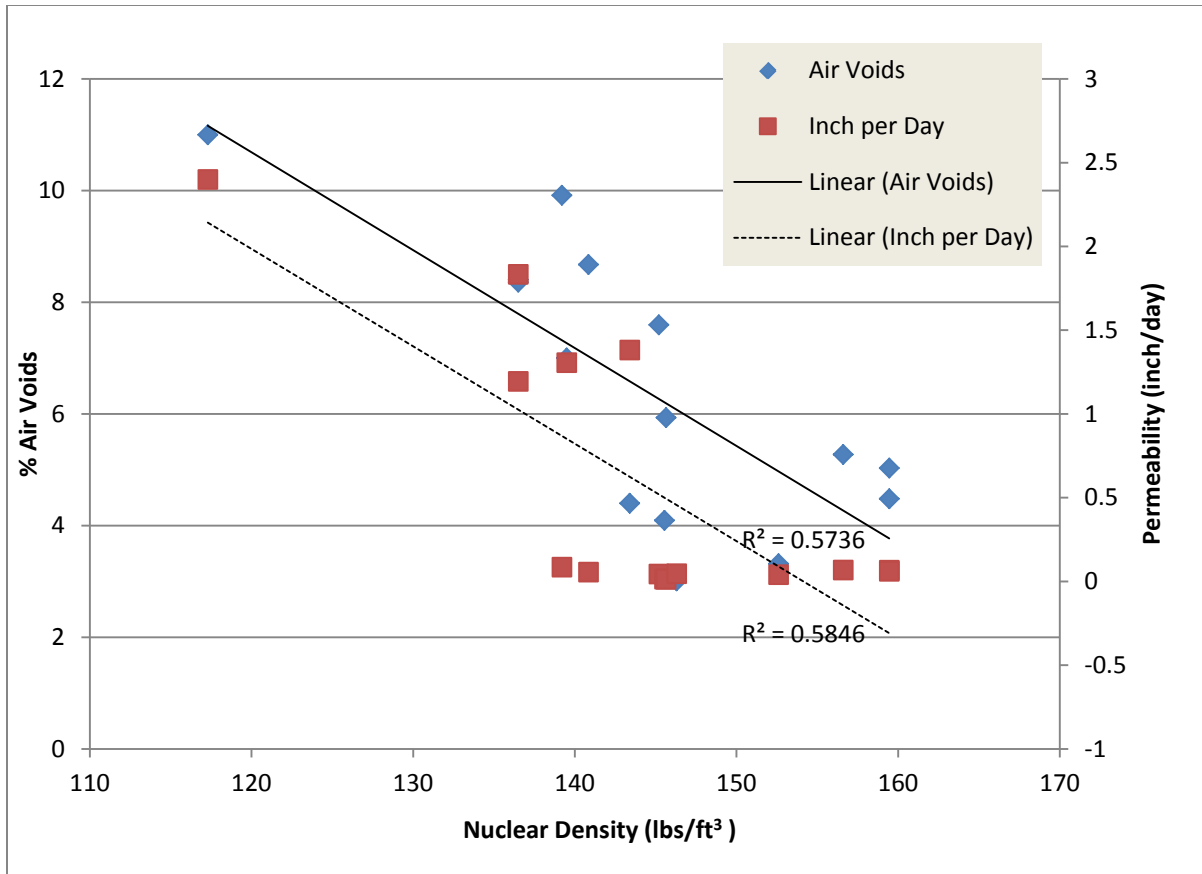


Figure 20 Air Voids and Permeability vs. Density

Figure 2 was made to compare it to the results found in a report from Cooley Jr., Brown and Maghsoodloo, “Development of Critical Field Permeability and Pavement Density Values for Coarse Graded Super Pave Pavements.” In this report the authors compared lab permeability to air voids. We saw similar results, it is important to note in this study the mixes tested are dense graded. Our results show a similar curve but less permeability.

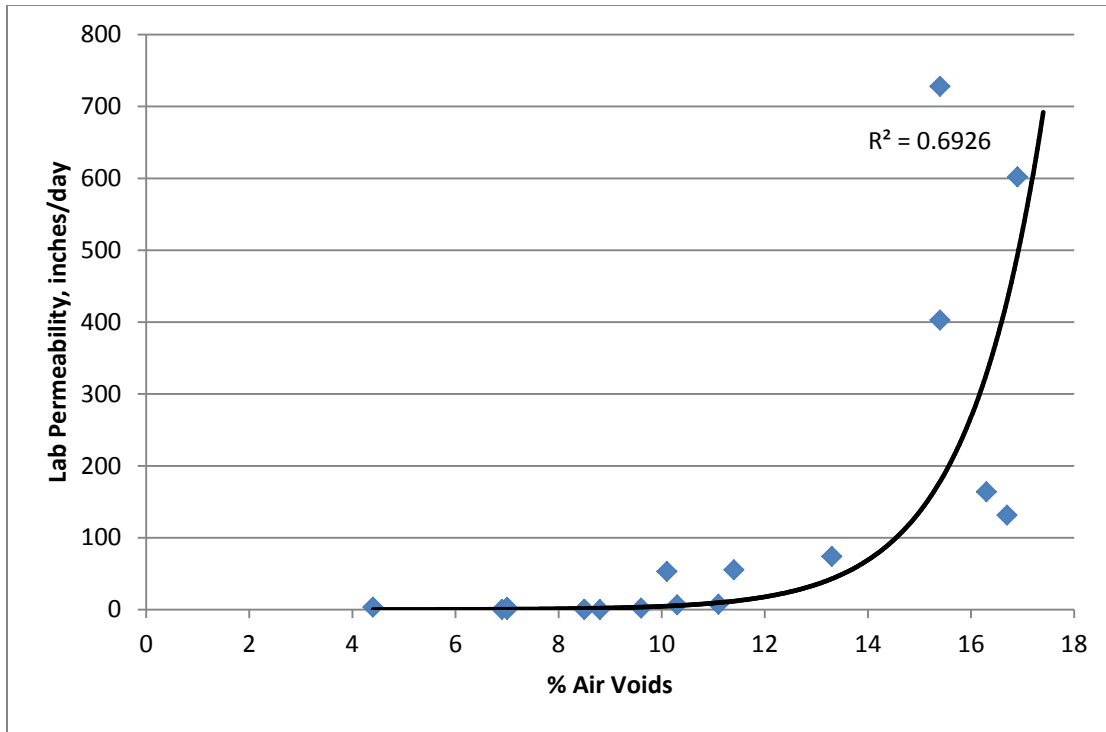


Figure 21 Air Voids vs. Lab Permeability

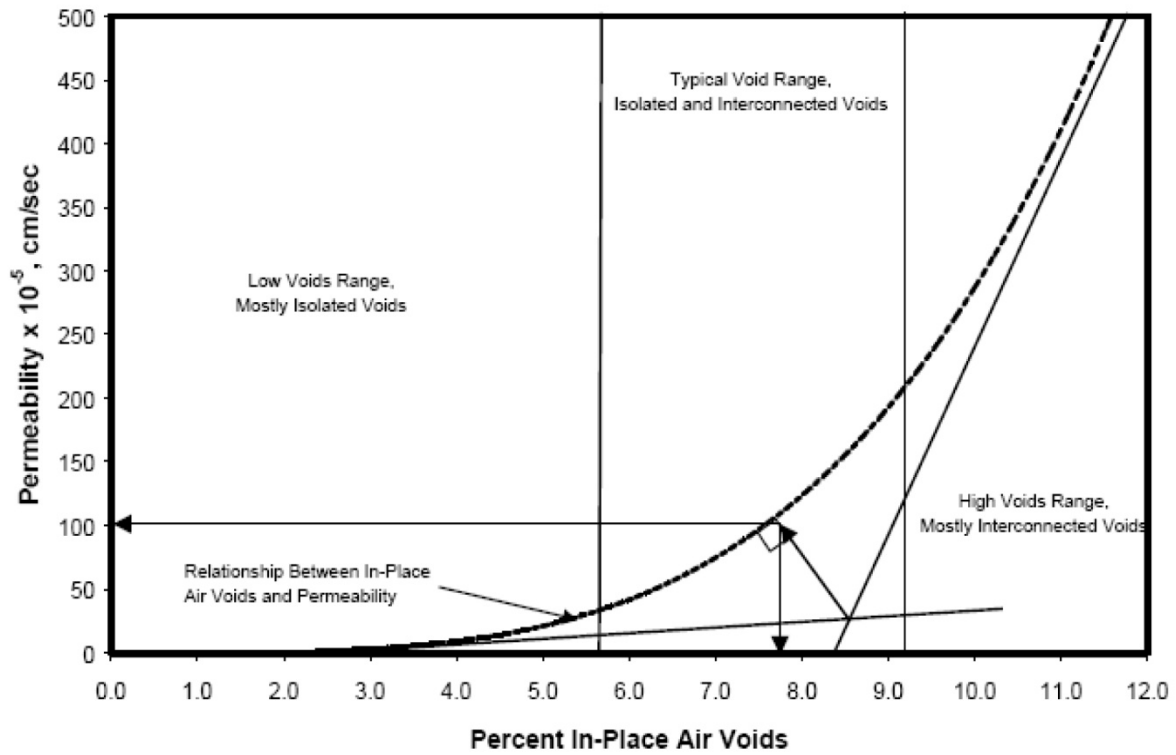


Figure 22 Permeability vs. In-Place Air Voids (Cooley Jr., Brown and Maghsoodloo, 2001).

Conclusions / Recommendations

Based on the field testing from this research project, it was determined that all three field test evaluated in this task are valid tests to perform to help predict if streets may strip after placement of a chip seal. All three evaluations correlated to each other and to stripping.

The easiest and least invasive test for agencies to perform to predict if the streets will strip is a nuclear density test. The air voids and lab permeability test require cores to be taken from the pavements and brought back to a lab for evaluations. After discuss with experts from around the country it is recommended to not chip seal a street if the variability in density varies more than 6 lbs/ft³ as measured with nuclear density gauge.

Prevention of Stripping Under Chip Seals

David L. Rettner, Principal Investigator
American Engineering Testing, Inc.

October 2017

Research Project
Final Report 2017-35



To request this document in an alternative format, such as braille or large print, call [651-366-4718](tel:651-366-4718) or [1-800-657-3774](tel:1-800-657-3774) (Greater Minnesota) or email your request to ADArequest.dot@state.mn.us. Please request at least one week in advance.

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16. Abstract (Limit: 250 words) Eighteen chip-sealed roadways in eight cities and counties in Minnesota were evaluated both in the field (for condition surveys and density tests) and in the laboratory (for permeability, stripping, tensile-strength ratio, asphalt film thickness, and mix properties) to evaluate factors associated with stripping in asphalt pavements under chip-seal treatments. Analysis of the test data did not support an earlier MnDOT finding that high air voids were a cause of stripping under chip seals. For those locations that did exhibit stripping, the test data did not support a direct relationship between asphalt pavement density and stripping. In addition, the research did not determine a direct relationship between incidence of stripping and site/supplier data (e.g., bituminous mixture, contractor, geographic location, or year of construction). This observation agreed with observations made by Minnesota city/county engineers. An additional outcome of the research is the large amount of testing data developed, which is documented fully in appendices to the final report.			
17. Document Analysis/Descriptors asphalt pavements, seal coating, chip seals, stripping (pavements), pavement maintenance		18. Availability Statement No restrictions. Document available from: National Technical Information Services, Alexandria, Virginia 22312	
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FINAL REPORT

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The authors, American Engineering Testing, and the Minnesota Department of Transportation do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to this report.

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EXECUTIVE SUMMARY

The Minnesota Department of Transportation (MnDOT) recently conducted a study that identified less dense areas, or high air voids, in underlying asphalt pavements as the main cause of stripping under chip seals (Wood & Cole, 2013). This research project follows the work of MnDOT with extensive testing and analysis of low-volume roads in Minnesota that have experienced stripping under chip seal surface treatments.

The project focus was on 18 chip-sealed roadways in eight cities and counties in Minnesota. The research team evaluated the *in-situ* roads and collected pavement samples for laboratory tests. The research conducted included field studies of pavement distress and density (using ground-penetrating radar and nuclear gauge tests) and laboratory tests for permeability, stripping, tensile strength ratio, asphalt film thickness, and mix properties.

A major outcome of the research is that the research was unable to verify the earlier finding that high air voids were a cause of stripping under chip seals. For those locations that did exhibit stripping, the test data did not support a direct relationship between asphalt pavement density and stripping. In addition, the research did not determine a direct relationship between incidence of stripping and site/supplier data (e.g., bituminous mixture, contractor, geographic location, or year of construction). This observation agreed with observations made by Minnesota city/county engineers.

Other observations from 129 municipal engineers in Minnesota were obtained through an eight-question survey. The survey found that 64 percent of the respondents used chip-seal treatments on a regular basis. Of that fraction, 26 percent reported stripping in chip-sealed pavements as a major issue, 39 percent reported observing stripping but did not perceive it as a major issue, and 35 percent reported that they did not observe stripping in their chip seals. Given the survey and field data results, it is clear that not all roads with chip seals exhibit stripping.

Finally, an additional outcome of the research is the large amount of testing data developed under the project work. This data, which is documented fully in appendices to the final report, will help support and improve future research on stripping in chip seals in Minnesota and chip seal performance in general.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Preventative maintenance ensures that roadways at all agency levels provide a maximum return on investment. Effective maintenance efforts rely on an understanding of pavement loads (environment and traffic) and proper construction and materials. A critical variable that relies on engineer experience and awareness is timing, or when to initiate maintenance on a given roadway. Unfortunately, the timing of maintenance events, such as chip sealing, can be complicated by unforeseen distresses that reduce the life span for a treatment.

Identifying the factors that contribute to chip seal, or seal coat, performance has been a pavement engineering research concern for many decades, with studies on surface treatments dating back to 1928 (Gransberg & James, 2005). In addition, recent major studies have attempted to isolate factors (such as materials, design, and construction practices) that contribute to better performing chip seals (Gransberg & James, 2005). These major studies provide sound, general advice on the use of chip sealing as preventative maintenance; however, ultimately chip seal performance is a local issue given that (1) the treatment itself is thin and short-lived, (2) small variations in materials or construction, which are known to vary by source/location, can have large effects on performance, and (3) overall performance can depend heavily on the environment.

At the 2014 City Engineers Association of Minnesota, a discussion on asphalt paving mixes included the topic of stripping under chip seals, which was emerging as a major concern for over one-half of city engineers (Garrity, 2014). Stripping is understood to be the loss of asphalt concrete material near the asphalt surface (at the bottom of the chip seal), due to a break-down in the bond between the binder and aggregate in the asphalt. This phenomenon is illustrated in Figure 1 using a sample taken from a Minnesota road during the research. Figure 1b shows how material from the stripped asphalt remains bonded to the chip.



(a)



(b)

Figure 1. (a) Surface and (b) underside of chip seal that has “flaked” with stripped material from underlying asphalt pavement

Surveys conducted in a Minnesota Local Road Research Board (LRRB) and Minnesota Department of Transportation (MnDOT) study found that 40 of 66 local Minnesota agency engineers observed stripping under chip seals (Wood & Cole, 2013). This concern is particularly important in terms of asphalt pavements constructed in the mid- to late-1990s, which have been found to experience premature aging and thus given to stripping. Given Minnesota’s experience with stripping and chip seals, the MnDOT study of chip seals attempted to identify causes of stripping in chip-sealed pavements (Wood & Cole, 2013). The primary hypothesis of this study was that low density (i.e., high air voids) makes asphalt paving mixes more prone to stripping.

Wood and Cole (2013) conducted a study of three locations in Minnesota, from which they collected specimens for air void and permeability analysis in the laboratory. In addition to laboratory testing of 16 field specimens, the authors conducted a laboratory trial of SuperPave mixes common to Minnesota with three levels of air voids (7%, 10%, and 14%). The laboratory trials found that there “was no test that explicitly showed asphalt stripping away from mixtures with higher air voids” (p. B-5). However, on the basis of the 16 field specimens, the authors concluded that less dense areas, or high air voids, were the main cause of stripping in Minnesota chip-sealed pavements.

1.2 RESEARCH SCOPE AND OBJECTIVES

This research project originated from a MnDOT research needs statement that used Wood and Cole (2013) as a starting point for additional investigation of an important issue for local pavement maintenance practices. Thus, the main research objective for this project was to investigate stripping in chip-sealed pavements using testing and analysis of local Minnesota roads.

The research team was provided access to eight municipalities, which provided a total of 18 locations for study. The project scope included the use of these locations for field observation and pavement samples for laboratory examination. The first phase of the project work utilized field surveys, specimen collection, laboratory testing, and analysis to:

1. Verify the finding of Wood and Cole (2013) that high air voids is the primary cause of stripping
2. Investigate why high air voids occurred for locations where observed
3. Identify mix design or construction practices that may have led to observed stripping.

Upon completion of the first phase work, the project objectives were to develop and/or suggest practices to address stripping. Possible practices discussed with LRRB prior to the project work included maintenance techniques to extend the life of chip seals that have failed in stripping; best practices to prevent stripping in Minnesota pavements; and specification, mix design, and construction guidelines for low-volume residential streets if current mix designs are susceptible to failure in stripping

1.3 OVERVIEW OF REPORT

This report documents the full research effort (including data), which included field testing/evaluation and material collection at 18 locations in eight Minnesota municipalities and laboratory testing of collected materials. The report discusses (A) the results of field and laboratory tests and (B) an analysis of collected data. Finally, the report provides recommendations based on testing and analysis.

CHAPTER 2: EVALUATION OF CHIP SEALS IN MINNESOTA

City and county engineers collaborated with the research team to identify 18 locations for the study of chip seal performance, most notably stripping. These locations were used for field testing (i.e., distress condition surveys and density testing) and pavement samples (to be used for further laboratory studies). The following sections describe the locations visited and tests conducted as a part of the project work.

2.1 FIELD LOCATIONS

In the early stages of the project work, during October 2014, members of the research team visited 31 locations in Minnesota as potential sites of stripping in chip seals that could provide data for research. The original 31 sites considered for study are summarized in Table 1. Of the sites considered, 18 were selected for inclusion based on a combination of factors, including the ability to obtain intact cores, the possibility of stripping, and proximity to the Minneapolis-St. Paul metropolitan area to limit travel costs.

The primary 18 sections, located in seven municipalities and one county, consulted for the project work are indicated in the subsections below and shown in Figure 2. Appendix A to this report provides survey condition and core identification information for each location, and Appendix H provides all section information provided to the research team by city/county engineers during the project work.

In addition to the primary sections, additional pavement sections were assessed for the project work. Those additional sections will be noted where applicable (e.g. nuclear gauge testing included extra test locations in six municipalities).

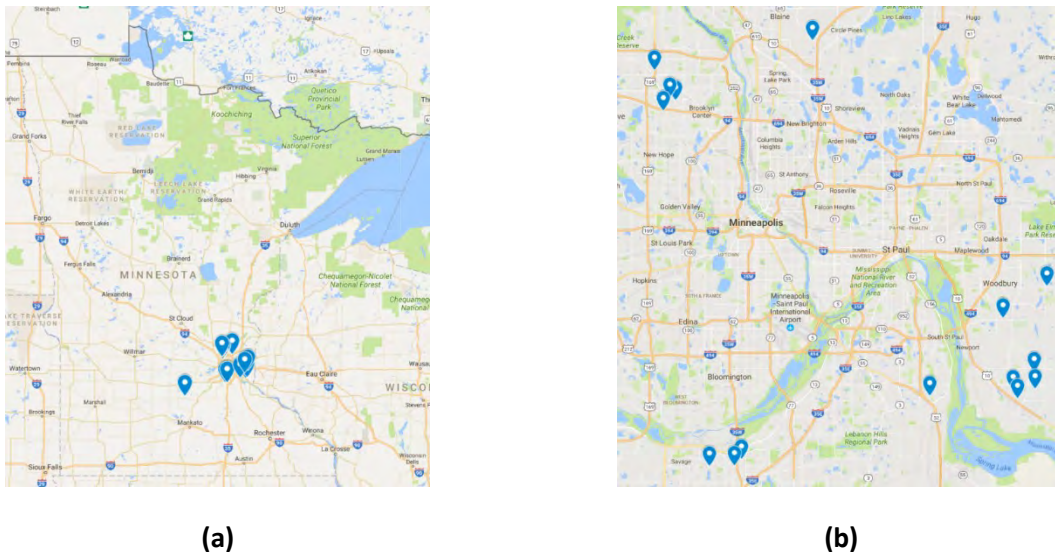


Figure 2. (a) State view and (b) Minneapolis-St. Paul metropolitan area view of locations of pavements surveyed for field and laboratory work

Table 1. Initial sites considered for study under project work

#	City	Street	Condition	Year Constr.	Year Seal Coat	Year last sealed	Last year seal rock	Mix Design	Street Section
1	Woodbury	Lochaven Drive	Stripping in various stages	1989			1/8" Trap Rock	1.5" 2341 Wear; 1.5" Type 2331 Base	8" CL5, 12" Sand
2	Woodbury	Newbury Alcove	Stripping in various stages	1989			1/8" Trap Rock	1.5" 2341 Wear; 1.5" Type 2331 Base	8" CL5, 12" Sand
3	Woodbury	Newbury Alcove	Non-sealed cul-de-sac	1989	n/a	N/A	N/A	1.5" 2341 Wear; 1.5" Type 2331 Base	8" CL5, 12" Sand
4	Woodbury	Torrey Drive	Stripping in various stages	1989			1/8" Trap Rock	1.5" Type 41B Wear; 1.5" Type 31 Base	8" CL5, 12" Sand
5	Woodbury	Bridgewater Parkway	Stripping in various stages	1998			1/8" Trap Rock	1.5" Type 41B Wear; 1.5" Type 31 Base	8" CL5, 12" Sand
6	Woodbury	Salem Drive	Stripping in various stages	1980			Buckshot	2" 2341 Wear	6" CL5, 4" Sand
7	Cottage Grove	Inberg Tr. So.	Stripping in Various stages	reconstructed in 1995	2000?	2007	1/8" Granite	1.5" 2341 Wear; 1.5" 2331 Base	6"-7" reclaimed gravel base
8	Cottage Grove	Islay Ave.	No signs of stripping	1980	2003	2010	1/8" Granite	1.5" 2341 Wear; 1.5" 2331 Base	4" CL 5 gravel base
9	Cottage Grove	Jergen	Stripping in various stages	1991	2003	2010	1/8" Granite	1.5" 2341 Wear; 1.5" 2331 Base	6" CL 5 gravel base
10	Cottage Grove	Jensen	No signs of stripping	1986	2003	2010	1/8" Granite	1.5" 2341 Wear; 1.5" 2331 Base	6" CL 5 gravel base

11	Cottage Grove	Hyde	No signs of stripping	1996	2000?	2007	1/8" Granite	1.5" Type 41B Wear; 1.5" Type 31B Base	5-9" reclaimed base
12	Brooklyn Park	Louisiana Ave	Stripping invarious stages	1995	1999, 2006	2014		1.5" Type 41A Wear; 2.5" Type 31B Base	4.5" Class 5 100% crushed Quarry
13	Brooklyn Park	Boone Avenue	Stripping invarious stages	1994	1999, 2006	2014		1.5" Type 41A Wear; 1.5" Type 41 Binder 7" Type 31 Base	6" Class 5 100% Crushed Quarry 16" Select Gran.
14	Brooklyn Park	63rd Avenue	Stripping invarious stages	1993/1994 (wear)	1999, 2006	2014		1.5" Type 41 Wear; 2.5" Type 41 Binder; 3.5" Type 31 Base	6" Class 5 (RAP), 18" Sel Gran/Gran
15	Brooklyn Park	Winnetka	Stripping invarious stages	1995	1999, 2006	2014		1.5" Type 41 Wear; 2.5" Type 31 Base	4.5" Class 5 100% crushed Quarry
16	Brooklyn Park	73rd Avenue	unsure	1998	2000	2007		1.5" Type 41 Wear; 2.5" Type 31 Base	4.5" Class 5 100% crushed Quarry
17	Brooklyn Park	Hampshire	unsure	1999	2000	2007		1.5" Type 41 Wear; 2.5" Type 31 Base	4.5" Class 5 100% crushed Quarry
18	Moundsview	Program Avenue	moderate to severe stripping in wheelpaths in both wear and non-wear	1994		records still being searched		1.5" Type 41 Wear; 1.5" Type 41 Binder; 2.0" Type 31 Base	
19	Blaine	93rd Avenue	moderate to severe in wheelpaths	1995		2004	FA-2 Granite	3.0" Type 41 Wear	4" Class 5
20	Blaine	93rd Avenue	moderate to severe in wheelpaths	1994		2004	FA-2 Granite	3.0" Type 41 Wear	4" Class 5
21	Burnsville	1990 Street Recon	moderate throughout project locations	8/1990 base, 7/91 wear	2001	2006		Type 41 Wear, Type 31 Base	
22	Burnsville	1991 Street Recon	moderate to severe throughout project locations	8-9/91 Base, 6-7/92 Wear	1999	2008		Type 41 Wear, Type 31 Base	

23	Burnsville	1992 Street Recon	Light (Frontier Lane) to Severe (Harold Drive)	8-9/92 Base, 6-7/93 Wear	1999/2000	None/2010		Type 41 Wear, Type 31 Base	
24	Burnsville	1993 Street Recon	Severe Throughout	8-9/93 Base, 6-7/94 Wear	1999	2010		Type 41 Wear, Type 31 Base	
25	Burnsville	1995 Street Recon	Light to Moderate Scattered	8-9/95 Base, 6-7/96 Wear		2002		Type 41 Wear, Type 31 Base	
26	Burnsville	2005 Street Recon	Light Along Joint (possible joint density problem)	8/31/2005		2011		2" Mill and Overlay; 2" MV3 (B)	
27	Inver Grove Heights	Cahill Avenue/Brooks Blvd	none	2009 (Mill and Overlay)		2011		2" Mill and Overlay; 2" MV3 (B)	previously stripped roadway
28	Sibley County	CSAH 9	Mostly Severe	1996				1.5" 31B Wear, 1.0" 31B Level	Existing Roadway
29	Sibley County	CSAH 9	Moderate to Severe	1997				1.5"31B Wear, 1.0" 31B Level	Existing Roadway
30	Sibley County	CSAH 9	Moderate to Severe	1997				1.5"31B Wear, 1.0" 31B Level	Existing Roadway
31	Osseo	City Wide	Moderate to Severe	1992				Depends on Roadway	

2.1.1 Blaine

Two locations in Blaine, MN, were examined for the project work. Separate ends (west and east) of a stretch of 93rd Avenue were surveyed and cored on December 1, 2014.

2.1.2 Brooklyn Park

Three locations in Brooklyn Park, MN, were examined for the project work. Sections of 73rd Avenue, Louisiana Avenue, and Winnetka Avenue were surveyed and cored on December 2, 2014, and December 3, 2014.

2.1.3 Burnsville

Three locations in Burnsville, MN, were examined for the project work. Sections of 134th Street, Heritage Circle, and Knob Hill were surveyed and cored on November 24, 2014, and November 25, 2014.

2.1.4 Cottage Grove

Four locations in Cottage Grove, MN, were examined for the project work. Sections of Hyde Avenue, Ingberg Trail, Jensen Avenue, and Jergen Avenue were surveyed and cored on November 18, 2014, and November 19, 2014. The cores from Jergen Avenue could not be extracted intact and therefore were not included in the study.

2.1.5 Inver Grove Heights

One location in Inver Grove Heights, MN, was examined for the project work. A section of Brooks Boulevard was surveyed and cored on November 21, 2014.

2.1.6 Osseo

One location in Osseo, MN, was examined for the project work. A section of 8th Avenue was surveyed and cored on December 5, 2014.

2.1.7 Sibley County

Two locations in Sibley County, MN, were examined for the project work. Separate ends (north and south) of a stretch of County State Aid Highway (CSAH) 9 were surveyed and cored on December 4, 2014.

2.1.8 Woodbury

Three locations in Woodbury, MN, were examined for the project work. Sections of Bridgewater Parkway and Newbury Alcove (the cul-de-sac and a straight portion) were surveyed and cored on November 19, 2014, and November 20, 2014. The Newbury Alcove cul-de-sac portion was unsealed and included for a comparison of the chip-sealed and unsealed portions of the road.

2.2 FIELD WORK CONDUCTED

The project research included surveys and extraction of cores from field locations indicated in Section 2.1. A total of 280 cores were collected for testing. The subsections below detail survey and testing procedures and core extraction operation; data and results are presented in Chapter 3.

2.2.1 Condition surveys

Members of the research team noted the general condition of all sections used for the project research. Condition surveys included observations and notes on localized distresses. The process of coring allowed the technician to assess the presence of stripping; this information was recorded with other general information on the pavement condition. In addition, ground penetrating radar (GPR) tests, detailed below, included supporting video surveys that could be used to examine the pavement condition.

2.2.2 Coring for laboratory testing

Coring operations for the project research involved the use of a coring rig mounted to the rear of a truck. The rig is shown in Figure 3. Six-inch diameter cores were obtained by drilling through the asphalt course to the top of the base layer. In addition to providing an intact specimen for testing, it allowed for the measurement of the in-situ pavement thickness.



Figure 3. Truck-mounted rig used to obtain cores on-site

2.2.3 Permeability testing

Field permeability tests using the NCAT Permeameter were investigated for the Cottage Grove, Inver Grove Heights, and Blaine sections. An illustration of one test is shown in Figure 4. Depending on surface roughness, obtaining a good seal was difficult, which complicated both the test and the usefulness of results from the test. Future permeability tests for this project were ruled out, given that the field permeability test has too many variables to confidently measure the permeability of an in-situ pavement with uncertain design.



Figure 4. Configuration of the NCAT Permeameter in attempts at field permeability testing

2.2.4 Evaluation using ground penetrating radar

Field work in support of the project research included ground penetrating radar (GPR) testing of pavement sections. GPR data was continuously collected at residential roadway speeds (20-40 miles per hour) using equipment mounted with 400 MHz and 2 GHz antennas and a SIR-20 control and data acquisition processor. The GPR configuration used for the study met or exceeded the ASTM D4748 and ASTM D6087 standards. Multiple passes were conducted to ensure that sufficient data was collected at 13 locations across five municipalities. The truck-mounted antenna is shown in Figure 5. All GPR data was coupled with precise GPS location data in support of more sophisticated analysis, which is presented in Chapter 3.



Figure 5. Vehicle-mounted GPR used for site evaluation

2.2.5 Nuclear density gauge testing

A nuclear gauge was used to assess the density of pavements on site. Backscatter testing was applied in accordance with ASTM D2950 to quickly assess both properties. Initially, nuclear gauge testing was conducted in six municipalities at 37 separate locations to compare asphalt densities. Of these 37 locations, mix data was available for 29 locations assessed. Extensive nuclear gauge testing was later conducted in these six municipalities to be coupled with the results of GPR testing. More details on these locations are included in the Chapter 3 analysis of test results.

2.3 LABORATORY WORK CONDUCTED

The research team conducted extensive laboratory testing to understand the behavior of chip sealed pavements. The laboratory testing relied upon the collection of a minimum of 12 cores from each of the locations; an example of a collected core is shown in Figure 6.

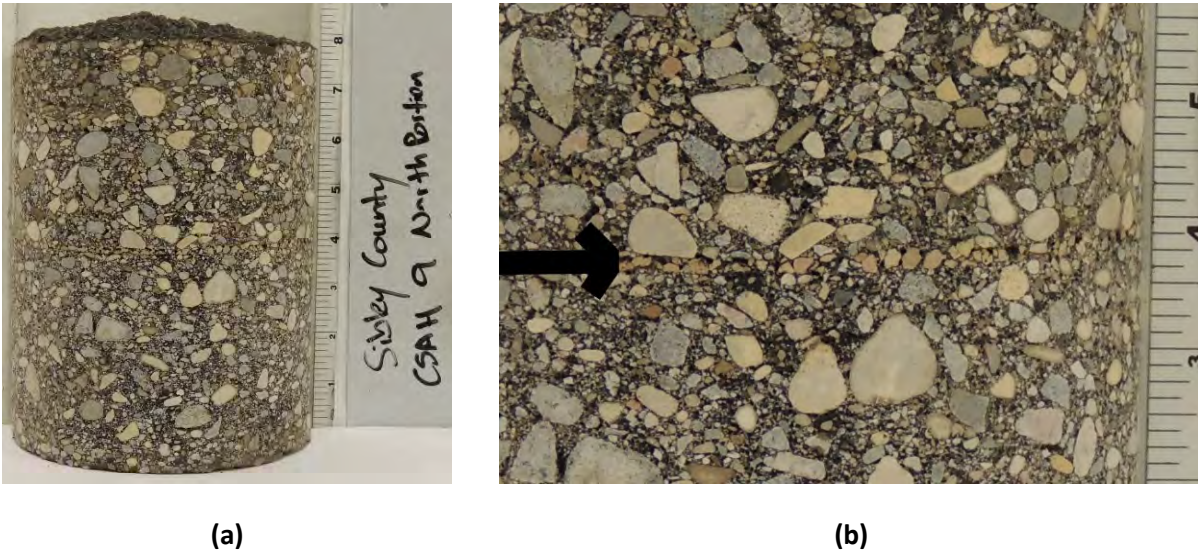


Figure 6. (a) Example of core extracted from pavement for study and (b) close-up of core shows evidence of past chip seal treatments

The subsections below detail the laboratory test procedures applied in this study; data and results from these tests are presented in Chapter 3.

2.3.1 Testing to determine volumetric properties of asphalt samples

Six samples from each of each of the 18 locations were used for volumetric analysis of the underlying asphalt. Specimens were compacted according to AASHTO T 312 for:

- Maximum theoretical specific density (G_{mm}) testing according to AASHTO T 209 and ASTM D 2401 and
- Bulk specific gravity (G_{mb}) testing according to AASHTO T 166.

In preparing cores for G_{mm} testing under AASHTO T 209, the cores were trimmed to remove cut aggregate, and testing was conducted with between 2000 and 2050 grams of material from the center of the core, which is briefly heated to 230°F to dry moisture from the core sample.

Given the results of the G_{mm} and G_{mb} tests, properties such as the percent air voids and the effective specific gravity were calculated. These properties in turn were used to determine the percent voids in mineral aggregate (VMA) and the percent voids filled with asphalt (VFA). Finally, given surface area characteristics for the sieve sizes of the aggregate, the average film thickness (AFT) was calculated.

2.3.2 Hamburg wheel tracker testing

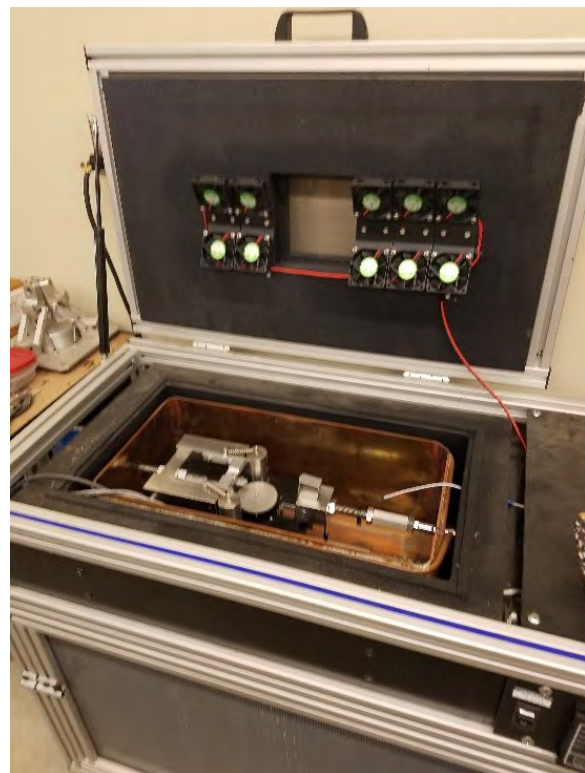
Circular specimens were tested using a Hamburg wheel tracking (HWT) device. AASHTO T 324 procedures were followed for all tests on a total of 18 specimens from 18 locations. The laboratory equipment used for the tests is shown in Figure 7a. The tests were conducted using paired specimens: the first of the pair was compacted with the chip seal, the second of the pair was compacted without the chip seal.

2.3.3 Fracture energy testing

Disk-shaped compact tension (DCT) tests were conducted on specimens to evaluate the fracture energy of asphalt mixes and field specimens. DCT tests were conducted on a total of seven specimens, and all tests were conducted in accordance with ASTM D7313. The laboratory equipment used for the tests is shown in Figure 7b.



(a)



(b)

Figure 7. (a) Hamburg wheel tracker test machine and (b) DCT test machine used for the project research

2.3.4 Permeability testing

Falling head permeability tests were conducted and coefficients of permeability were calculated according to the standard outlined in ASTM PS 129-01. Laboratory permeability tests were conducted on a total of 68 samples from 18 locations. The laboratory equipment used for the tests is shown in Figure 8a.

2.3.5 Tensile strength ratio testing

The tensile strength ratio (TSR) test measures tensile strength loss due to damage under accelerated water conditioning in the laboratory. The modified Lottman tensile strength ratio (TSR) test was conducted according to AASHTO T 283. TSR tests were applied to a total of 18 specimens. The laboratory equipment used for the tests is shown in Figure 8b.



(a)



(b)

Figure 8. (a) Asphalt permeability test and (b) TSR test rig used for the project research

2.4 SURVEY OF MUNICIPAL ENGINEERS

An eight-question survey of Minnesota city and county engineers on their chip sealing practices was performed during Fall 2015. One-hundred twenty nine engineers responded to the survey, which was coordinated online by engineers at the City of Woodbury. The questions are indicated in Table 2. A summary of responses is provided in the results of Chapter 3. Full responses are provided in Appendix K.

Table 2. Questionnaire for survey of Minnesota local engineer chip sealing practices

Item	Question
Q1	Are you currently using chipseals as part of your pavement maintenance program?
Q2	Has your organization used chipseals in the past?
Q3	On roads where chipseals have been used, have you experienced any problems with stripping or delamination of the chipseal with the underlying layer of asphalt? Stripping is defined as a loss in the asphalt/aggregate bond resulting in raveling, a shallow surface pothole, or delamination of the chipseal surface.
Q4	Do you use a polymer modified emulsion with your chipseals?
Q5	When did you start specifying the polymer modified emulsion?
Q6	Have you noticed any difference in the incidence of stripping/delamination on roads with polymer modified emulsion?
Q7	Do you have any pavements which are not chipsealed that are experiencing stripping failures? Stripping is defined as a loss in the asphalt/aggregate bond resulting in raveling, a shallow surface pothole, or delamination of the chipsealed surface.
Q8	Is there anything else you'd like to share about your use or non-use of chipseals?

CHAPTER 3: RESULTS AND DISCUSSION

The results of field testing, laboratory testing, and surveys of municipal engineers are summarized and discussed in this chapter. Additional information on testing or survey data can be found in the appendices to the final report.

3.1 SUMMARY OF FIELD DATA AND SPECIMENS COLLECTED

Given the extent of the data, it is summarized in this chapter rather than being presented in full. The full field data are recorded in Appendix A (Condition surveys and core collection information) and Appendix F (GPR and nuclear density). In addition, while example photographs of core collection are provided in Appendix I, a full record of all core photographs, including cores used for Hamburg Wheel and permeability tests, is hosted online by MnDOT at:

<ftp://ftp2.dot.state.mn.us/pub/outbound/researchservices/Chip%20Seal%20Research/>

Table 3 records locations and nomenclature used to identify field specimens collected and used for laboratory testing.

Table 3. Identification nomenclature for core and field assessments

Core ID Designation	City/County	Road Location
B-93E	Blaine	93 rd Ave, East
B-93W	Blaine	93 rd Ave, West
BP-L	Brooklyn Park	Louisiana Ave
BP-73	Brooklyn Park	73 rd Ave
BP-W	Brooklyn Park	Winnetka Ave
B-134	Burnsville	134 th St
B-H	Burnsville	Heritage Circle Area
B-K	Burnsville	Knob Hill Area
CG-H	Cottage Grove	Hyde Ave
CG-I	Cottage Grove	Ingberg Trail
CG-J	Cottage Grove	Jensen Ave
IGH-B	Inver Grove Heights	Brooks Blvd
O-8	Osseo	8 th Ave
SC-9N	Sibley County	CSAH 9, North
SC-9S	Sibley County	CSAH 9, South
W-B	Woodbury	Bridgewater
W-NA-C	Woodbury	Newbury Alcove, Cul de sac (Unsealed)
W-NA-S	Woodbury	Newbury Alcove, Straight section

3.1.1 Condition of pavement sections

The level of stripping varied from site to site. In the collection of core specimens, field observations were made on the extent of stripping in the vicinity of coring, in addition to general notes on the core itself. A comparison of core condition is shown in Figure 9 using cores collected for the study from a location in Shoreview, MN, that was not included in the final database. Figure 9b shows not only stripping behavior under the chip seal, but also stripping in asphalt lifts. An intact core from a nearby location is shown in Figure 9a to illustrate the extent of stripping through the core depth.



Figure 9. (a) Intact core and (b) core stripped under chip seal and between asphalt lifts, recovered from city of Shoreview, MN

A rough assessment of stripping for all cores on a given site location is recorded in Table 4, based on the extent of condition notes. As a rule, sites with more cores with notes on stripping were considered to have higher levels of stripping than sites with cores with fewer notes. Given its dependency on the observer, this measure is not comprehensive nor objective, and levels of stripping are referred to only in a general sense in the discussion and conclusions. Individual condition surveys and core collection notes are recorded in Appendix A.

Table 4. General observed levels of stripping in field

City/County	Road Location	Observed levels of stripping
Blaine	93 rd Ave, East	Moderate to High
Blaine	93 rd Ave, West	Moderate to High
Brooklyn Park	Louisiana Ave	Moderate
Brooklyn Park	73 rd Ave	Moderate
Brooklyn Park	Winnetka Ave	Moderate
Burnsville	134 th St	Low
Burnsville	Heritage Circle Area	High
Burnsville	Knob Hill Area	Low to Moderate
Cottage Grove	Hyde Ave	Low
Cottage Grove	Ingberg Trail	Moderate
Cottage Grove	Jensen Ave	Low
Inver Grove Heights	Brooks Blvd	Low
Osseo	8 th Ave	Moderate to High
Sibley County	CSAH 9, North	High
Sibley County	CSAH 9, South	High
Woodbury	Bridgewater	Moderate
Woodbury	Newbury Alcove, Cul de sac (Unsealed)	n/a
Woodbury	Newbury Alcove, Straight section	Moderate

3.1.2 Overview of GPR and nuclear gauge testing

The GPR testing included constant GIS information to provide exact locations of measurements. Likewise, the exact location of all nuclear density testing was recorded. This information has been presented in tandem to potentially allow for correlations between nuclear density and GPR dielectric readings. The reporting of this information results in “heat maps” for all sites surveyed. An example of such a map is shown in Figure 10. All maps for all locations are presented in Appendix F. Given the

limitations of the GPR antenna used for the testing, which is a longer-wave antenna, correlating the dielectric with density data does not provide reliable maps of density in the asphalt.



Figure 10. Map of dielectric and density data collected at Newbury Alcove site in Woodbury, MN

However, the nuclear gauge density data can provide useful feedback when viewed alongside other information, such as the results of core testing data from the laboratory. In this study, two rounds of nuclear gauge density testing at a total of 37 locations were conducted in two stages.

Results of the initial testing stage are shown in Table 5. For those initial tests at 9 of the 18 test sites, it was observed that densities did not match the cores, as average field densities were observed to range between 85.3 and 97.2 percent of the maximum core density (i.e. all air voids removed) obtained from volumetric testing. Furthermore, the average densities for some locations were unreasonably low. This raised concerns about compaction on municipal roads.

To address more general concerns about asphalt compaction – rather than issues specific to chip seal treatments – a second round of nuclear gauge testing was conducted on roads with and without chip seals. The results of the second round of tests are shown in Table 6.

The observed densities in the second round of tests were more reasonable. The second round of testing showed that municipal roads had adequate densities in most cases: of the 28 locations in the second round, only two had an average density below 91 percent, and the average maximum density across all locations was 93.3 percent. The second round of testing also indicated that “ordinary” compaction practices in the field produce adequate results. Thus, the cause of stripping is not necessarily related to density if 92 percent field density, as indicated in the MnDOT specification for asphalt compaction, is

considered adequate (MnDOT, 2016). Additional volumetric lab testing is discussed in Section 3.2 to elaborate on density in asphalt under chip sealed pavements.

Table 5. First round of nuclear gauge density tests for locations with available mix design information

Location	Mix	Year Paved	Maximum density (pcf)	Statistics (% of max density)	
				Standard Deviation	Average
Woodbury - Newbury Alcove	41 Wear	1989	154.8*	2.7%	97.2%
Woodbury - Newbury Alcove (CDS)	41 Wear	1989	155.7*	1.9%	94.3%
Blaine - 93rd Ave East End	41A Wear	1994	154.1*	1.4%	90.5%
Blaine - 93rd Ave West End	41A Wear	1995	153.8*	1.7%	85.3%
Brooklyn Park - Louisiana Ave	41A Wear	1995	152.9*	1.9%	91.5%
Brooklyn Park - Winnetka Ave	41A Wear	1995	153.6*	1.1%	93.7%
Brooklyn Park - 73rd Ave	41A Wear	1998	155.3*	1.6%	90.0%
Woodbury - Bridgewater Pkwy	41B Wear	1998	155.9*	2.3%	90.4%
Inver Grove Heights - Brooks Blvd	MVWE35035B	2009	154.6	1.3%	89.9%

**Obtained from lab-batched mix design and not volumetric testing of field core*

Table 6. Second round of nuclear gauge density tests

Location	Mix	Year Paved	Maximum density (pcf)	Statistics (% of max density)	
				Standard Deviation	Average
Woodbury - Dunmore Rd	LVWE35030B	2005	153.4	1.5%	92.9%
Woodbury - Evergreen Dr	LVWE35035B	2006	152.9	1.6%	96.7%

Cottage Grove - Hedgecroft Ave	LVWE35030B	2007	153.4	2.3%	95.4%
Cottage Grove - 77th Street S	LVWE35030B	2008	153.4	2.1%	92.2%
Woodbury - Paul Rd	MVWE35035B	2008	154.6	1.7%	92.1%
Woodbury - Hillcrest Dr	MVWE35035B	2009	154.2	1.6%	95.2%
Cottage Grove - 63rd Street S	LVWE35030C	2010	154.1	1.2%	96.1%
Woodbury - Crackleberry Tr	SPWEB240B	2010	156	0.9%	92.5%
Cottage Grove - Lock Ridge Ave S	SPWEB240B	2011	155.8	1.4%	88.4%
Inver Grove Heights - Addisen Path	SPWEB240C(R)	2011	156	1.4%	91.5%
Inver Grove Heights - 68th Street SE	SPWEB240C(R)	2012	156	1.6%	91.6%
Inver Grove Heights - Borden Way	SPWEB240C(R)	2012	156	1.0%	91.5%
Cottage Grove - Jeffery Lane S	SPWEB340C	2013	159.3	1.3%	95.9%
Inver Grove Heights - Conroy Way	SPWEB240C(R)	2013	156	1.1%	90.6%
Cottage Grove - Jasmine Ave S	SPWEA330C	2014	152.7	1.5%	94.4%
Inver Grove Heights - Bower Path	SPWEB240C(R)	2014	156	1.2%	94.2%
Woodbury - Somerset Rd	SPWEA330C	2014	155.1	1.5%	96.1%
Osseo - 1.5 St NE	SPWEA240(R)	2015	152.8	0.9%	93.5%
Osseo - 1st Ave	SPWEA240(R)	2015	152.8	1.6%	96.0%
Osseo - 1st St. NE	SPWEA240(R)	2015	152.8	1.1%	91.9%

Osseo - 1st St. SE	SPWEA240(R)	2015	152.8	1.3%	93.0%
Osseo - 3rd Ave. NE	SPWEA240(R)	2015	152.8	1.4%	92.0%
Osseo - 3rd St. NE	SPWEA240(R)	2015	152.8	1.3%	91.3%
Osseo - 4th St. NE	SPWEA240(R)	2015	152.8	1.1%	97.1%
Osseo - 5th Ave. NE	SPWEA240(R)	2015	152.8	0.9%	92.8%
Osseo - 6th Ave. NE	SPWEA240(R)	2015	152.8	1.2%	92.9%
Osseo - 7th St. NE	SPWEA240(R)	2015	152.8	1.1%	92.6%
Osseo - E. Broadway	SPWEA240(R)	2015	152.8	1.2%	92.6%

**Obtained from lab-batched mix design and not volumetric testing of field core*

3.2 SUMMARY OF LABORATORY DATA

As with the field data, laboratory data is summarized in the body of the final report. The following appendices record the laboratory data in full:

- Appendix B, Volumetric testing and summary properties
- Appendix C, Fracture energy testing
- Appendix D, Lab permeability testing
- Appendix E, Hamburg wheel tracking testing
- Appendix G, Tensile strength ratio testing
- Appendix J, Hamburg test photographs

3.2.1 Volumetric testing of asphalt samples

Table 7 summarizes the results of volumetric tests conducted on samples collected from 18 locations considered in the study. Six samples were tested for each location. Chapter 3 details the testing and calculations involved in the development of Table 7. The average air void content across all samples was 5.5 percent, and over 60 percent of tested samples had air void contents between 5 and 8 percent.

Table 7. Summary averages of volumetric testing of asphalt samples from 18 locations

Location	Air Voids (%)	VMA (%)	AFT (microns)	VFA (%)	Extracted asphalt content (%)	Max Density (pcf)
Blaine - 93rd Ave East End	3.0	15.3	9	80.5	5.3	154.1
Blaine - 93rd Ave West End	6.7	17.4	7.3	61.3	4.8	153.8
Brooklyn Park 73rd Ave	8.4	17.7	9.2	52.6	4.2	155.3
Brooklyn Park - Louisiana Ave	4.8	17.2	8.2	72.1	5.5	152.9
Brooklyn Park - Winnetka Ave	2.5	16.0	10.9	84.3	5.8	153.6
Burnsville - 134th St	7.0	18.0	9.1	61.1	4.9	155.9
Burnsville - Heritage Cir Area	7.2	18.4	9.7	60.5	5.0	153.9
Burnsville - Knob Hill Area	8.0	19.3	8.7	58.5	5.1	154.5
Cottage Grove - Hyde Ave S	6.3	16.6	8.9	62.3	4.6	155.2
Cottage Grove - Ingberg Trl S	7.5	18.4	7.1	59.2	4.9	155.9
Cottage Grove - Jensen Ave	7.7	17.6	7	56.4	4.4	156.9
Inver Grove Heights - Brooks Blvd	4.5	15.1	7.9	70.0	4.6	155.1
Osseo 8th Ave SE	7.2	17.9	8.7	59.6	4.8	155.2
Sibley County CSAH 9 North Portion	5.7	17.6	9.7	67.6	5.4	151.0
Sibley County CSAH 9 South Portion	3.9	16.4	8.2	76.3	5.6	150.6
Woodbury - Bridgewater	4.8	16.1	7.3	70.0	4.9	155.9
Woodbury - Newbury Alcove Cul-de-sac	1.4	13.2	11	89.7	5.0	155.7
Woodbury - Newbury Alcove Straight Portion	2.1	13.2	8.5	84.1	4.7	154.8

3.2.2 Summary of Hamburg wheel tracking tests

The results of Hamburg wheel tracking tests (tested samples shown in Figure 11) are used to directly assess the susceptibility of asphalt mixes to moisture and the likelihood of stripping due to moisture damage. These results are presented in Appendix E. The general result of Hamburg testing was that the majority of mixes performed well in stripping resistance; the only clear outlier was the performance of

the Woodbury Newbury Alcove Straight Section sample, which showed signs of stripping after only 521 passes. An additional observation from the data is that mixes from older pavements performed better than those of newer pavements due to higher stiffness values for the aged binders.

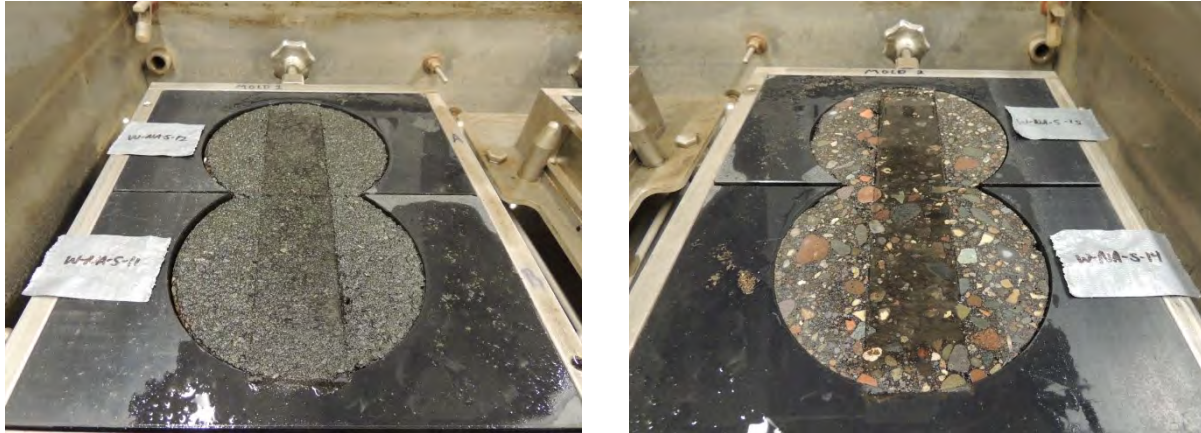


Figure 11. Specimens for stripping study undergoing Hamburg wheel testing

3.2.3 Fracture energy testing

The results of DCT tests are reported in Appendix C. As the tests provided no useful information about stripping behavior in chip-sealed asphalt, DCT testing was discontinued after seven tests.

3.2.4 Laboratory permeability tests

The majority of locations yielded four samples for permeability tests, the exceptions being the west end of 93rd Avenue in Blaine (2 samples) and the cul-de-sac of Newbury Alcove in Woodbury (2 samples). The average permeability results (K and K_{20} , the permeability at 20 deg Celsius) are reported in Table 8. Full data from all 68 samples tested are presented in Appendix D. As noted in Table 8, the specimens collected were relatively impermeable, with the highest measured permeability from a single test no higher than 23.7×10^{-5} cm/sec across all samples.

Table 8. Average calculated coefficients of permeability from laboratory permeability testing according to ASTM PS 129-01

Location	Permeability, K (10⁻⁵ cm/sec)	Permeability, K₂₀ (10⁻⁵ cm/sec)
Blaine - 93rd Ave East End	0.8	0.6
Blaine - 93rd Ave West End	1	0.8
Brooklyn Park 73rd Ave	10.7	7.8
Brooklyn Park - Louisiana Ave	0	0
Brooklyn Park - Winnetka Ave	0	0
Burnsville - 134th St	3.1	2.3
Burnsville - Heritage Cir Area	0.4	0.3
Burnsville - Knob Hill Area	0.4	0.3
Cottage Grove - Hyde Ave S	0.2	0.2
Cottage Grove - Ingberg Trl S	3.5	2.5
Cottage Grove - Jensen Ave	6.9	5
Inver Grove Heights - Brooks Blvd	0	0
Osseo 8th Ave SE	4	2.9
Sibley County CSAH 9 North Portion	0	0
Sibley County CSAH 9 South Portion	0	0
Woodbury - Bridgewater	0.3	0.2
Woodbury - Newbury Alcove Cul de sac (Unsealed)	0	0
Woodbury - Newbury Alcove Straight Portion	0	0

3.2.5 Overview of tensile strength ratio testing

As the results of TSR tests are sometimes used to infer long-term behavior of asphalt in terms of stripping, the results of these tests are relevant to this study. For this project material obtained from the roadway cores was heated and re-compacted at 7% and 11% air voids and TSR tests were performed on

these specimens. Further analysis using the laboratory data aggregated TSR data with condition surveys from field site visits. Results are summarized in Table 9 and Table 10.

Table 9. Summary of tensile strength ratios on mixtures re-compacted at 7% air voids and 11% air voids by location and extent of stripping observed in field

Location	Amount of Stripping Observed	TSR (7% voids)	TSR (11% voids)	Extracted asphalt content (%)
Burnsville - 134th St	Low	0.79	0.7	4.9
Cottage Grove - Hyde Ave S	Low	0.77	0.7	4.6
Cottage Grove - Jensen Ave	Low	0.65	0.51	4.4
Inver Grove Heights - Brooks Blvd	Low	0.76	0.63	4.6
Burnsville - Knob Hill Area	Low to Moderate	0.7	0.65	5.1
Brooklyn Park - 73rd Ave	Moderate	0.7	0.65	4.2
Brooklyn Park - Louisiana Ave	Moderate	0.77	0.74	5.5
Brooklyn Park - Winnetka Ave	Moderate	0.93	0.87	5.8
Cottage Grove - Ingberg Trl S	Moderate	0.73	0.66	4.9
Woodbury - Bridgewater	Moderate	0.91	0.69	4.9
Woodbury - Newbury Alcove Straight Portion	Moderate	0.76	0.65	4.7
Blaine - 93rd Ave East End	Moderate to High	0.76	0.67	5.3
Blaine - 93rd Ave West End	Moderate to High	0.69	0.61	4.8
Osseo - 8th Ave SE	Moderate to High	0.81	0.76	4.8
Burnsville - Heritage Cir Area	High	0.75	0.66	5
Sibley County - CSAH 9 North Portion	High	0.78	0.69	5.4
Sibley County - CSAH 9 South Portion	High	0.84	0.78	5.6

Table 10. Correlating TSR and observed stripping for field sections visited

Amount of Stripping Observed	Count	Average TSR (7% voids)	Average TSR (11% voids)	Average extracted asphalt content (%)
Low	4	0.74	0.64	4.63
Low to Moderate	1	0.77	0.70	4.60
Moderate	6	0.80	0.71	5.00
Moderate to High	3	0.75	0.68	4.97
High	3	0.79	0.71	5.33

3.3 SURVEY RESULTS

As noted in Section 2.4, 129 municipal engineers responded to the survey on local experience with chip seal treatments. Responses are summarized in Table 11, and full responses are provided in Appendix K.

Of the engineers surveyed, 64 percent “regularly” used chip seals, 17 percent “sometimes” used chip seals, and 19 percent “never” used chip seals. Of the respondents who use chip seals, 35 percent reported that they do not observe stripping in pavements treated with chip seals. 39 percent reported observing some stripping in chip-sealed pavements, yet did not consider it a major issue. The remaining 26 percent reported stripping as a major issue for their chip-sealed pavements.

Finally, only four percent of respondents reported significant stripping in roads that were not treated with chip seals (unsealed). Twenty-one percent of respondents reported stripping in unsealed roads as a minor issue, and 75 percent did not observe stripping in unsealed roads and did not consider it a significant issue.

Table 11 Questionnaire for survey of Minnesota local engineer chip sealing practices

Item	Question	Answered	Skipped	Responses
Q1	Are you currently using chipseals as part of your pavement maintenance program?	129	0	<p>83 Yes, regularly based on a schedule for most roadways</p> <p>22 Yes, occasionally depending on pavement and traffic conditions</p> <p>24 No</p>
Q2	Has your organization used chipseals in the past?	25	104	<p>9 Yes, but not in the last approximately 5 years</p> <p>6 Yes, but not in the last approximately 10 years</p> <p>3 Yes, but not in the last approximately 20 years</p> <p>7 No</p>
Q3	On roads where chipseals have been used, have you experienced any problems with stripping or delamination of the chipseal with the underlying layer of asphalt? Stripping is defined as a loss in the asphalt/aggregate bond resulting in raveling, a shallow surface pothole, or delamination of the chipseal surface.	112	17	<p>39 No, we have not experienced this issue</p> <p>44 Yes, but this is not a major issue on our roadway network</p> <p>29 Yes, this is a major issue on our roadway network</p>

Q4	Do you use a polymer modified emulsion with your chipseals?	112	17	<p>40 Yes, on all chipsealed roadways</p> <p>27 Yes, on some chipsealed roadways</p> <p>14 No</p> <p>31 Unknown</p>
Q5	When did you start specifying the polymer modified emulsion?	51	78	<i>See Appendix K</i>
Q6	Have you noticed any difference in the incidence of stripping/delamination on roads with polymer modified emulsion?	65	64	<p>10 Yes</p> <p>24 No</p> <p>31 Unknown</p>
Q7	Do you have any pavements which are not chipsealed that are experiencing stripping failures? Stripping is defined as a loss in the asphalt/aggregate bond resulting in raveling, a shallow surface pothole, or delamination of the chipsealed surface.	113	16	<p>4 Yes, this is a significant issue</p> <p>24 Yes, this is a minor issue</p> <p>85 No, we have not experienced stripping on non-chipsealed surfaces</p>
Q8	Is there anything else you'd like to share about your use or non-use of chipseals?	34	95	<i>See Appendix K</i>

3.4 DISCUSSION AND OBSERVATIONS

3.4.1 Lab and field data

Given the extent of the field and laboratory testing, there is sufficient data to support general observations that would be unsubstantiated in smaller studies. First, based on the condition surveys

from field testing, not all roads with chip seals exhibited stripping. Information provided by city engineers for field sites locations identified less than Moderate levels of stripping in 6 of the 18 primary field sites. Condition information relative to volumetric core data (percent air voids and maximum density) is described in Figure 12.

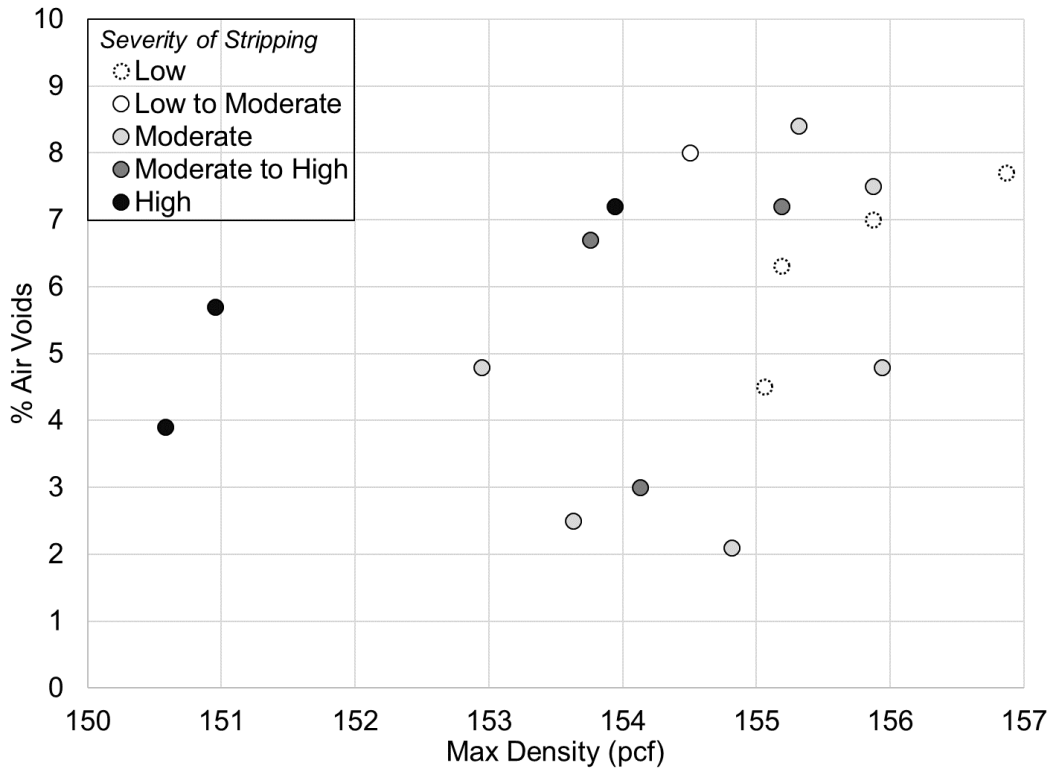


Figure 12. Severity of stripping in chip-sealed pavements in 18 locations with maximum theoretical density and percent air voids

Figure 12 does not describe an observable trend relating the extent of stripping to air void content. As the air void content for all sections examined is 8.5 percent or lower, no sections with excessive air voids were considered in the study. Thus, it is difficult to correlate stripping behavior directly with excessive air voids or air void content in general.

In addition, previous to the MnDOT study published in 2013 (Wood & Cole, 2013), many state and city/county engineers supposed that there may exist a relationship between (A) a specific bituminous mixture, contractor, geographic location, or year of construction and (B) the likelihood and extent of stripping. Table 12 summarizes data addressing this hypothesis. One limitation of the project was the lack of pavement information from municipalities on the sections considered; much of the information provided lacked specific detail on the mix design, for instance. However, based on the data available to this project, a correlation is not apparent between stripping in chip-sealed pavements and a specific mix, contractor, or paving year.

Table 12. Summary of level of stripping and pavement information by section

Location	Amount of Stripping Observed	HMA Design	Year Paved
Burnsville - 134th St	Low	41A Wear	2005
Cottage Grove - Hyde Ave S	Low	LVWE35030B	1996
Cottage Grove - Jensen Ave	Low	SPWEB340C	1986
Inver Grove Heights - Brooks Blvd	Low	MVWE35035B	2009
Burnsville - Knob Hill Area	Low to Moderate	41A Wear	1996
Brooklyn Park - 73rd Ave	Moderate	41A Wear	1998
Brooklyn Park - Louisiana Ave	Moderate	41A Wear	1995
Brooklyn Park - Winnetka Ave	Moderate	41A Wear	1995
Cottage Grove - Ingberg Trl S	Moderate	LVWE35030B	1995
Woodbury - Bridgewater	Moderate	SPWEA240(R)	1998
Woodbury - Newbury Alcove Straight Portion	Moderate	41 Wear	1995
Blaine - 93rd Ave East End	Moderate to High	41A Wear	1994
Blaine - 93rd Ave West End	Moderate to High	41A Wear	1995
Osseo - 8th Ave SE	Moderate to High	SPWEA240(R)	1992
Burnsville - Heritage Cir Area	High	41A Wear	1994
Sibley County - CSAH 9 North Portion	High	SPWEA240(R)	1996
Sibley County - CSAH 9 South Portion	High	SPWEA240(R)	1997

Other questions were proposed to the research team through the course of the study, and these questions were addressed based on limited information available to the study. Those questions include:

- *Is there a relationship between the use of a granular subbase and stripping in chip-sealed pavements?*

No relationship was apparent based on the performance of qualified sections in the study. This can be observed in Table 1.

- *Does the use of polymer-modified emulsions for chip seals lead to stripping?*

A large percentage of municipalities surveyed were unable to identify dates or years for polymer-modified emulsion adoption for their chip seal treatments. Therefore, a relationship between the presence of polymers and stripping could not be determined.

3.4.2 Field behaviors associated with stripping

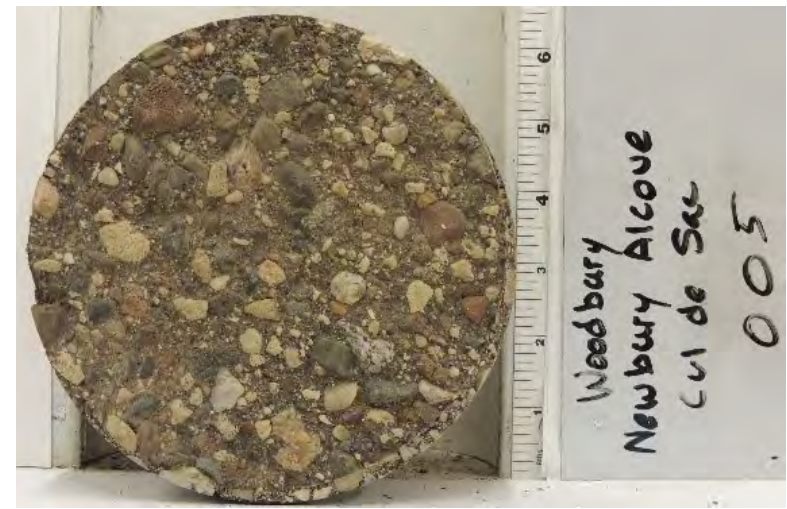
One important outcome of the study was the project survey, which identified important information in the understanding of stripping. First, the stripping behavior observed under chip-sealed pavements is not typically seen on roadways that were unsealed (four percent of engineers reported significant stripping and 21 percent of respondents reported minor stripping in unsealed roads). In this regard, the survey suggests that the presence of the chip seal treatment itself, and not properties of the underlying asphalt, may contribute to stripping.

While not as thorough as the lab and field studies, the project research included surveys of field sections in cities and counties to study how a chip seal may encourage stripping. Municipal engineers have observed that often in roads featuring neighboring chip-sealed and unsealed portions, the chip-sealed roadway will exhibit stripping behaviors, while the unsealed portion experiences only surface raveling. One type of road that was useful for such a survey was a road ending in a cul-de-sac, as these roads are often chip-sealed on their straight portions while the cul-de-sacs are unsealed.

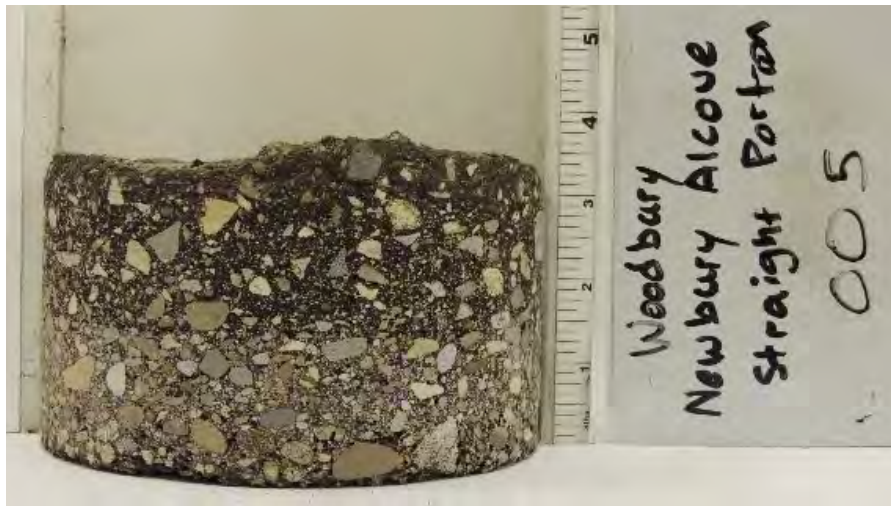
The project included one such road, Newbury Alcove in Woodbury, MN. The relative material lost due to stripping can be seen in comparing Figure 13b and Figure 13d. One confounding factor in this observation, however, is the fact that the Hamburg Wheel test found that the straight portion mix was the only mix susceptible to stripping due to moisture damage.



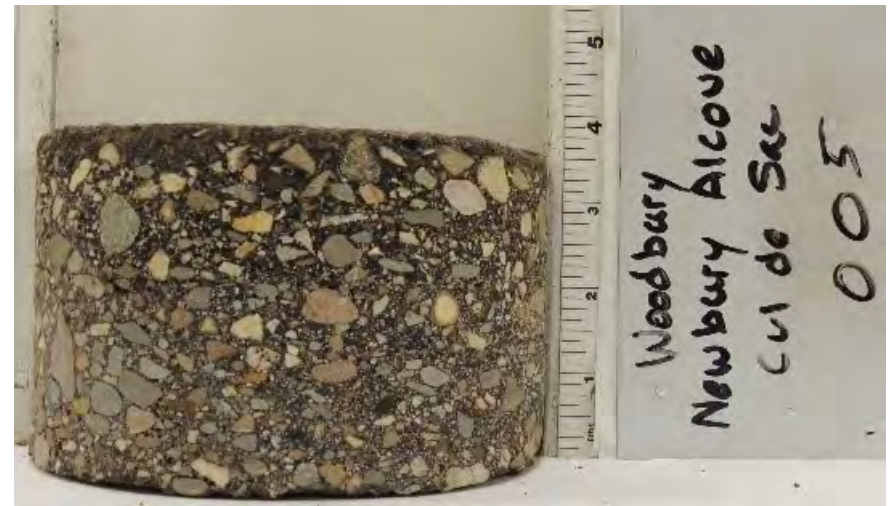
(a)



(c)



(b)



(d)

Figure 13. Comparison of stripping of cores collected from (a-b) straight portion (with chip seal) and (c-d) cul-de-sac (unsealed) of Newbury Alcove in Woodbury, MN

In addition, it has been observed that the presence of the chip seal can exacerbate distresses, as illustrated from a survey of Blue Heron Road in Woodbury, MN, in Figure 14. In other words, a road with sealed and unsealed sections may experience more block cracking in areas with the chip seal (Figure 14b) than in areas without the chip seal (Figure 14a).



Figure 14. Possible contribution of chip seal to advanced cracking in (a) unsealed and (b) chip-sealed pavement on Blue Heron Road in Woodbury, MN

These observations raise questions about how a chip seal may create conditions that (A) contribute to the incidence of stripping and (B) exacerbate other distress in the asphalt pavement. While the project research was extensive, the scope did not include the complex phenomena that govern this problem. It is possible that the chip seal may “trap” moisture/vapor in the asphalt layer immediately beneath the seal. Freeze-thaw cycling may break down the asphalt at an accelerated rate due to the presence of trapped moisture. This is an issue for future research.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

The field and laboratory work conducted in this project represents an extensive study of chip-sealed pavement performance in Minnesota. In spite of this effort, many concerns surrounding the behavior chip-sealed pavements remain unresolved.

First, the study was not able to verify the conclusion of earlier MnDOT research that high air voids is the primary cause of stripping (Wood & Cole, 2013). High air voids were not observed in the locations used for the study; furthermore, not all chip-sealed pavements considered in the study exhibited signs of stripping. The latter observation agrees with municipal experience: survey data indicated that 74 percent of city engineers did not identify stripping in chip seals as a major issue.

The study was also unable to identify mix design or construction practices that correlated with the incidence of stripping. That is, based on the results of this study:

- There does not appear to be direct relationship between pavement density and stripping under chip seals.
- There does not appear to be a direct relationship between any specific bituminous mixture, contractor, geographic location, or year of construction and this distress.

The main conclusion of the study is that while stripping under chip seals is a concern, it is not a concern that can be addressed with a simple mix design or paving rule of thumb.

Finally, the distress was observed to be a complex phenomenon that may be caused by the presence of the chip seal as much as it is the composition of the underlying asphalt. Perhaps the matrix of binder and densely packed, angular chip creates too tight of a “seal” on the pavement, thereby trapping moisture and vapor and creating conditions that become damaging under freeze-thaw action. It is hoped that the field and laboratory data collected in this study will be of value to future work that examines this phenomenon in detail.

4.2 RECOMMENDATIONS

Based on field observations and discussions with state, city, and county engineers, the following recommendations and observations are provided on the use of chip-seal treatments and the incidence of stripping under chip seals. As the study was unable to point to an overwhelming cause for the stripping behavior, the recommendations are intended to be a starting point for future discussions and studies of important issues in the use of chip seals.

First, it was observed that stripping behavior under chip seals may be due to trapped moisture and water vapor between the chip seal and the asphalt pavement. This phenomenon would be similar to

stripping behavior observed in conventional overlays of asphalt (Kandhal & Rickards, 2001). Thus, appropriate drainage is important in chip-sealed pavements. The utilization of subsurface drainage will reduce the probability of saturated subbase and base layers, which will reduce the amount of moisture that would be moving through the pavement.

Another factor is to minimize trapped water vapor between the chip seal and the underlying asphalt. If the first lift of pavement is damaged due to insufficient structural capacity to withstand heavy loads (which often occur immediately after the initial lift of bituminous is placed during the construction of a housing development), the pavement may already have significant microscopic sized cracking that allows water vapor to be transmitted from the subgrade soils into the pavement layer and be trapped. Causes of this cracking can include staggered construction of bituminous pavement layers across multiple construction seasons, which subjects the pavement to heavy loads while it is not at full strength.

Many of the cities surveyed during this project have explored the use of thin bituminous overlays, approximately five-eighths inches in thickness, as an alternative to chip seal treatments. In Texas, these fine-mix overlays have shown promise as a surface treatment on oxidized pavement and as a surface treatment to extend the life of roadways exhibiting signs of stripping. Studies have shown these thin overlays can extend the service life by an additional three to five years before a mill-and-overlay is required (Newcomb et al., 2013).

MnDOT has taken steps toward providing guidance on alternatives to chip-seal treatments. Modifications to Sections 2360 and 3139 of the 2016 MnDOT Standard Specifications for Construction account for the use of an overlay, or “thinlay,” using aggregate passing the three-eighths inch sieve as a surface treatment (MnDOT, 2016). As noted, the state of Texas has similar experience and the Texas Department of Transportation has also developed a specification for its fine-mix overlay, detailed in Newcomb et al. (2013). Either of these resources serve as a starting point for municipal efforts in Minnesota.

Finally, one observation of this study was a need for better municipal records on both the paving contractor and the paving materials. While many city and county engineers were able to provide valuable detail on their chip-sealed roads for this study, the results and conclusions were limited by a lack of information (as noted in Section 3.4). More detailed records of the contractor and materials would benefit both future research efforts and municipal efforts to maintain roads.

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APPENDIX A

FIELD CORE IDENTIFICATION AND OBSERVATIONS

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
B-93E-1	86	2666	45.13897	-93.19541	3.5		Moderate	
B-93E-2	87	2667	45.13894	-93.19551	3.5	Chipped Top	Moderate	
B-93E-3	146	2668	45.13894	-93.19579	3			Perm
B-93E-4	150	2669	45.13894	-93.1958	3			
B-93E-5	89	2670	45.13894	-93.19602	3.25	Chipped Top		Ham - Chip Seal Removed
B-93E-6	89	2671	45.13896	-93.19606	3.25			Perm
B-93E-7	143	2672	45.13895	-93.19621	3.25	Chipped Top		
B-93E-8	143	2673	45.13895	-93.19611	3.25	Chipped Top		
B-93E-9	132	2674	45.13894	-93.1962	3.5			Ham
B-93E-10	132	2675	45.13894	-93.19618	3.5			
B-93E-11	98	2676	45.13892	-93.19595	3.5			Ham - Chip Seal Removed
B-93E-12	98	2677	45.13891	-93.19595	3.75			Ham
B-93E-13	146	2678	45.13897	-93.19575	3.5			Perm
B-93E-14	154	2679	45.13895	-93.19583	3.5	Rounded Top		Perm - Chip Seal Removed
B-93E-15	141	2680	45.13893	-93.1955	2.75	Chipped Top		
B-93E-16	141	2681	45.13896	-93.19571	2.75	Chipped Top		
B-93W-1	159	2682	45.13901	-93.2012	3.5	Chipped Top	Moderate	
B-93W-2	159	2683	45.139	-93.2012	3.5	No Good		
B-93W-3	94	2684	45.13899	-93.20131	3.25			Perm - Chip Seal Removed
B-93W-4	94	2685	45.13902	-93.20133	3.25			Ham
B-93W-5	151	2686	45.13905	-93.20158	4			
B-93W-6	151	2687	45.13906	-93.20157	4		Top 1.5" Moderate Ravel	
B-93W-7	144	2688	45.139	-93.20202	4		Top 1.5" Moderate Ravel	Ham - Chip Seal Removed
B-93W-8	144	2689	45.139	-93.20204	4.25		Top 1.5" Moderate Ravel	Ham - Chip Seal Removed
B-93W-9	94	2690	45.139	-93.20229	3.75	No Good		
B-93W-10	96	2691	45.139	-93.20232	3.25	Chipped Top	Top 2" Moderate Ravel	
B-93W-11	108	2692	45.13901	-93.20217	3.5		Top 2.5" Moderate Ravel	
B-93W-12	108	2693	45.13901	-93.20205	3.5	No Good		
B-93W-13	94	2694	45.139	-93.20171	4		Top 2" Moderate Ravel	
B-93W-14	94	2695	45.13899	-93.20164	4	Chipped Top	Top 2" Moderate Ravel	
B-93W-15	100	2696	45.13899	-93.20151	3.5			Ham
B-93W-16	100	2697	45.13898	-93.20165	3.5			Perm
BP-73-1	147	2717	45.08731	-93.37563	4.5	Core Barrel Marking		
BP-73-2	144	2718	45.08734	-93.37559	4.5			Perm - Chip Seal Removed

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
BP-73-3	66	2719	45.08723	-93.37544	5	Broke off @ 5 inches	Top 1.5" Moderate Ravel	
BP-73-4	67	2720	45.08728	-93.37553	5	Broke off @ 5 inches, Chipped Top		
BP-73-5	95	2721	45.08724	-93.37529	4.75		Top 2" Moderate Ravel	
BP-73-6	100	2722	45.08724	-93.37528	4.75	Chipped Top	Top 2" Moderate Ravel	
BP-73-7	65	2723	45.08724	-93.33752	5.5			Ham
BP-73-8	72	2724	45.08724	-93.375	5		Top 2" Moderate Ravel	Ham
BP-73-9	73	2725	45.08726	-93.37497	5.25			Ham - Chip Seal Removed
BP-73-10	104	2726	45.08727	-93.37494	5.25	Slight - moderate Ravel	Top 2" Moderate Ravel	
BP-73-11	65	2727	45.08731	-93.37468	5	Chipped Top		Ham - Chip Seal Removed
BP-73-12	62	2728	45.08732	-93.37473	5	No Good		Perm
BP-73-13	114	2729	45.08731	-93.37521	4.5	No Good		
BP-73-14	110	2730	45.0873	-93.37522	4.5	Moderate - Severe Ravel		
BP-73-15	56	2731	45.0873	-93.37529	5	Slight - moderate Ravel	Top 2" Moderate Ravel	Perm
BP-73-16	58	2732	45.08731	-93.3753	5.25	Chipped Top	Top 2" Moderate Ravel	Perm - Chip Seal Removed
BP-L-1	79	2733	45.0689	-93.37054	4.5	Chipped Top		Perm - Chip Seal Removed
BP-L-2	78	2734	45.06887	-93.37055	4.5	Chipped Top		
BP-L-3	98	2735	45.06854	-93.3705	4.5			Perm - Chip Seal Removed
BP-L-4	83	2736	45.06854	-93.37048	4.75			Perm
BP-L-5	124	2737	45.06829	-93.37048	4.5			Ham
BP-L-6	134	2738	45.06827	-93.3705	4.5			Ham - Chip Seal Removed
BP-L-7	135	2739	45.06813	-93.37042	4.75			Ham
BP-L-8	123	2740	45.06812	-93.37042	5			Ham - Chip Seal Removed
BP-L-9	75	2741	45.06804	-93.37046	5	Slight - Moderate Ravel	Top 2" Moderate Ravel	
BP-L-10	78	2742	45.06802	-93.37044	5			Perm
BP-L-11	70	2743	45.06792	-93.37044	6			
BP-L-12	68	2744	45.06796	-93.37045	5.5			
BP-L-13	124	2745	45.06808	-93.37044	4.75		Top 2.5" Moderate Ravel	
BP-L-14	122	2746	45.06811	-93.37045	Broke Off	No Good		
BP-L-15	66	2747	45.06842	-93.37041	5.5		Top 2.5" Moderate Ravel	
BP-L-16	72	2748	45.06842	-93.37044	5.25		Top 2" Moderate Ravel	
BP-W-1	98	2700	45.07529	-93.38113	4.25			
BP-W-2	105	2701	45.07533	-93.38116	4.5			

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
BP-W-3	55	2702	45.07533	-93.3811	6	No Good Top Raveled		
BP-W-4	144	2703/4	45.07534	-93.38115	5	Crack on Side		
BP-W-5	138	2705	45.07536	-93.38115	6		Moderate	
BP-W-6	88	2706	45.07537	-93.38112	4.75			
BP-W-7	86	2707	45.07543	-93.38112	4.75			Perm
BP-W-8	100	2708	45.07545	-93.38112	broken	No Good		
BP-W-9	89	2709	45.07543	-93.38109	4			
BP-W-10	138	2710	45.07553	-93.3811	4			
BP-W-11	135	2711	45.07554	-93.38111	4.5			Perm - Chip Seal Removed
BP-W-12	76	2712	45.07565	-93.38113	5.25			
BP-W-13	80	2713	45.07565	-93.38112	5			Perm
BP-W-14	98	2714	45.07574	-93.38114	4.5	Chipped Top		
BP-W-15	100	2715	45.07575	-93.38113	4.75			Perm - Chip Seal Removed
BP-W-16	96	2716	45.07579	-93.38116	4.5			
B-134-1	183	2650	44.76126	-93.2654	5.5		Top 1.5" Moderate Ravel	Ham
B-134-2	183	2651	10 feet away		5		Top 1.5" Moderate Ravel	Ham
B-134-3	173	2652	44.76124	-93.26577	5.5	Chipped Top	Top 1.5" Moderate Ravel	Perm - Chip Seal Removed
B-134-4	168	2653	10 feet away		5.25		Top 1" High - Moderate Ravel	
B-134-5	142	2654	44.76131	-93.26618	6.5		Moderate, High @ 2"	
B-134-6	142	2655	10 feet away		6		High Ravel @ 2.5"	
B-134-7	208	2656	44.76111	-93.26701	5.25	Core Barrel Marking on Top	Top 1.5" Moderate Ravel	Perm
B-134-8	208	2657	10 feet away		5.25		Top 1.5" Moderate Ravel	
B-134-9	130	2658	44.76098	-93.26761	6	No Good		
B-134-10	154	2659	10 feet away		6.5		High	
B-134-11	168	2660	44.76082	-93.26806	6		Top 1" Moderate Ravel	Perm - Chip Seal Removed
B-134-12	168	2661	10 feet away		6.75	severe raveling bottom 2/3, Chipped Top		Perm
B-134-13	205	2662	44.76073	-93.26856	6		Top 1.5" Moderate Ravel	

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
B-134-14	205	2663	10 feet away		6		Top 1.5" Moderate Ravel	
B-134-15	160	2664	44.76096	-93.26978	4.25	Possible Different Construction		Ham
B-134-16	160	2665	10 feet away		4	Possible Different Construction		Ham
B-H-1	Abor Ln 78		44.76486	-93.27869	3	Chipped Top	Moderate - High	
B-H-2	Mayo Dr 110		44.76518	-93.2803	3.5	Lift Line	Moderate	
B-H-3	Northern Dr 138		44.76423	-93.28109	2.5	Lift Line, Chipped Top	Moderate	Perm
B-H-4	Abor Ln 92		44.76486	-93.28234	3.5	Chipped Top	Moderate	
B-H-5	Donegal Dr center of sac		44.76547	-93.28194	3.5	No Good		
B-H-6	Pleasant Dr 115		44.7656	-93.28356	3.25		Top 1.5" High, Moderate Rest	
B-H-7	Grand 100		44.76534	-93.28476	3		Moderate	Perm - Chip Seal Removed
B-H-8	Grand 138		44.76627	-93.28479	2.5	Core Barrel Marking on Top	Moderate	
B-H-9	Grand 100		44.76714	-93.28475	2.75	Rounded Top	Moderate	
B-H-10	Herit Cir S Center of sac	2643	44.76633	-93.27958	4.25/4	A: Cracked B: ok	Moderate	
B-H-11	Herit Cir S 106	2644	44.76658	-93.2803	3		Top 1.5" High, Moderate Rest	
B-H-12	Herit Cir S 126	2645	44.76659	-93.28212	3	Chipped Top	Moderate	Perm
B-H-13	Herit Cir N 64	2646	44.76757	-93.28385	4	No Good		
B-H-14	Herit Cir N 77	2647	44.76756	-93.28137	3.5	No Good		

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
B-H-15	Herit Cir N 107	2648	44.7675	-93.28015	3		Top 1.5" High, Moderate Rest	
B-H-16	Herit Cir 92	2649	44.76712	-93.27862	3.25		Moderate	
B-H-17	Herit Cir 92	2649	4 feet away from 16		3		Moderate	Perm - Chip Seal Removed
B-K-1	Bryant Ave 110		44.75992	-93.29125	3.5		Top 0.5" High, Moderate Rest	Perm
B-K-2	Bryant Ave 123		44.75891	-93.2913	3.4	Chipped Top	Top 0.5" High, Moderate Rest	Perm - Chip Seal Removed
B-K-3	Bryant Ave 101		44.75788	-93.29139	3.25		Moderate	
B-K-4	Colfax 104		44.75774	-93.29266	3	Chipped Top	Moderate	
B-K-5	Colfax 78		44.75892	-93.29265	3	Chipped Top	High	
B-K-6	Colfax 48		44.75993	-93.2925	3.5		Moderate	Perm
B-K-7	Emerson 112		44.76019	-93.29412	3.5		Moderate	
B-K-8	Emerson 53		44.75954	-93.29377	3.25	Chipped Top	Moderate	
B-K-9	Fremont 77		44.75933	-93.29339	3.5	Chipped Top	Moderate	
B-K-10	Fremont 120		44.75878	-93.29481	3.25	Chipped Top	Moderate	
B-K-11	Knob Hill Ln 109		44.75994	-93.29603	2.75	Chipped Top	Moderate	
B-K-12	Knob Hill Ln 116		44.76014	-93.29677	3.25	Chipped Top	Moderate	Perm - Chip Seal Removed
B-K-13	Knob Hill Ln 112		44.76012	-93.29755	3.5	No Good		
B-K-14	Holly Ln 75		44.75829	-93.29541	3.5		Moderate	
B-K-15	Holly Ln 86		44.75829	-93.29443	3.25	Chipped Top	Moderate	

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
B-K-16	Holly Ln 74		44.75829	-93.29342	4.25	Chipped Top	Moderate	
CG-H-1	101	2536	44.82561	-92.94412	3		Moderate	
CG-H-2	93	2537	44.82587	-92.94413	3.5		Moderate	
CG-H-3	110	2538	44.82605	-92.94406	3		Moderate	Perm
CG-H-4	101	2539	44.82628	-92.9441	2.75		Moderate	
CG-H-5	59	2540	44.82649	-92.94407	3	Chipped Top	Moderate - High	
CG-H-6	120	2541	44.82665	-92.94411	3	Core barrel Markings on Top	Moderate	
CG-H-7	130	2542	44.82668	-92.94409	3	Core barrel Markings on Top	Moderate	
CG-H-8	93	2543	44.82705	-92.94408	3.75	Core barrel Markings on Top	Moderate - High	
CG-H-9	110	2544	44.82715	-92.94412	2.75	Chipped Top	Moderate	Perm - Chip Seal Removed
CG-H-10	72	2545	44.8269	-92.94417	3.25	Lift Line	Moderate	
CG-H-11	95	2546	44.82687	-92.94418	3.25	Rounded Top		
CG-H-12	78	2547	44.82646	-92.9442	3			Perm
CG-H-13	134	2548	44.82619	-92.94416	3	Core barrel Markings on Top		Perm - Chip Seal Removed
CG-I-1	160	2521	44.82075	-92.93758	2.75	No Good		
CG-I-2	142	2522	44.82073	-92.93755	2.75		Top 1" High, Moderate Rest	Perm
CG-I-3	82	2523	44.82078	-92.93761	3		Low	Perm - Chip Seal Removed
CG-I-4	84	2524	44.82079	-92.93761	3.25		Low	
CG-I-5	90	2519/2520	44.82086	-92.93775	3.5	Cracked on one side (HAM sample)	Top 0.25" High, Moderate Rest	
CG-I-6	118	2525	44.82101	-92.93814	3.25		Low	
CG-I-7	140	2526	44.82112	-92.93827	3.5		Top 1.5" High, Moderate Rest	
CG-I-8	50	2527	44.82122	-92.93843	4		Top 1.5" High, Moderate Rest	
CG-I-9	112	2528	44.82137	-92.93872	3.5		Top 0.25" High, Moderate Rest	
CG-I-10	88	2529	44.82152	-92.93897	3.5	Core Barrel Markings on Top	Top 0.25" High, Moderate Rest	
CG-I-11	80	2530	44.82128	-92.93864	4.25	No Good		
CG-I-12	55	2531	44.82116	-92.93843	3.75	Almost debonded	Low	

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
CG-I-13	88	2532	44.82107	-92.93822	3	Core Barrel Markings on Top		Perm
CG-I-14	93	2533	44.82092	-92.93806	3.75	Rounded Top	Top 0.5" Moderate, Low Rest	
CG-I-15	134	2534	44.82076	-92.93768	3.75	Rounded Top	Top 1/8" Moderate, Low Rest	
CG-I-16	112	2535	44.82068	-92.93753	3.75	Rounded Top	Low	Perm - Chip Seal Removed
CG-J-1	72	2626	44.82964	-92.91728	3.5		High	
CG-J-2	117	2627	44.82983	-92.91727	3.25		High	
CG-J-3	71	2628	44.83004	-92.91725	5.5		Top 1" High	
CG-J-4	117	2629/30	44.83018	-92.91727	3.25		High	
CG-J-5	116	2631	44.83034	-92.91724	3.75		High Ravel @ 1"	
CG-J-6	82	2632	44.83049	-92.91724	3.75		High Ravel @ 1"	Perm - Chip Seal Removed
CG-J-7	103	2633	44.83088	-92.91724	3.5	Rounded Top, Possible different mix		
CG-J-8	100	2635	44.83104	-92.91723	4		High	Perm
CG-J-9	112	2636	44.83137	-92.91727	4			
CG-J-10	80	2637	44.83143	-92.91724	4.25	Rounded Top	High Ravel @ 1"	
CG-J-11	110	2638	44.8316	-92.91723	3.5	Chipped Top		Perm - Chip Seal Removed
CG-J-12	78	2639	44.83175	-92.91721	3.5			
CG-J-13	98	2640	44.83176	-92.91737	3.5			Perm
CG-J-14	103	2641	44.83159	-92.91733	3.5		High Ravel @ 1-2"	
CG-JE-1	172		44.82842	-92.91596	3.75	8" extremely raveled		
IGH-B-1	75	2610	44.82507	-93.04418	4.25	Chipped Top	Low	
IGH-B-2	126	2611	44.82491	-93.0448	5.25	Rounded Top	Low	
IGH-B-3	60	2612	44.82484	-93.0453	5		Low	
IGH-B-4	107	2613	44.82478	-93.04596	5.5		Low	Perm - Chip Seal Removed
IGH-B-5	59	2614	44.82465	93.04664	4.5		Low	Ham - Chip Seal Removed
IGH-B-6	128	2615	44.82448	-93.04708	4.25	Chipped Top	Low	
IGH-B-7	96	2616	44.82426	-93.04741	5.25	Rounded Top	Low	Perm - Chip Seal Removed
IGH-B-8	70	2617	44.82396	-93.04767	5		Low	
IGH-B-9	118	2618	44.82349	-93.04776	4.5	Rounded Top	Low	Ham
IGH-B-10	58	2619	44.82327	-93.04777	5.5	Chipped & Rounded Top	Low	Ham
IGH-B-11	136	2620	44.82311	-93.04774	5	Chipped & Rounded Top	Low	
IGH-B-12	78	2621	44.82274	-93.04776	5.25	Chipped Top	Low	Perm
IGH-B-13	114	2622	44.82243	-93.04782	5.5	Chipped & Rounded Top	Low	Perm

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
IGH-B-14	68	2623	44.82227	-93.04788	6		Low	
IGH-B-15	124	2624	44.82211	-93.04791	5	Chipped & Rounded Top	Low	
IGH-B-16	52	2625	44.82198	-93.04798	3.75	Chipped Top	Low	Ham - Chip Seal Removed
O-1	120	2777	45.11086	-93.39199	4.75	Rounded Top		Ham - Chip Seal Removed
O-2	93	2778	45.11093	-93.39205	4.5	No Good		
O-3	56	2780	45.11119	-93.39204	5			
O-4	56	2781	45.11112	-93.39204	5			Perm
O-5	62	2782	45.11136	-93.39204	5.5	Chipped Top		
O-6	67	2783	45.11138	-93.39203	5.5		Top 1.5" Moderate Ravel	
O-7	100	2784	45.11155	-93.39208	4			
O-8	100	2785	45.11157	-93.39205	3.75			
O-9	52	2786	45.11163	-93.39206	5.25			Ham
O-10	53	2787	45.11163	-93.39206	5.25			Perm
O-11	102	2788	45.11175	-93.39207	4			
O-12	104	2789	45.11178	-93.39205	4.25			Perm - Chip Seal Removed
O-13	58	2790	45.11179	-93.39205	5.25			Ham
O-14	54	2791	45.11177	-93.39205	5			Ham - Chip Seal Removed
O-15	116	2792	45.11194	-93.39202	4			
O-16	118	2793	45.11189	-93.39202	4.5			Perm - Chip Seal Removed
SC-9N-1	43	2763	44.65232	-94.09159	8			
SC-9N-2	43	2764	44.65234	-94.09158	6			
SC-9N-3	58	2765	44.6524	-94.09161	8			
SC-9N-4	60	2766	44.65242	-94.09162	8		Moderate Ravel @ 2"	Perm - Chip Seal Removed
SC-9N-5	26	2767	44.6525	-94.09158	8.5			
SC-9N-6	26	2768	44.65254	-94.09159	8.5		Moderate Ravel @ 2"	Perm
SC-9N-7	48	2769	44.65262	-94.09158	8.5	Chip @ top		
SC-9N-8	52	2770	44.65266	-94.0916	9		Moderate Ravel @ 2.5"	
SC-9N-9	33	2771	44.65275	-94.09158	9.5			Perm
SC-9N-10	36	2772	44.65276	-94.09158	9			Perm - Chip Seal Removed
SC-9N-11	90	2773	44.65284	-94.0916	8			
SC-9N-12	87	2774	44.65289	-94.09159	8	Lift Line		
SC-9N-13	22	2775	44.65297	-94.09158	7.5			
SC-9N-14	19	2776	44.65301	-94.09158	7.5	Core Barrel Marking		
SC-9S-1	36	2749	44.6018	-94.0921	9.25		Low	Perm

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
SC-9S-2	30	2750	44.60182	-94.0921	10		Low	
SC-9S-3	46	2751	44.60195	-94.09214	9	No Good Top Broke Off		
SC-9S-4	85	2752	44.60199	-94.09213	9		Low	
SC-9S-5	23	2753	44.60221	-94.09209	8.5		Low	
SC-9S-6	23	2754	44.60223	-94.09209	10		Low	
SC-9S-7	68	2755	44.60231	-94.09211	8.25	Chipped Top	Low	
SC-9S-8	70	2756	44.60235	-94.09213	9	Chipped Top	Low	Perm - Chip Seal Removed
SC-9S-9	96	2757	44.60242	-94.09214	9.5		Low	
SC-9S-10	98	2758	44.60245	-94.09212	9.25	Chipped Top	Low	
SC-9S-11	23	2759/60	44.60259	-94.09213	6.75		Low	Perm
SC-9S-12	23	2761	44.60257	-94.09209	8.5		Low	Perm - Chip Seal Removed
SC-9S-13	18	2762	44.60265	-94.09211	8		Low	
W-B-1	116	2562	44.92165	-92.90073	3.25	Small crack on top (HAM Sample) Chipped on Top	Low	Ham
W-B-2	122	2563	44.92155	-92.90065	3.5	Chipped on Top	Low	Perm
W-B-3	114	2564	44.92151	-92.90055	3.5		Low	
W-B-4	88	2565	44.92149	-92.90059	3.5		Low	Perm - Chip Seal Removed
W-B-5	104	2566	44.92144	-92.90052	3.5	Chipped on Top	Low	Ham
W-B-6	98	2567	44.92139	-92.90045	3	Chipped & Rounded on Top	Low	
W-B-7	105	2568	44.92136	-92.90038	3.25		Low	Ham - Chip Seal Removed
W-B-8	78	2569	44.92131	-92.90029	3.5		Low	Ham - Chip Seal Removed
W-B-9	92	2570	44.92125	-92.90021	3.75		Low	Perm - Chip Seal Removed
W-B-10	67	2571	44.92127	-92.90017	3.5	Chipped on Top	Low	
W-B-11	85	2572	44.9214	-92.90035	3.75	Chipped on Top	Top 1" moderate Rest Low	
W-B-12	63	2573	44.92145	-92.90044	3.75		Low	
W-B-13	64	2574	44.9215	-92.90048	4		Low	
W-B-14	79	2575	44.92154	-92.90054	4		Low	Perm
W-B-15	74	2576	44.92166	-92.90065	3.75		Low	
W-B-16	70	2577	44.92171	-92.90071	3.5	Chipped & Rounded on Top	Top 1.5" moderate Rest Low	
W-NA-C-1	Middle of Circle	2578	44.89251	-92.95605	3.25		Low	
W-NA-C-2	185	2579	44.8926	-92.95605	3.25	Chipped Top	Low	

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
W-NA-C-3	360	2580	44.89255	-92.95609	2.5	Chipped Top	Low	
W-NA-C-4	105	2581	44.89252	-92.95612	4		Low	Perm Tested(12/5), No water level movement @ 20 min
W-NA-C-5	158	2582	44.89251	-92.95616	3.5	Core Barrel Moved creating a ring on top	Low	Perm Tested(12/5), No water level movement @ 20 min
W-NA-C-6	173	2583	44.89248	-92.95617	4		Low	
W-NA-C-7	200	2584	44.89248	-92.95621	3.5		Low	
W-NA-C-8	287	2585	44.89246	-92.95616	3		Low	
W-NA-C-9	312	2586	44.89245	-92.95615	3		Low	
W-NA-C-10	208	2587	44.89242	-92.95613	3		Low	
W-NA-C-11	336	2588	44.89242	-92.95609	3		Low	
W-NA-C-12	336	2589	44.89244	-92.95602	4		Low	Hamburg Sample
W-NA-C-13	270	2590	44.89244	-92.95603	3.25		Low	
W-NA-C-14	251	2591	44.89249	-92.95598	4		Low	Hamburg Sample
W-NA-C-15	190	2592	44.89255	-92.95604	3		Low	
W-NA-C-16	120	2593	44.89256	-92.95602	3.5		Low	
W-NA-S-1	92	2594	44.89271	-92.95601	3.5		Low	Chip seal removed by saw, Perm Tested(12/5), No water level movement @ 20 min
W-NA-S-2	94	2595	44.89272	-92.95603	3.25	Rounded Top Edges	Low	
W-NA-S-3	88	2596	44.89277	-92.95604	3.25		Low	
W-NA-S-4	70	2597	44.89287	-92.95602	3	Chipped Top	Low	
W-NA-S-5	62	2598	44.8929	-92.95599	3.25	Chipped Top, Bit Marking on Top	Low	

CORE ID	DISTANCE FROM CURB (inch)	PHOTO ID	LAT.	LONG.	CORE THICKNESS (in)	Other details	Ravel Level	Lab Notes
W-NA-S-6	63	2599	44.89293	-92.95602	3.5	Chipped Top	Low	
W-NA-S-7	86	2600	44.89304	-92.95605	3	Chipped Top	Low	
W-NA-S-8	93	2601	44.89303	-92.95605	3.25	Rounded Top Edges, Bit Markings on Surface	Low	
W-NA-S-9	70	2602	44.89315	-92.95607	4.5	Chipped Top	Low	Chip seal removed by saw, Perm Tested(12/5), No water level movement @ 20 min
W-NA-S-10	147	2603	44.89305	-92.95608	3.5	Rounded Top Edges	Low	Perm Tested(12/5), No water level movement @ 20 min
W-NA-S-11	168	2604	44.89277	-92.95607	4		Low	Hamburg Sample
W-NA-S-12	132	2605	44.89275	-92.95605	3.5	Chipped & Rounded Top	Low	Hamburg Sample
W-NA-S-13	124	2606	44.8927	-92.95609	3.5		Low	Perm Tested(12/5), No water level movement @ 20 min
W-NA-S-14	180	2607	44.89265	-92.95606	3.5		Low	Hamburg Sample Chip seal removed with saw
W-NA-S-15	130	2608	44.8926	-92.95607	3.5	Chipped & Rounded Top	Low	Hamburg Sample Chip seal removed with saw
W-NA-S-16	91	2609	44.89257	-92.95611	3.25	Chipped & Rounded Top	Low	

APPENDIX B

MIX TESTING AND PROPERTIES

Project Road	Year	Mix	Extracted A/C	Gradation Sieves											
				3/4"	1/2"	3/8"	#4	#8	#10	#16	#30	#40	#50	#100	#200
Blaine - 93rd Ave East End	1994	2340/41A wear	5.3	100	99	91	70	56		46	34		17	8	4.4
Blaine - 93rd Ave West End	1995	2340/41A wear	4.8	100	99	95	81	69		56	39		19	9	5.0
Brooklyn Park - 73rd Ave	1998	2340/41 wear	4.2	100	98	93	71	57		48	32		12	3	1.9
Brooklyn Park - Louisiana Ave	1995	2340/41 wear	5.5	100	100	97	79	66		53	38		21	10	5.6
Brooklyn Park - Winnetka Ave	1995	2340/41 Wear	5.8	100	100	969	73	58		45	29		14	6	3.8
Burnsville - 134th St	2005	2350 MV3-B	4.9	100	95	88	69	56		44	29		12	6	4.1
Burnsville - Heritage Cir Area	1994	2331-31/41	5.0	100	100	97	72	56		43	27		13	6	3.8
Burnsville - Knob Hill Area	1996	2331-31/41	5.1	100	100	98	77	62		48	31		14	7	5.1
Cottage Grove - Hyde Ave S	1996	2340/41B wear	4.6	100	93	83	67	54		40	24		11	6	4.4
Cottage Grove - Ingberg Trail	1995	2341	4.9	100	91	83	72	63		56	45		25	10	5.2
Cottage Grove - Jensen Ave	1986	2340/41B wear	4.4	100	93	85	68	54		45	34		19	9	5.4
Inver Grove Heights - Brooks Blvd	2009	MVWE3503 5B R	4.6	100	97	90	74	59		47	34		18	8	3.8
Osseo - 8th Ave	1992		4.8	100	99	96	78	61		46	30		14	7	3.6
Sibley County - CSAH 9 North Portion	1996	31B Wear	5.4	100	97	93	77	60		46	32		13	6	4.1
Sibley County - CSAH 9 South Portion	1997	31B Wear	5.6	100	96	92	74	57		43	30		14	11	8.5
Woodbury - Bridgewater	1998	41 Wear	4.9	100	93	86	74	64		54	41		22	10	5.2
Woodbury - Newbury Alcove Cul de sac	1998	41B Wear	5.0	100	91	83	62	47		35	24		11	6	2.9
Woodbury - Newbury Alcove Striaht Portion	1995	41B Wear	4.7	100	94	90	70	54		42	29		14	7	4.3

Project Road	SpG	SpG -#4	Core Gmm	Core Gmb	Core Air Voids	Core VMA	Core AFT	Core VFA	TSR 7% Air Voids	TSR 11% Air Voids	Perm Test
Blaine - 93rd Ave East End	2.684	2.684	2.474	154.1	2.400	3.0	15.3	9.0	80.5	76.0	67.0
Blaine - 93rd Ave West End	2.652	2.652	2.468	153.8	2.302	6.7	17.4	7.3	61.3	69.0	61.0
Brooklyn Park - 73rd Ave	2.658	2.658	2.493	155.3	2.284	8.4	17.7	9.2	52.6	70.0	65.0
Brooklyn Park - Louisiana Ave	2.668	2.668	2.455	152.9	2.337	4.8	17.2	8.2	72.1	77.0	74.0
Brooklyn Park - Winnetka Ave	2.697	2.697	2.466	153.6	2.404	2.5	16.0	10.9	84.3	93.0	87.0
Burnsville - 134th St	2.698	2.698	2.502	155.9	2.327	7.0	18.0	9.1	61.1	79.0	70.0
Burnsville - Heritage Cir Area	2.667	2.667	2.471	153.9	2.292	7.2	18.4	9.7	60.5	75.0	66.0
Burnsville - Knob Hill Area	2.683	2.683	2.480	154.5	2.281	8.0	19.3	8.7	58.5	70.0	65.0
Cottage Grove - Hyde Ave S	2.672	2.672	2.491	155.2	2.335	6.3	16.6	8.9	62.3	77.0	70.0
Cottage Grove - Ingberg Trail	2.698	2.698	2.502	155.9	2.314	7.5	18.4	7.1	59.2	73.0	66.0
Cottage Grove - Jensen Ave	2.697	2.697	2.518	156.9	2.325	7.7	17.6	7.0	56.4	65.0	51.0
Inver Grove Heights - Brooks Blvd	2.671	2.671	2.489	155.1	2.376	4.5	15.1	7.9	70.0	76.0	63.0
Osseo - 8th Ave	2.679	2.679	2.491	155.2	2.311	7.2	17.9	8.7	59.6	81.0	76.0
Sibley County - CSAH 9 North Portion	2.622	2.622	2.423	151.0	2.285	5.7	17.6	9.7	67.6	78.0	69.0
Sibley County - CSAH 9 South Portion	2.623	2.623	2.417	150.6	2.323	3.9	16.4	8.2	76.3	84.0	78.0
Woodbury - Bridgewater	2.700	2.700	2.503	155.9	2.382	4.8	16.1	7.3	70.0	91.0	69.0
Woodbury - Newbury Alcove Cul de sac	2.699	2.699	2.499	155.7	2.465	1.4	13.2	11.0	89.7	97.0	78.0
Woodbury - Newbury Alcove Striaht Portion	2.671	2.671	2.485	154.8	2.433	2.1	13.2	8.5	84.1	76.0	65.0

APPENDIX C

FRACTURE ENERGY TESTING



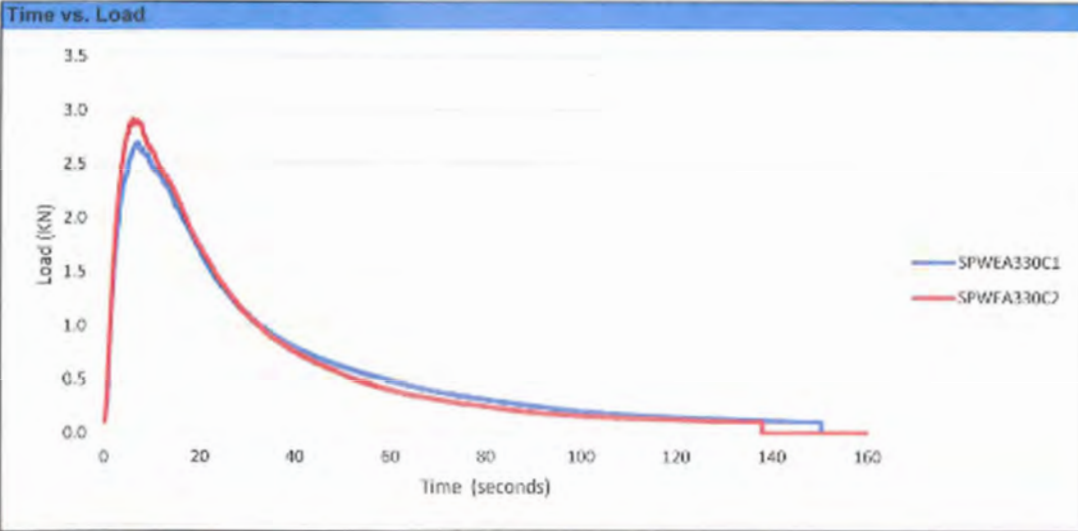
**AMERICAN
ENGINEERING
TESTING, INC.**

American engineering testing, inc.
 Saint Paul
 550 Cleveland Ave N
 St. Paul, MN 55114
 Toll Free: (800)972-6364
 www.aengetest.com

Disk-Shaped Compact Tension Test Report

Client: LRRB	CC:	This document is not to be reproduced or distributed without the express written consent of American Engineering Testing, Inc.
Project: 27-00006 LRRB Asphalt Stripping Study		

Sample Information	
Asphalt Mixture Type: SPWEA330C	Testing Temperature: -24.0 C



Specimen Information							Area		
ID	Air Voids %	Thickness mm	Ligament mm	Peak Load kN	Actual Slope mm/s	Fracture Energy J/m ²	Under the Curve Nmm	Length of Test s	
SPWEA330 C1		49.88	80.10	2.70	0.017	412.53	1648.21	150.40	
SPWEA330 C2		49.75	80.78	2.92	0.017	394.79	1586.60	138.16	
Average Fracture Energy:						403.66 J/m ² †			
Standard Deviation:						12.54 J/m ²			

Tested By	Remarks

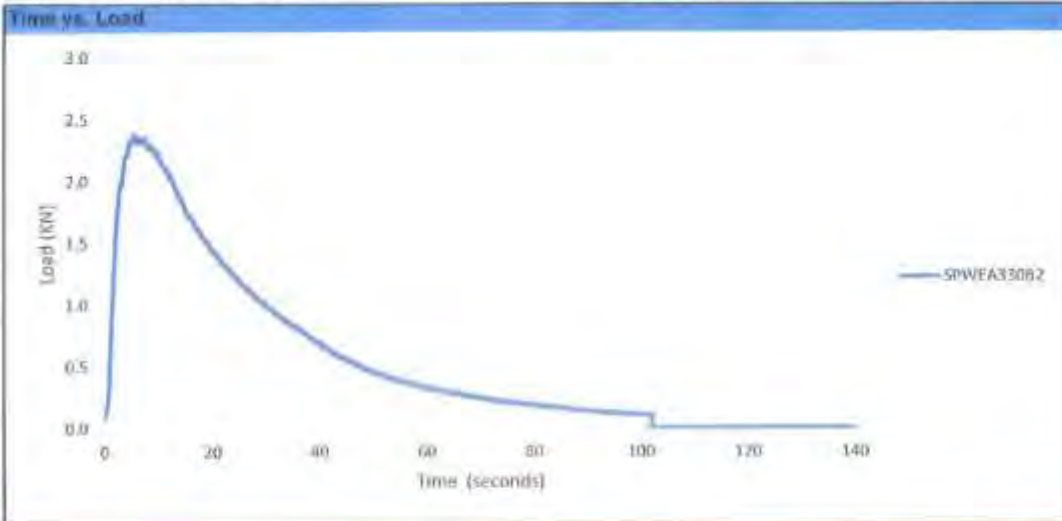


American Engineering Testing, Inc.
 Selma, PA 15
 550 Cleveland Ave N
 St. Paul, MN 55114
 Toll free: (800)972-6364
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Disk-Shaped Compact Tension Test Report

Client: LRRB	CC:	This document is the copyrighted property of American Engineering Testing, Inc. Date of _____ Reviewed By: _____
Project: 27-00006 LRRB Asphalt Stripping Study		

Sample Information		
Asphalt Mixture Type: SPWEA330B	Testing Temperature:	-18.0 C



Specimen Information									
ID	Air Voids %	Thickness mm	Ligament mm	Peak Load kN	Actual Slope mm/s	Fracture Energy J/m ²	Area Under the Curve Nmm	Length of Test s	
SPWEA330B2		49.91	79.28	2.39	0.017	322.30	1275.31	102.20	
Average Fracture Energy:						322.30 J/m ² †			
Standard Deviation:						N/A J/m ²			

Tested By	Remarks

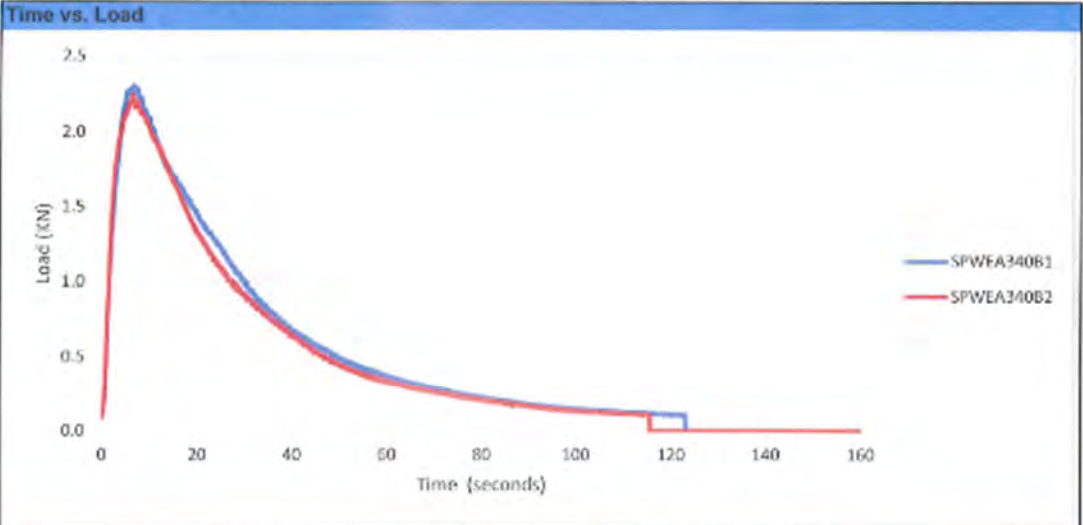


American Engineering Testing, Inc.
 Saint Paul
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 St. Paul, MN 55114
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Disk-Shaped Compact Tension Test Report

Client: LRRB	CC:	This document is the property of American Engineering Testing, Inc. All rights reserved. Reproduction without permission is prohibited.
Project: 27-00006 LRRB Asphalt Stripping Study		

Sample Information			
Asphalt Mixture Type:	SPWEA340B	Testing Temperature:	-18.0 C



Specimen Information									
ID	Air Voids %	Thickness mm	Ligament mm	Peak Load kN	Actual Slope mm/s	Fracture Energy J/m ²	Area Under the Curve Nmm	Length of Test s	
SPWEA340 B1		49.72	79.24	2.31	0.017	335.30	1321.02	123.28	
SPWEA340 B2		50.00	78.88	2.25	0.017	314.06	1238.65	115.78	
Average Fracture Energy:						324.68 J/m ²			
Standard Deviation:						15.02 J/m ²			

Tested By	Remarks



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 St. Paul, MN 55114
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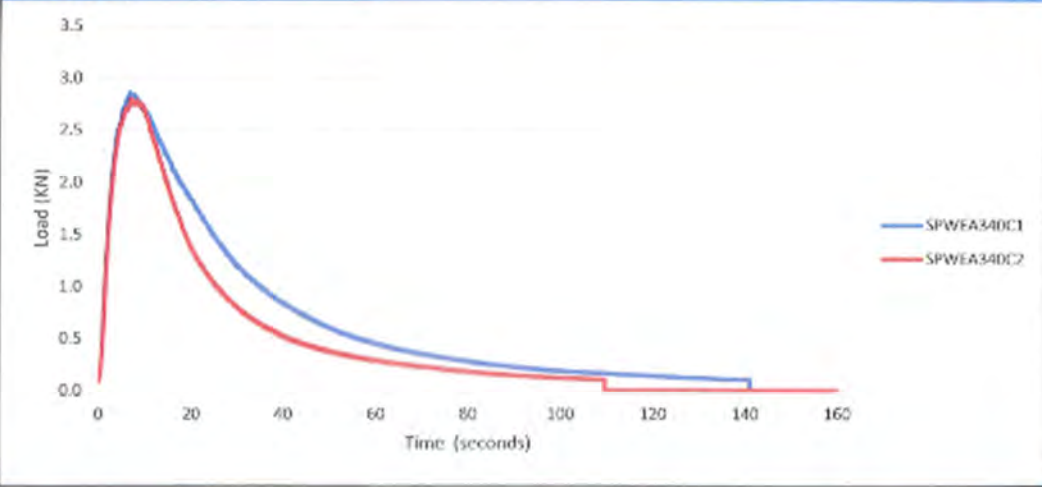
Disk-Shaped Compact Tension Test Report

Client: LRRB	CC:	File location of test data: \\server\americantesting\lrrb\27-00006\SPWEA340C1 Date of Review: _____ Reviewed By: _____
Project: 27-00006 LRRB Asphalt Stripping Study		

Sample Information

Asphalt Mixture Type: SPWEA340C	Testing Temperature: -24.0 C
---------------------------------	------------------------------

Time vs. Load



Specimen Information

ID	Air Voids %	Thickness mm	Ligament mm	Peak Load kN	Actual Slope mm/s	Fracture Energy J/m ²	Area Under the Curve Nmm	Length of Test s
SPWEA340 C1		49.88	80.22	2.86	0.017	420.32	1681.86	141.18
SPWEA340 C2		49.88	79.59	2.80	0.017	318.88	1265.93	109.68

Average Fracture Energy: 369.60 J/m² ±
 Standard Deviation: 71.73 J/m²

Tested By

Tested By	Remarks

APPENDIX D

LAB PERMEABILITY TESTING

Location	Permeability (10-5 cm/sec)	Sample 1	Sample 2	Sample 3	Sample 4	Average
Blaine - 93rd Ave East End	K=	0.9	0.0	2.3	0.1	0.8
	K20=	0.6	0.0	1.7	0.0	0.6
Blaine - 93rd Ave West End	K=	1.5	0.5	-	-	1.0
	K20=	1.1	0.4	-	-	0.8
Brooklyn Park 73rd Ave	K=	1.0	9.4	12.5	19.9	10.7
	K20=	0.7	6.8	9.1	14.4	7.8
Brooklyn Park - Louisiana Ave	K=	0.0	0.0	0.0	0.0	0.0
	K20=	0.0	0.0	0.0	0.0	0.0
Brooklyn Park - Winnetka Ave	K=	0.0	0.0	0.1	0.0	0.0
	K20=	0.0	0.0	0.0	0.0	0.0
Burnsville - 134th St	K=	9.8	1.2	1.5	0.1	3.1
	K20=	7.1	0.9	1.1	0.1	2.3
Burnsville - Heritage Cir Area	K=	0.1	0.1	1.2	0.3	0.4
	K20=	0.0	0.1	0.9	0.2	0.3
Burnsville - Knob Hill Area	K=	0.0	0.9	0.3	0.3	0.4
	K20=	0.0	0.7	0.2	0.2	0.3
Cottage Grove - Hyde Ave S	K=	0.0	0.5	0.1	0.5	0.2
	K20=	0.0	0.3	0.0	0.3	0.2
Cottage Grove - Ingberg Trl S	K=	12.7	0.1	1.3	0.0	3.5
	K20=	9.2	0.0	1.0	0.0	2.5
Cottage Grove - Jensen Ave	K=	3.7	0.0	0.1	23.7	6.9
	K20=	2.7	0.0	0.1	17.2	5.0
Inver Grove Heights - Brooks Blvd	K=	0.0	0.0	0.0	0.0	0.0
	K20=	0.0	0.0	0.0	0.0	0.0
Osseo 8th Ave SE	K=	0.0	4.2	11.9	0.0	4.0
	K20=	0.0	3.1	8.6	0.0	2.9
Sibley County CSAH 9 North Portion	K=	0.0	0.0	0.2	0.0	0.0
	K20=	0.0	0.0	0.1	0.0	0.0
Sibley County CSAH 9 South Portion	K=	0.0	0.0	0.1	0.0	0.0
	K20=	0.0	0.0	0.0	0.0	0.0
Woodbury - Bridgewater	K=	1.0	0.0	0.0	0.0	0.3
	K20=	0.8	0.0	0.0	0.0	0.2
Woodbury - Newbury Alcove Cul de sac	K=	0.0	0.0	-	-	0.0
	K20=	0.0	0.0	-	-	0.0
Woodbury - Newbury Alcove Straight Portion	K=	0.0	0.0	0.0	0.0	0.0
	K20=	0.0	0.0	0.0	0.0	0.0

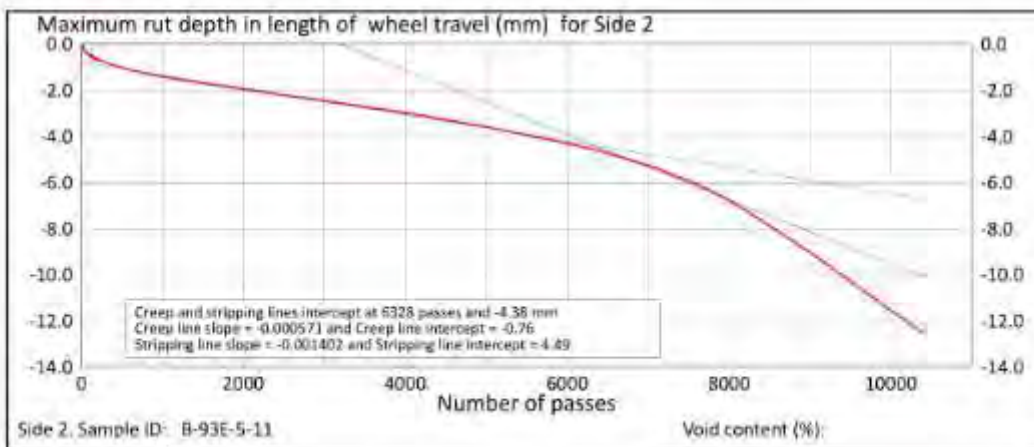
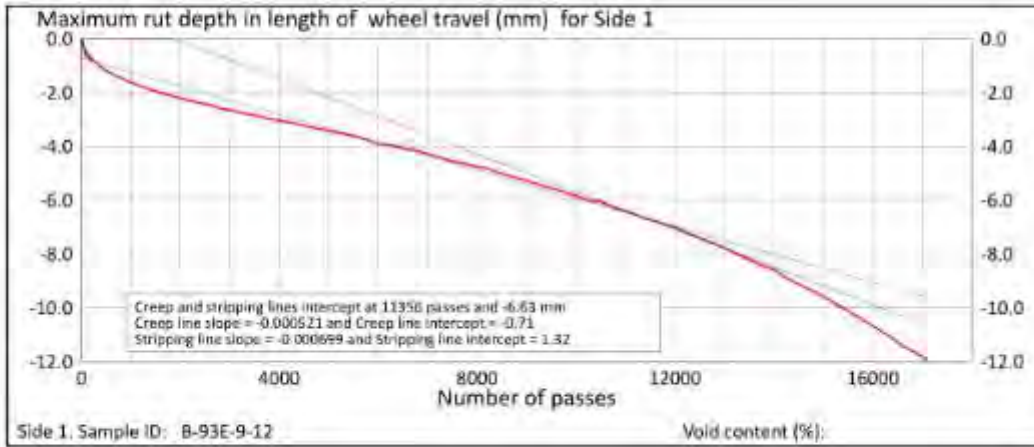
APPENDIX E

HAMBURG TEST DATA

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/29/2014 6:56 AM
 Lab. No.: B-93E
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-3.42	-3.57
10000	-5.83	-11.54
15000	-9.55	
10384		-12.51
17102	-11.98	

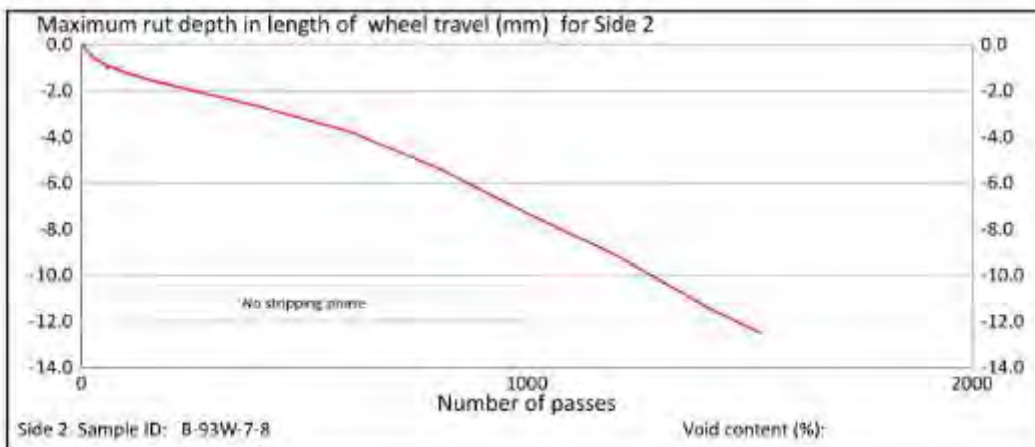
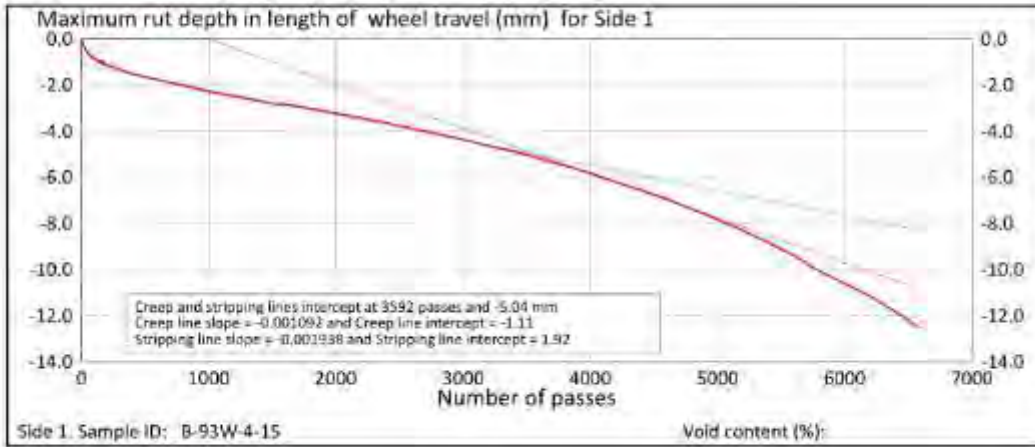
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/23/2014 7:10 AM
 Lab. No.: B-93W
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Pass No.	Rut depths (mm)	
	Side 1	Side 2
5000	-7.82	
1526		-12.53
6586	-12.52	

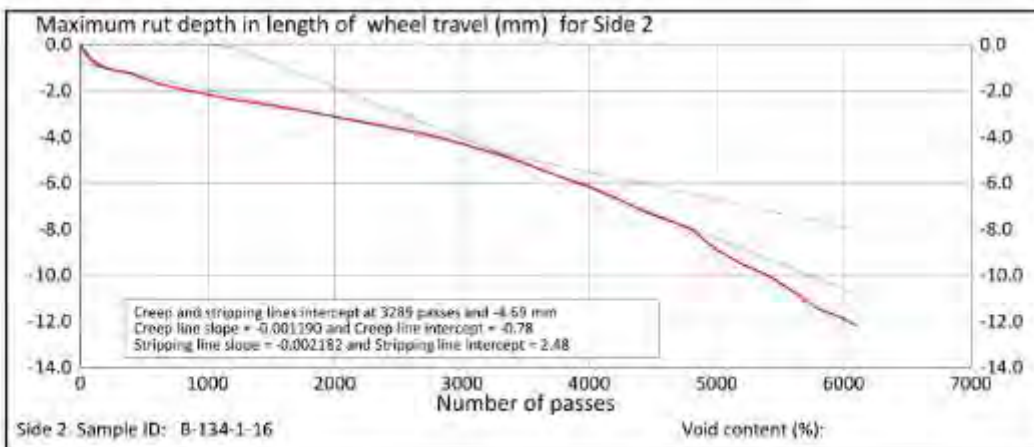
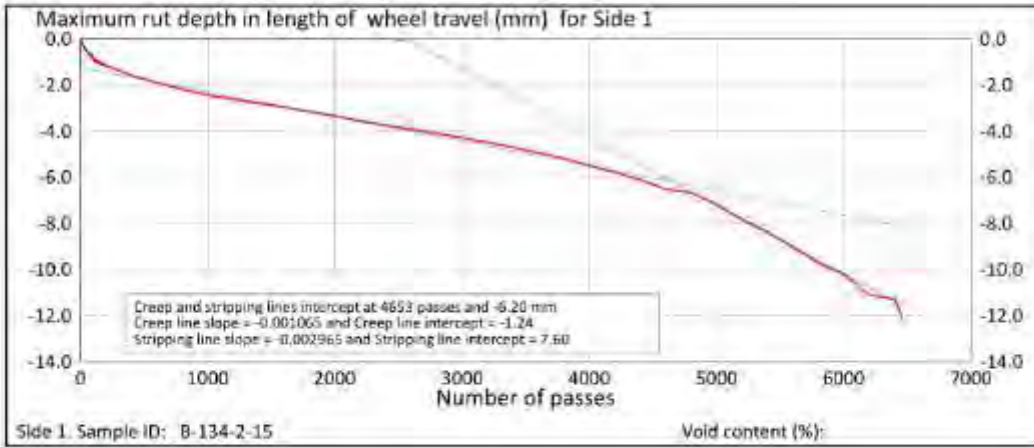
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/22/2014 7:27 AM
 Lab. No.: B-134
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-7.17	-8.9
6090		-12.18
6460	-12.11	

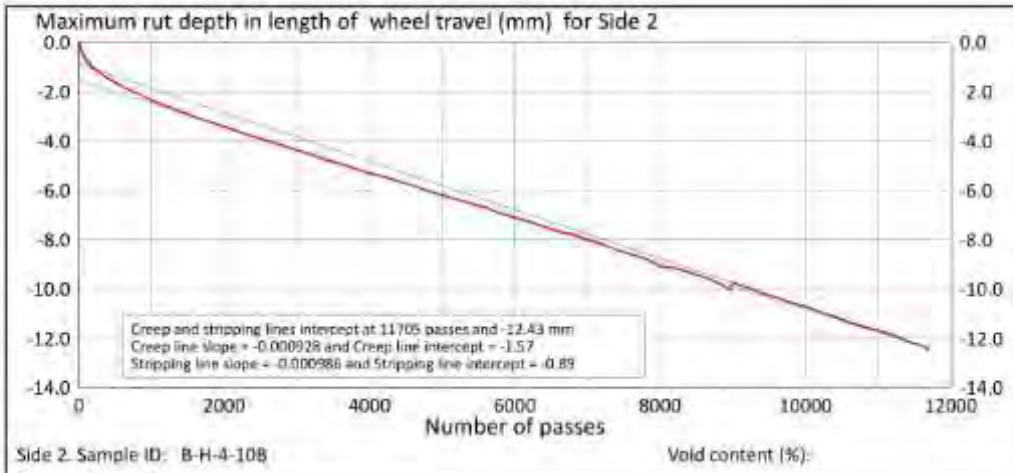
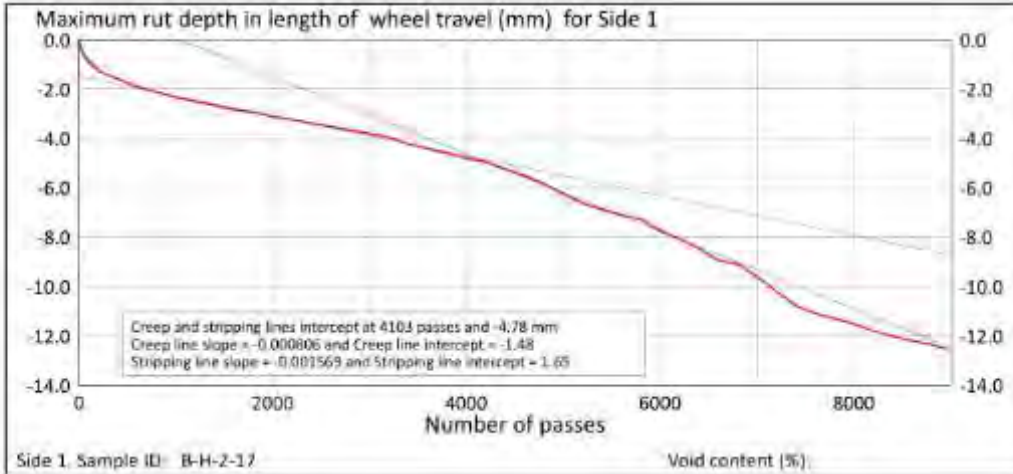
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 1/7/2015 6:39 AM
 Lab. No.: B-H
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-6.25	-6.2
10000		-10.72
8968	-12.53	
11696		-12.51

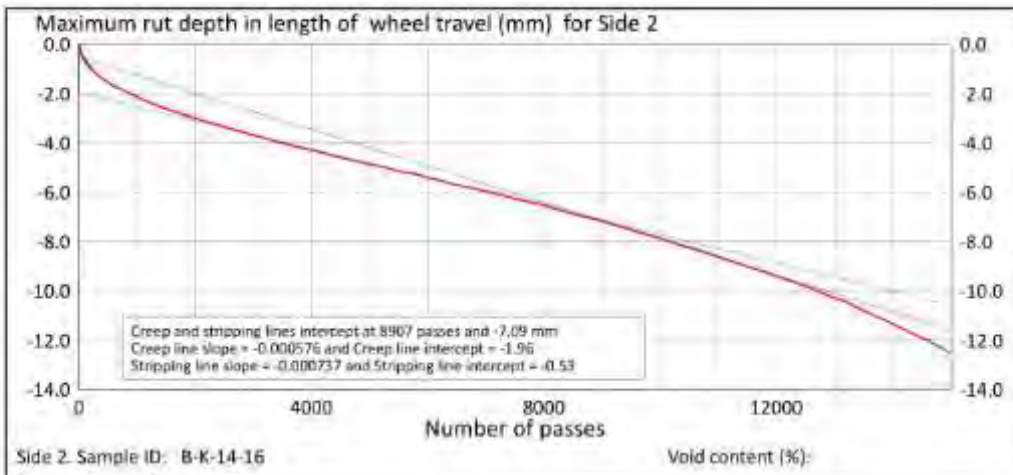
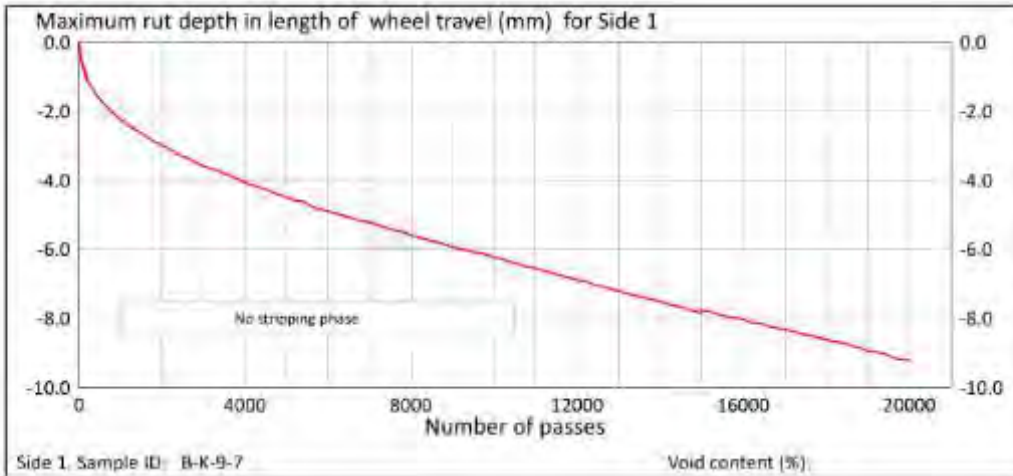
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 1/6/2015 9:12 AM
 Lab. No.: B-K
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-4.5	-4.87
10000	-6.25	-7.87
15000	-7.76	
20000	-9.22	
14976		-12.56

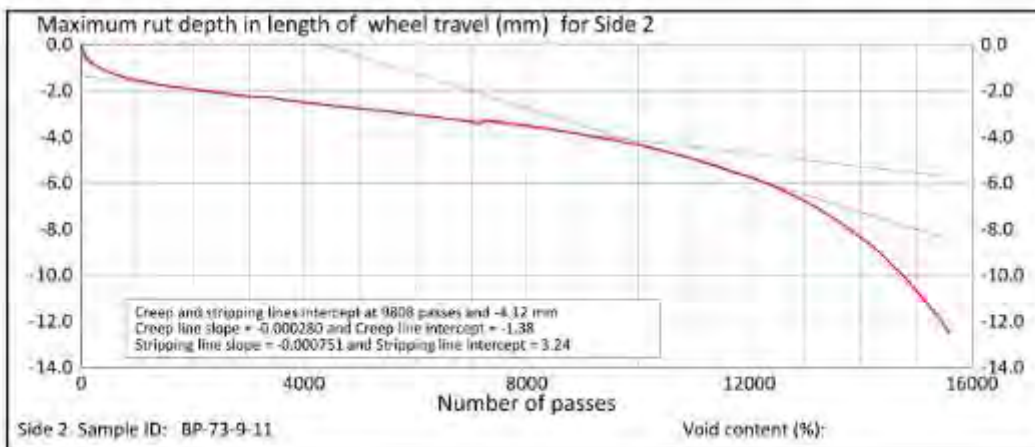
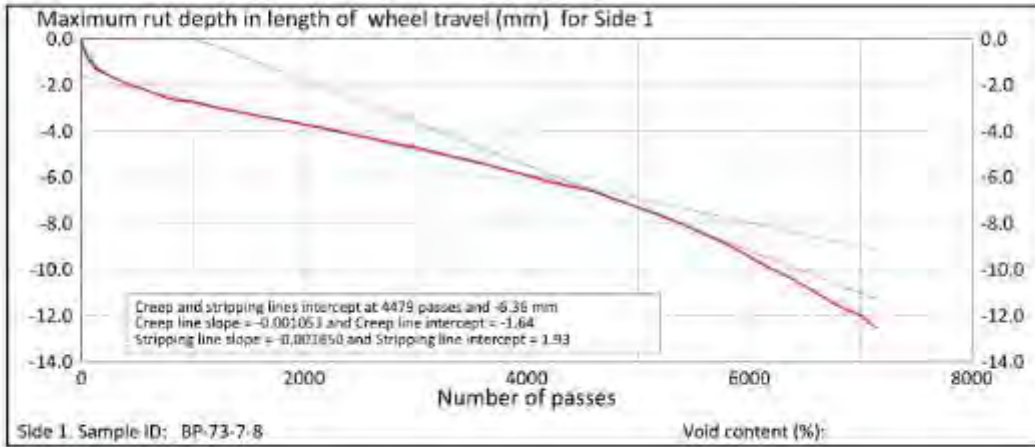
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/22/2014 12:15 PM
 Lab. No.: BP-73
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-7.31	-2.79
10000		-4.36
15000		-10.69
7134	-12.51	
15590		-12.5

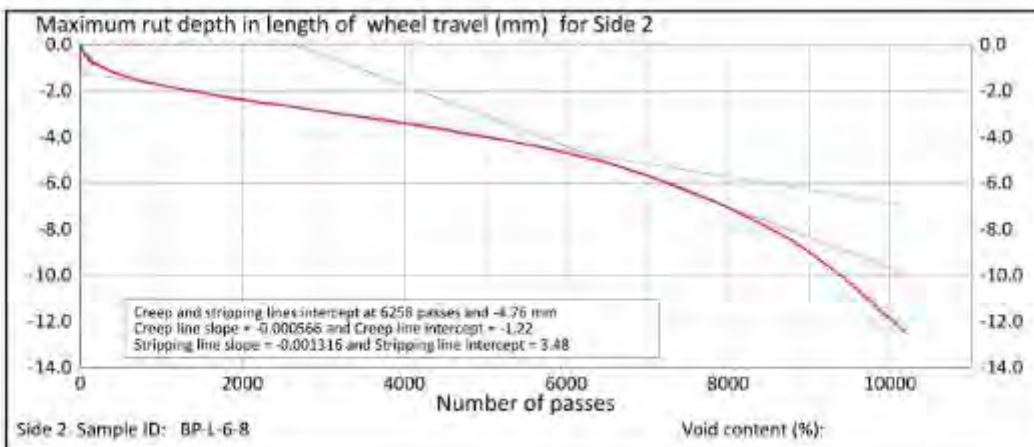
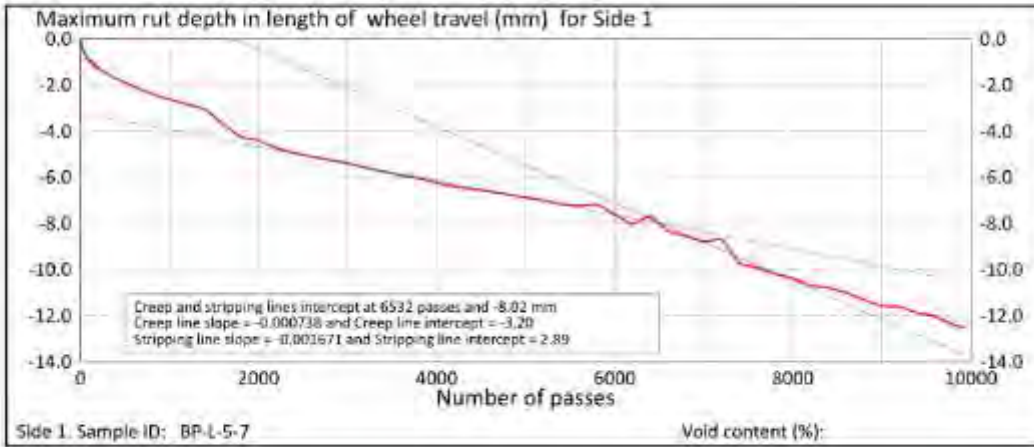
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/17/2014 4:25 PM
 Lab. No.: BP-L
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-6.87	-4.01
10000		-11.86
9936	-12.5	
10194		-12.51

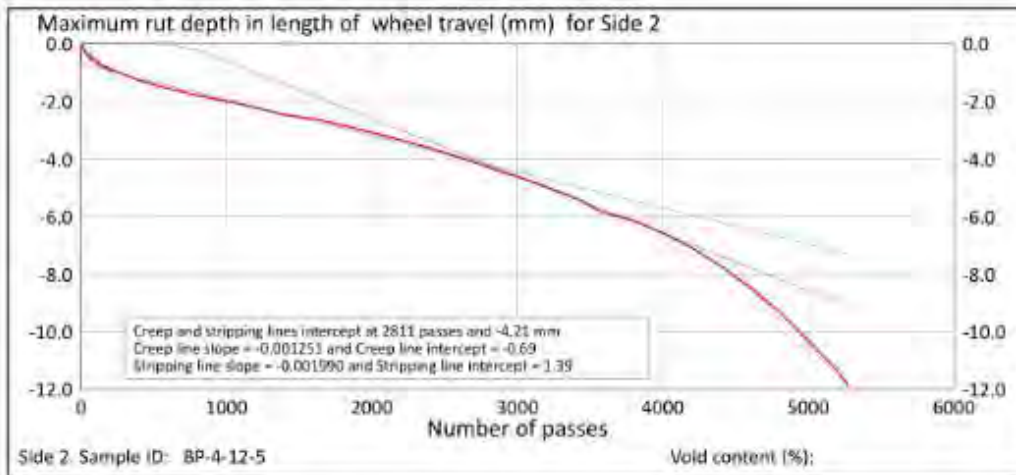
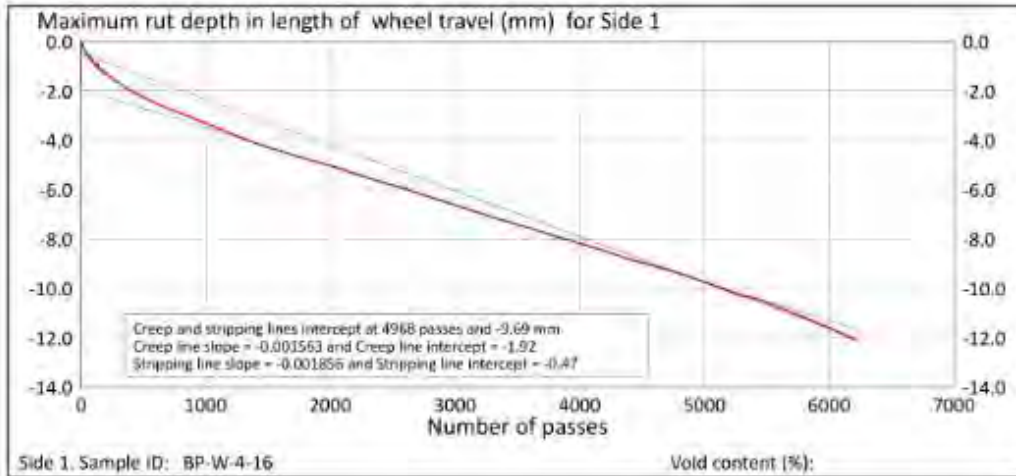
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 1/7/2015 1:05 PM
 Lab. No.: BP-W
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-9.74	-10.32
5272		-11.85
6220	-12.11	

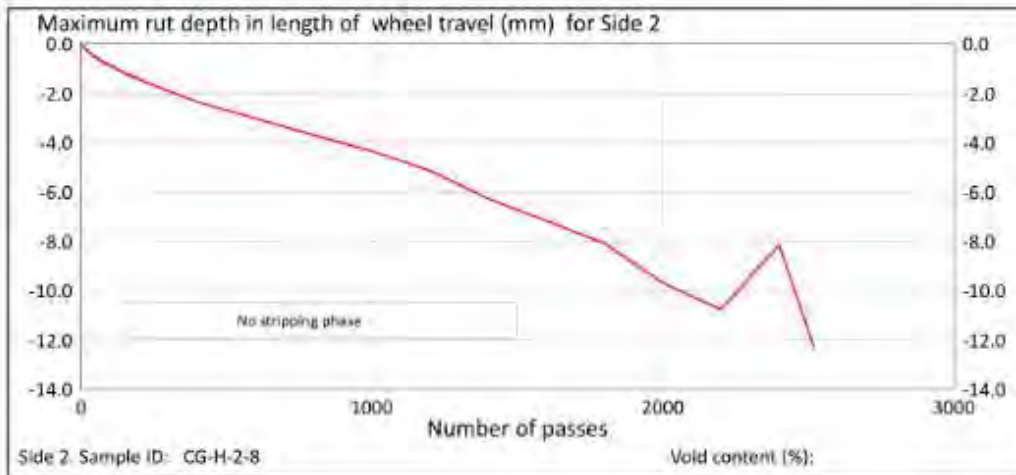
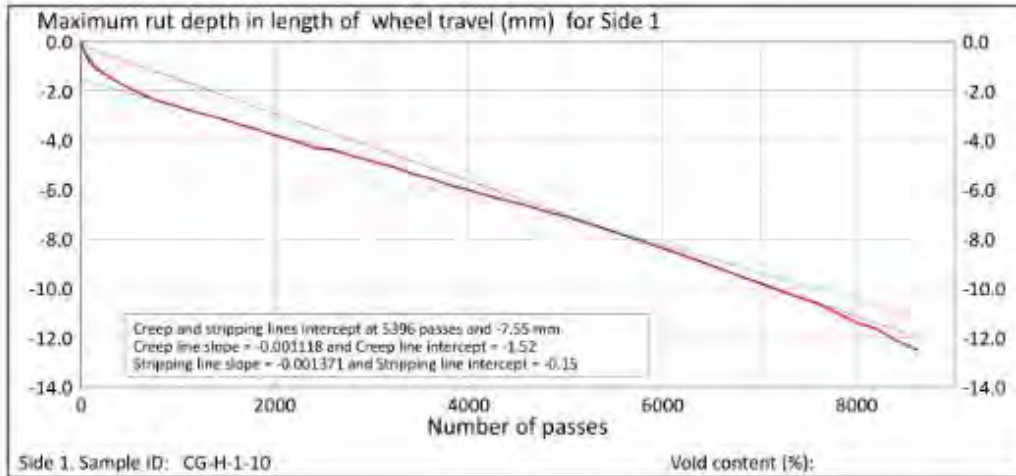
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 1/5/2015 1:56 PM
 Lab. No.: CG-H
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Pass No.	Rut depths (mm)	
	Side 1	Side 2
5000	-7.09	
2518		-12.25
8626	-12.5	

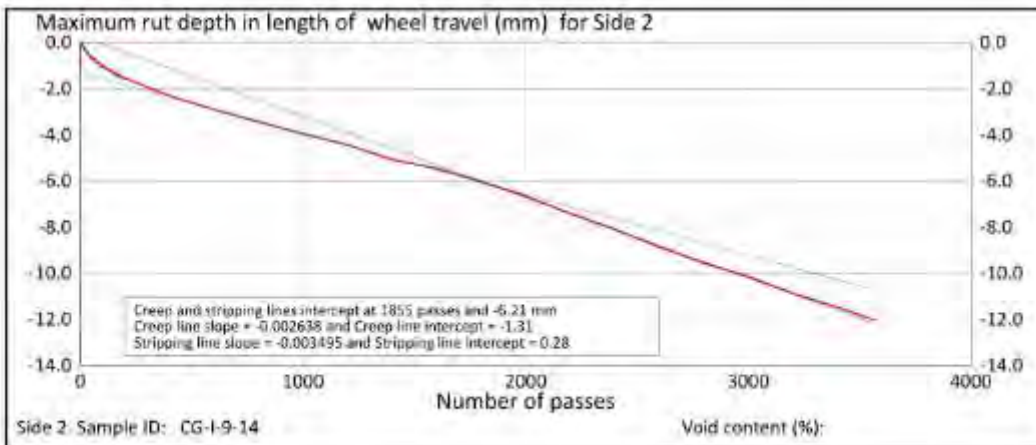
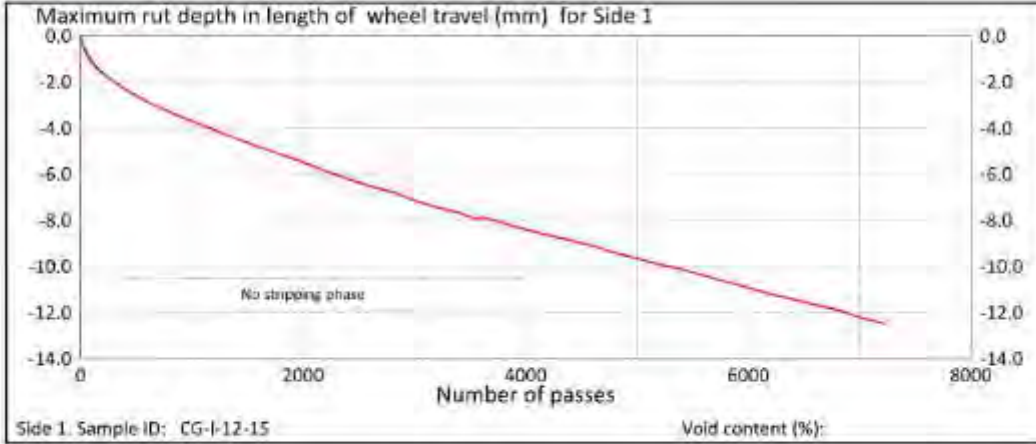
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/30/2014 7:02 AM
 Lab. No.: CG-1
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-9.65	
3564		-12.04
7224	-12.53	

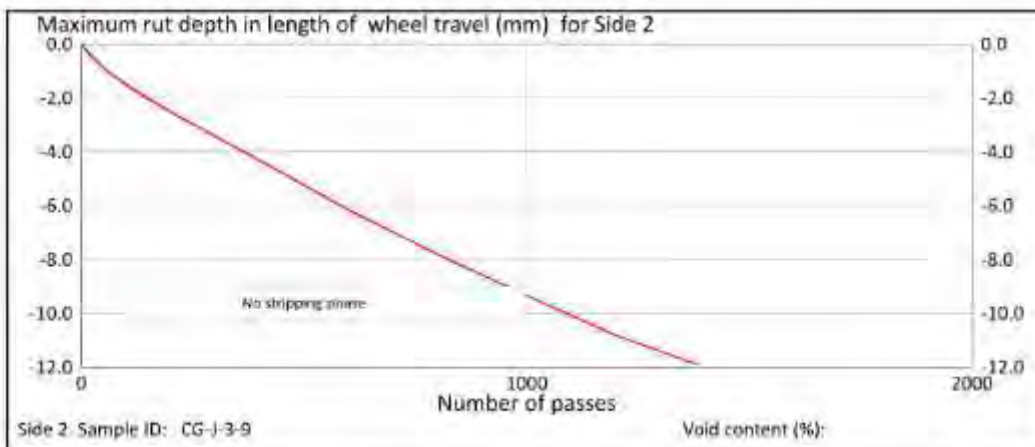
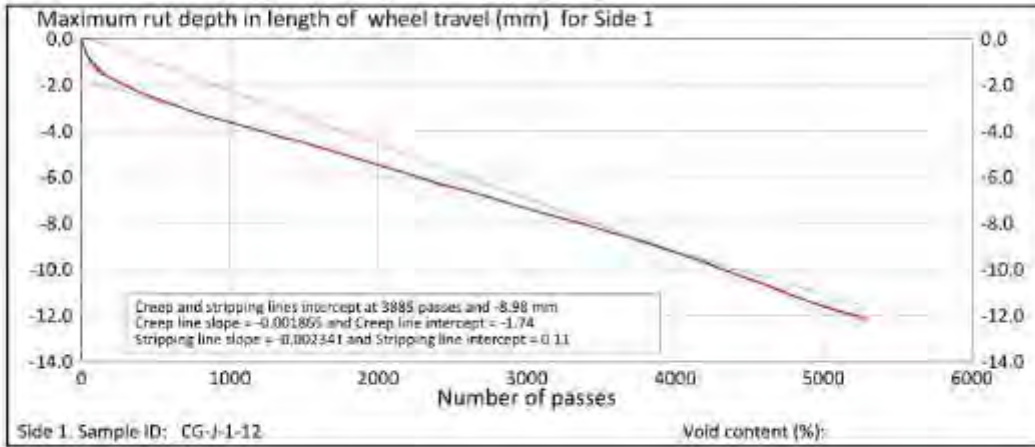
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/31/2014 6:58 AM
 Lab. No.: CG-J
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-11.6	
1382		-11.89
5288	-12.15	

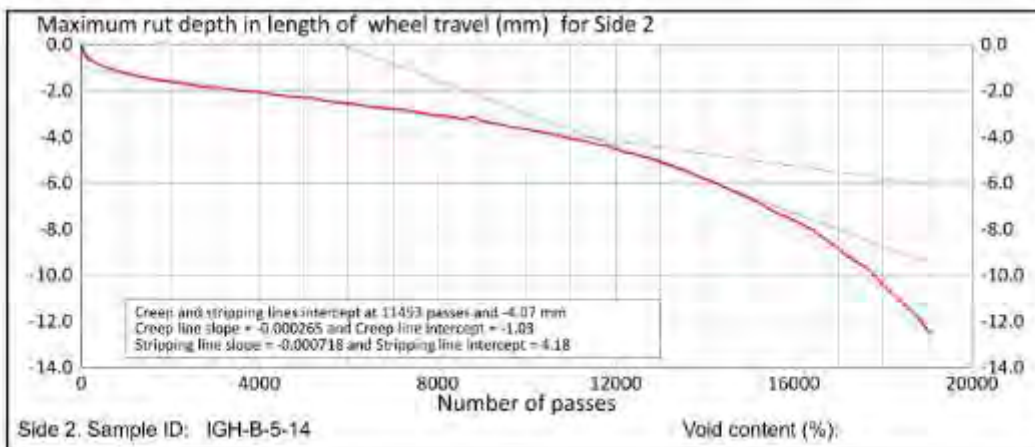
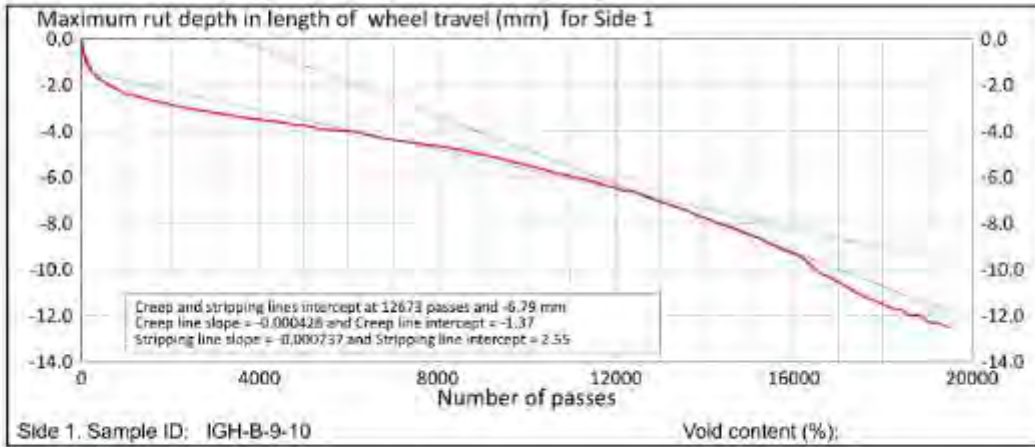
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/17/2014 8:13 AM
 Lab. No.: IGH-B
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-3.75	-2.31
10000	-5.47	-3.68
15000	-8.48	-6.68
19078		-12.51
19472	-12.51	

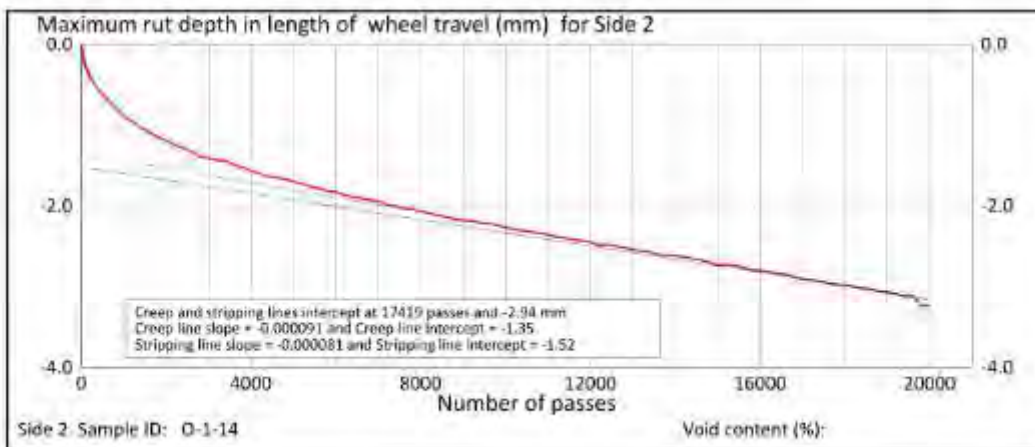
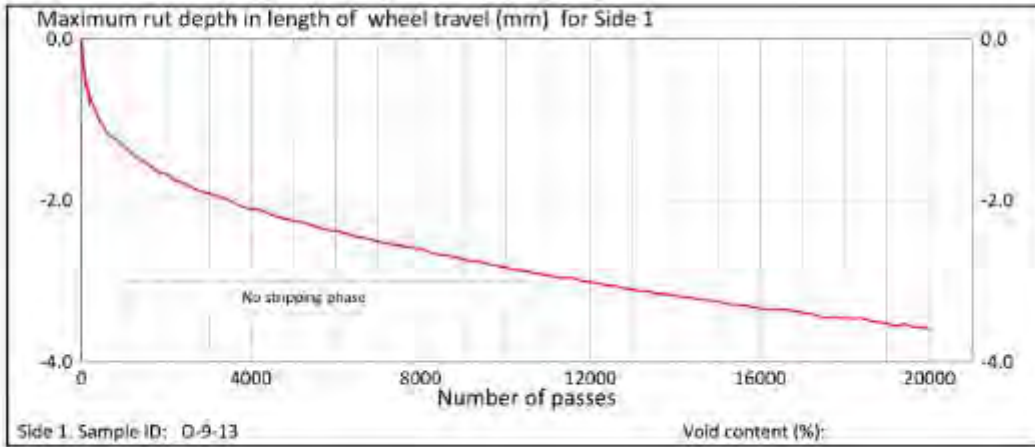
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 45.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/19/2014 7:05 AM
 Lab. No.: 0
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-2.25	-1.7
10000	-2.83	-2.27
15000	-3.25	-2.74
20000	-3.59	-3.24

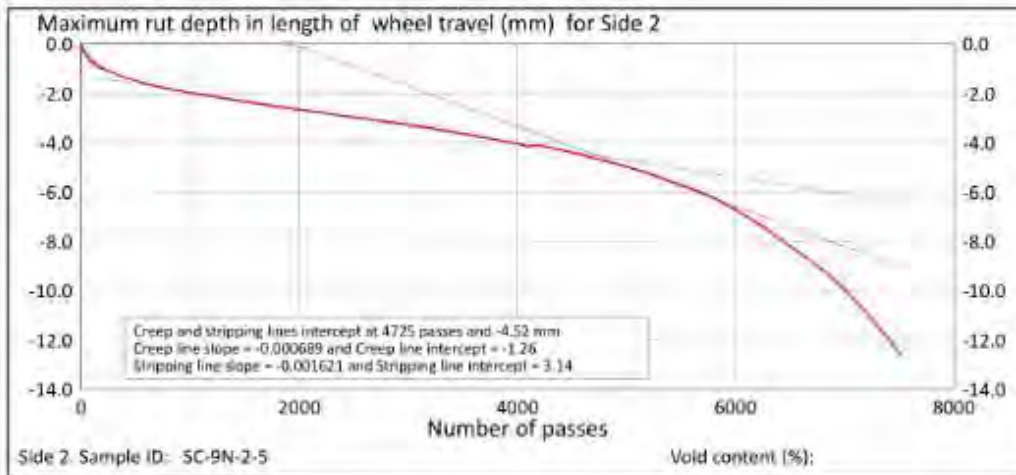
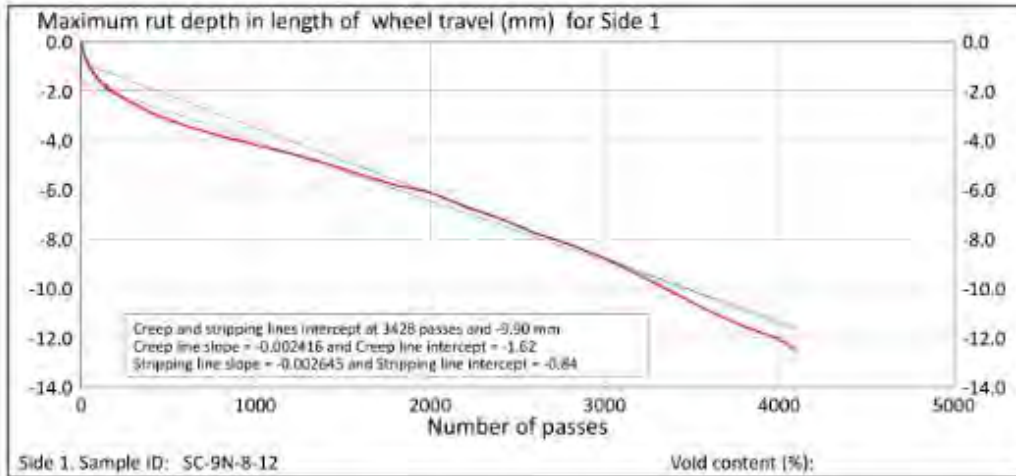
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 1/5/2015 8:01 AM
 Lab. No.: 5C-9N
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer:



Pass No.	Rut depths (mm)	
	Side 1	Side 2
5000		-4.98
4102	-12.53	
7506		-12.59

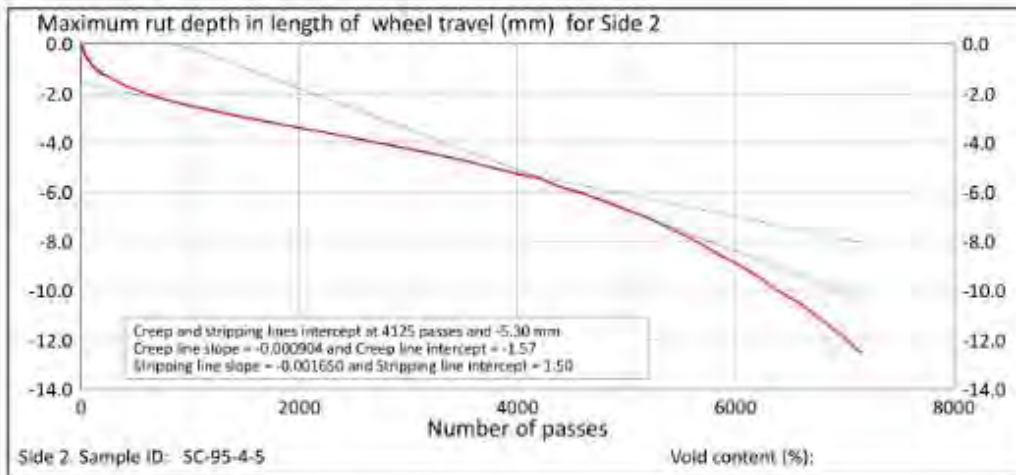
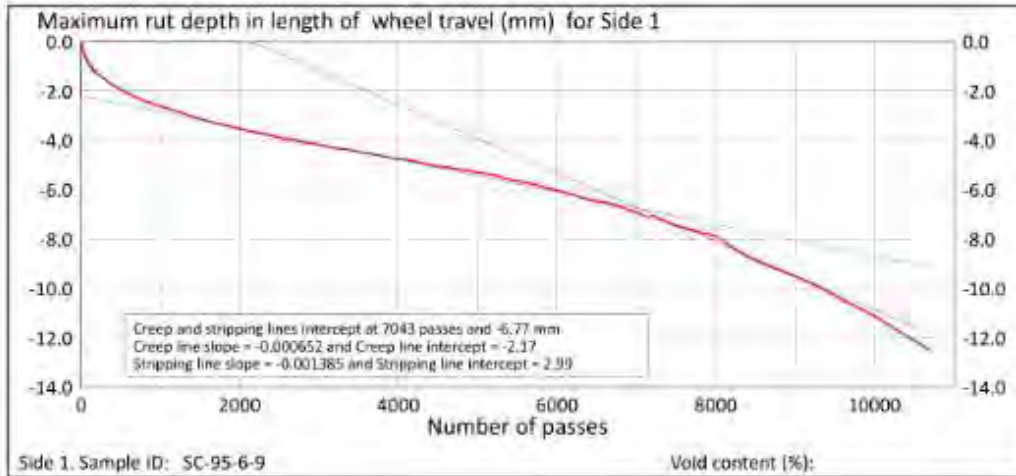
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/31/2014 11:23 AM
 Lab. No.: SC-95
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-5.3	-6.72
10000	-11.12	
7150		-12.53
10702	-12.51	

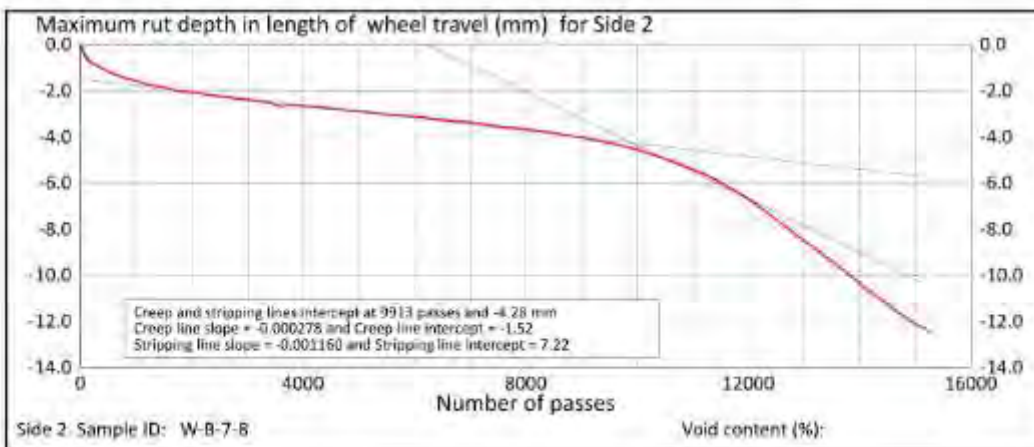
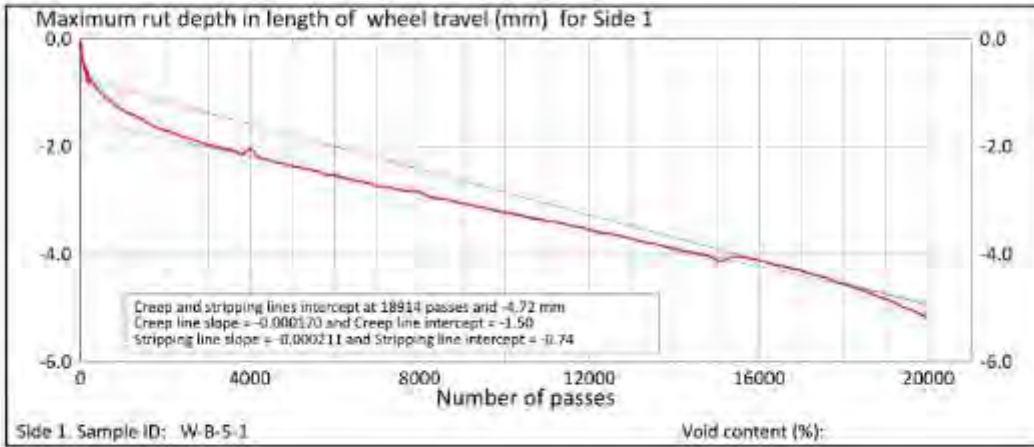
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/18/2014 7:09 AM
 Lab. No.: W-B
 Project name: LRRB Study
 Submitted by:

Date sampled:
 Job No.:
 Project No.:
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-2.37	-2.91
10000	-3.23	-4.56
15000	-4.11	-12.14
20000	-5.19	
15254		-12.53

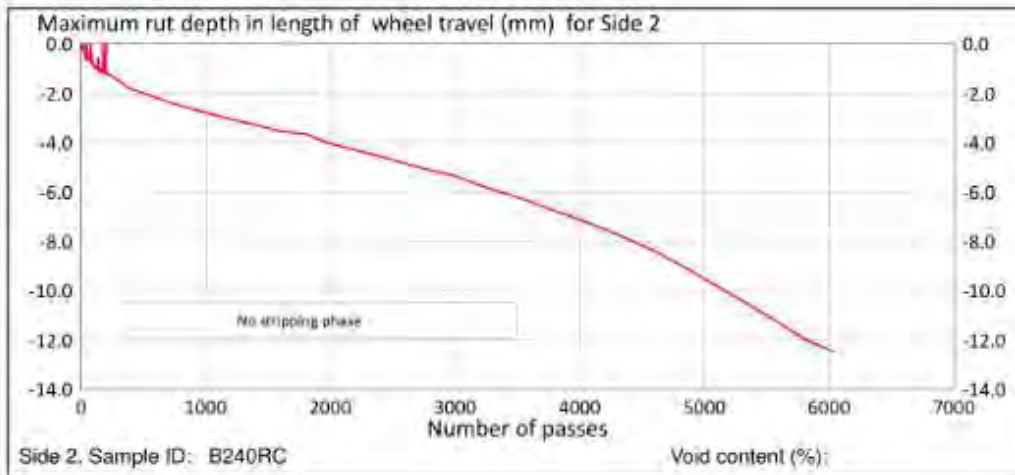
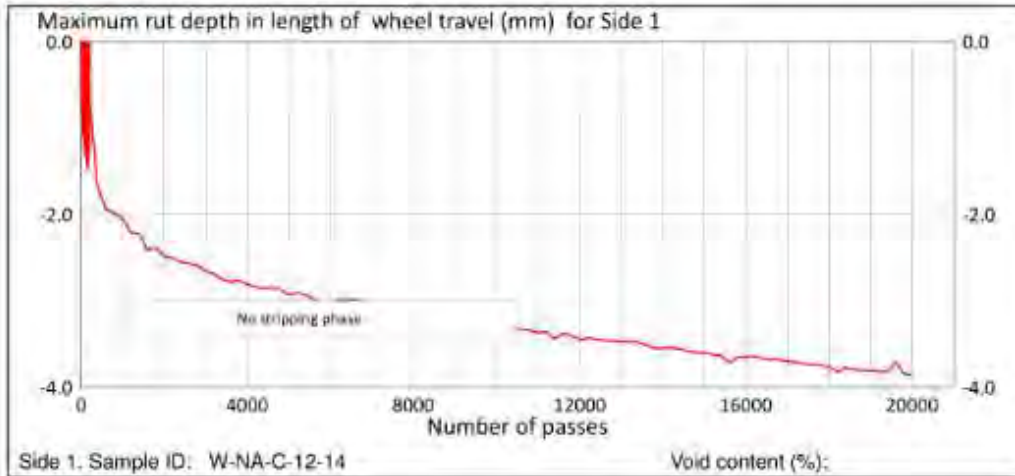
Mix type:
 Asphalt grade:
 Mix source:
 Test temperature (°C): 50.0
 Mix depth (mm): 60.0

Signature:

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/15/2014 9:45 AM
 Lab. No.:
 Project name:
 Submitted by:

Date sampled:
 Job No.:
 Project No.: 27-00006
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-2.93	-9.51
10000	-3.29	
15000	-3.6	
20000	-3.86	
6036		-12.5

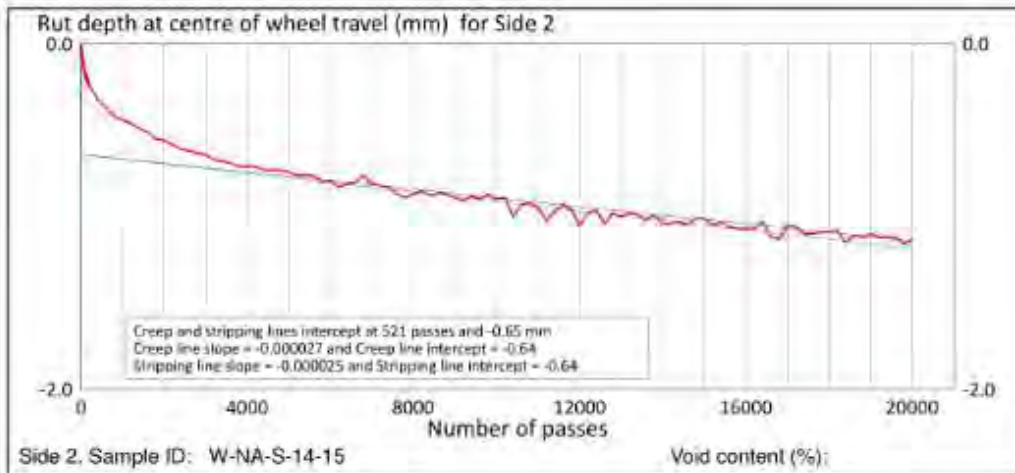
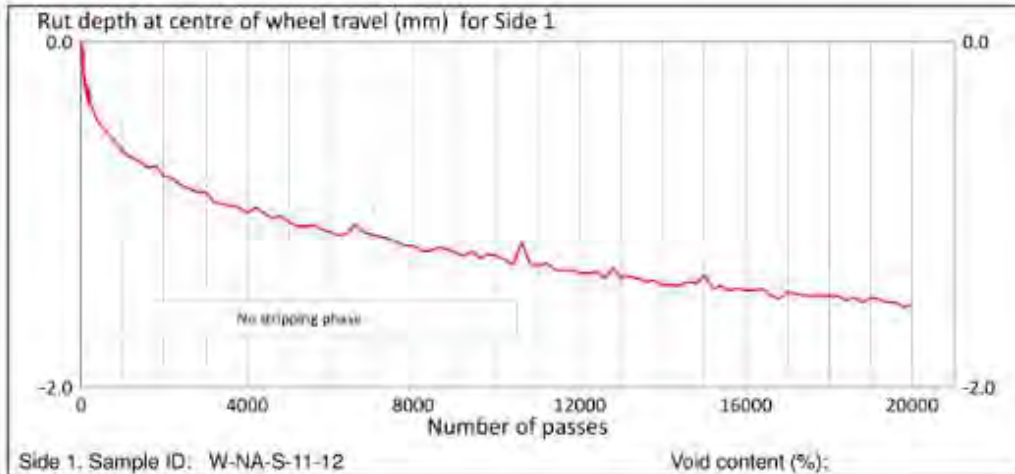
Mix type:
 Asphalt grade:
 HMA Production: Field
 Compaction method: SGC
 Mix source:
 Test temperature (°C): 45.0
 Mix depth (mm): 60.0

Signature

Hamburg Wheel-Tracker Test Results

AASHTO 324 (Modified)
 Date/time of test: 12/16/2014 8:14 AM
 Lab. No.:
 Project name:
 Submitted by:

Date sampled:
 Job No.:
 Project No.: 27-00006
 Project Engineer.:



Rut depths (mm)		
Pass No.	Side 1	Side 2
5000	-1.04	-.74
10000	-1.24	-.9
15000	-1.35	-1.01
20000	-1.52	-1.13

Mix type:
 Asphalt grade:
 HMA Production: Not selected
 Compaction method: Not selected
 Mix source:
 Test temperature (°C): 45.0
 Mix depth (mm): 60.0

Signature

APPENDIX F

GROUND PENETRATING RADAR AND NUCLEAR DENSITY DATA

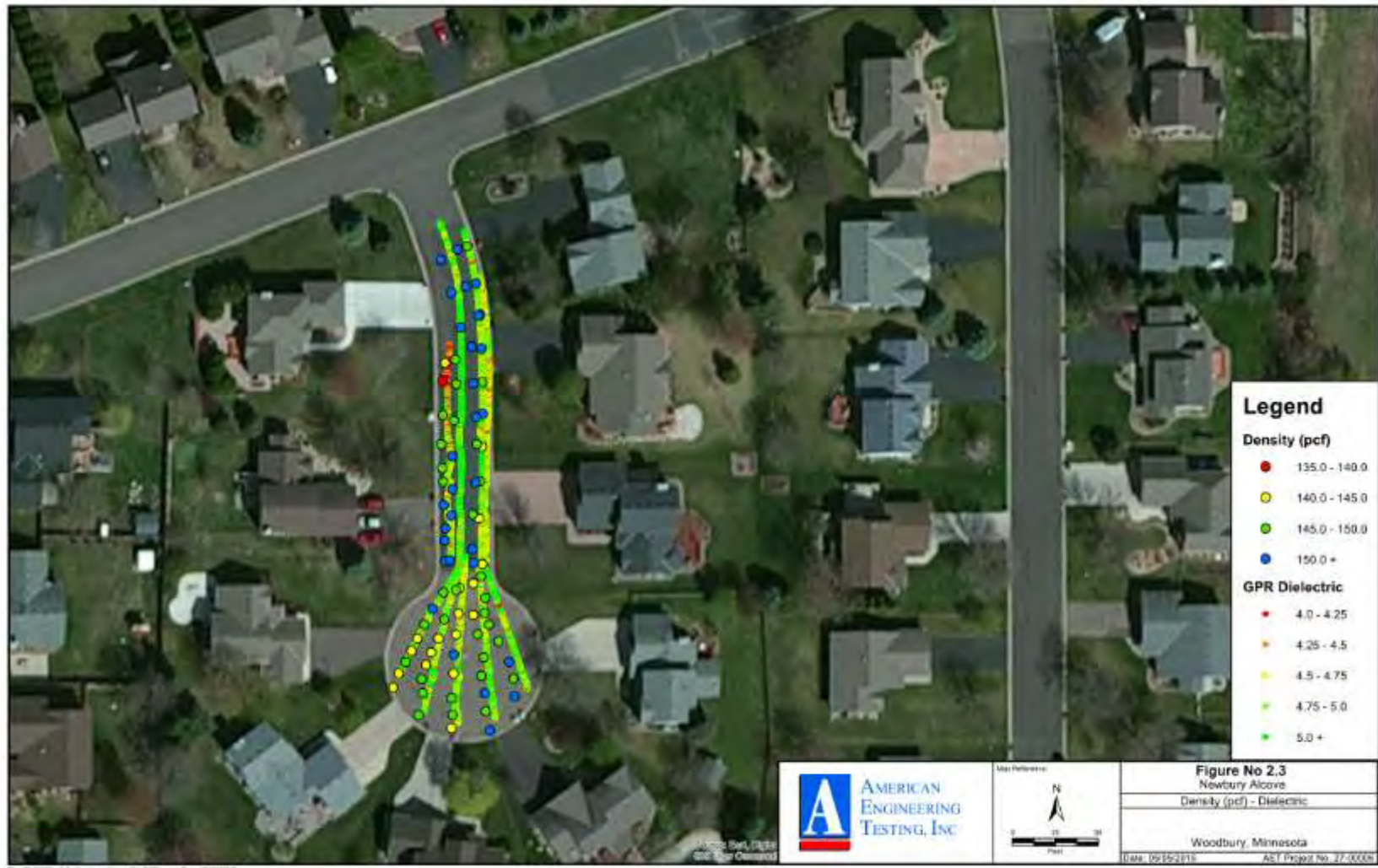


Fig. 2.1-0000 - 2.3 - Newbury Above 01, 02/01 and Date 09/02/01



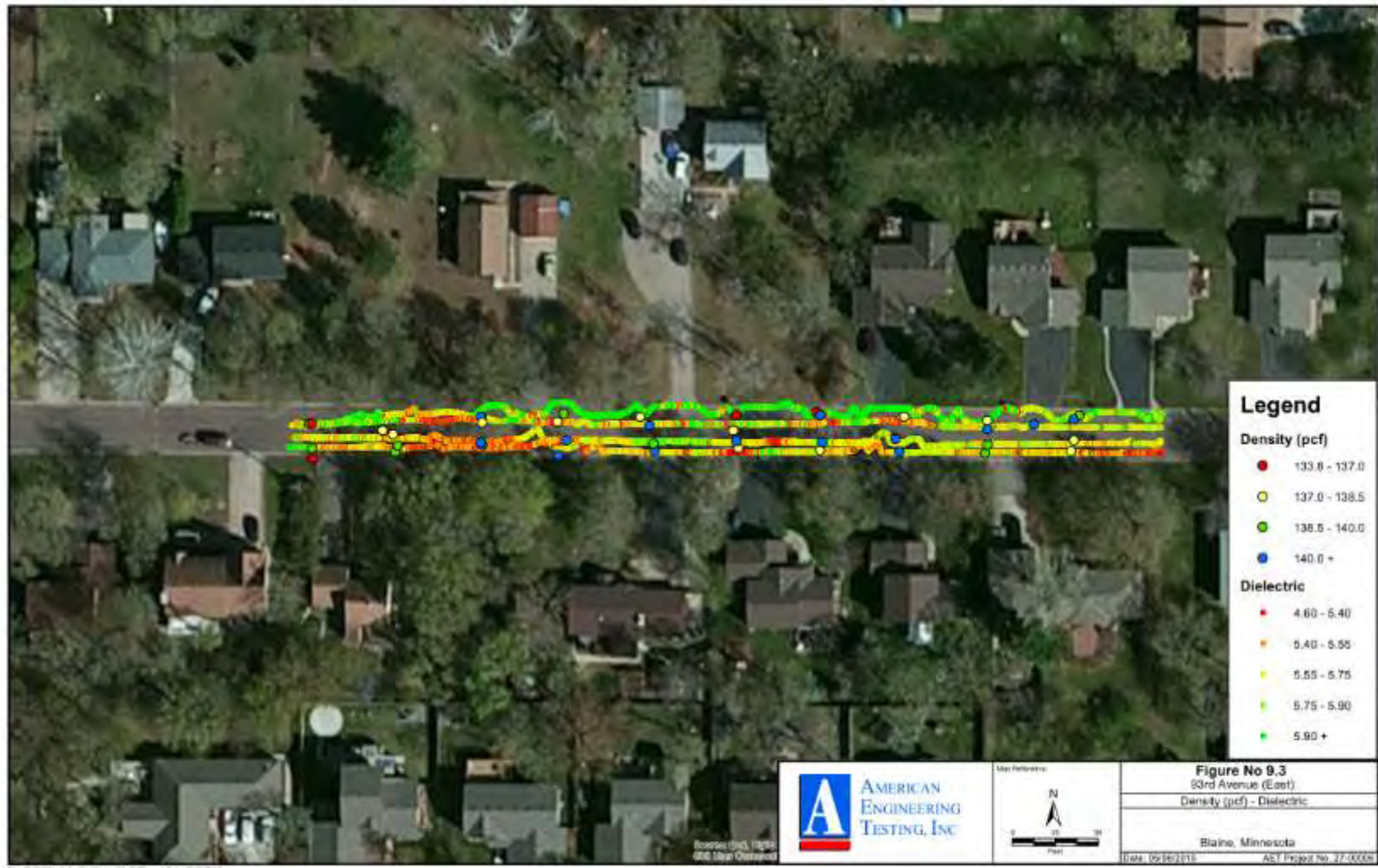


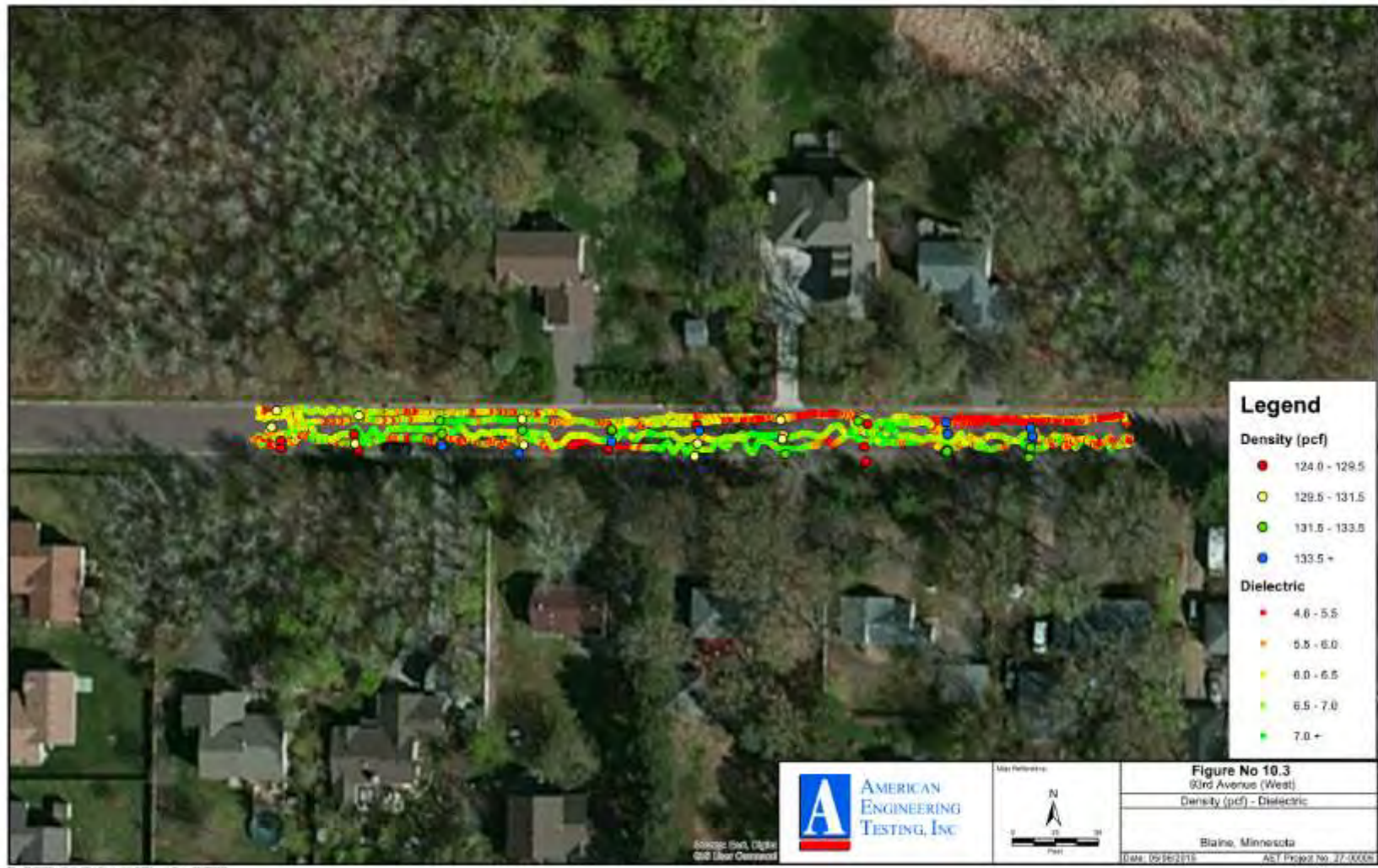




















APPENDIX G

TENSILE STRENGTH RATIO DATA

MODIFIED LOTTMAN

SPEC 2360 MIX TYPE SPWEA330B 7% DATE 5/7/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	2		3		1		4	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3760.7		3759.6		3726.0		3762.5	
SSD WT.	3773.7		3766.3		3743.2		3770.1	
WT. IN H2O	2114.3		2109.1		2100.0		2111.6	
VOLUME	1659.4		1657.2		1643.2		1658.5	
BULK Sp. Gr.	2.266		2.269	2.267	2.268		2.269	2.268
MAX Sp. Gr.	2.438		2.438	2.438	2.438		2.438	2.438
% AIR VOIDS	7.0		6.9	7.0	7.0		6.9	7.0
VOLUME AIR VOIDS	116.87		115.12	115.99				
LOAD, POUNDS					2110		2225	2168

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3837.0		3835.0	
WT. IN H2O	2177.0		2176.9	
VOLUME	1660.0		1658.1	
VOL. OF ABS. H2O	76.3		75.4	
% SATURATION	65.3		65.5	65.4
% SWELL	0.04		0.05	0.0

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.82		149.96				
THICKNESS	95.050		95.030				
SSD WT.	3822.4		3823.3				
WT. IN H2O.	2162.1		2164.5				
VOLUME	1660.3		1658.8				
VOL. OF ABS. H2O	61.7		63.7				
% SATURATION	52.8		55.3				
% SWELL	0.05		0.10	0.08			
LOAD IN POUNDS	1994		1970	1982			
DRY STRENGTH					60.8		64.1 62.5
WET STRENGTH	57.5		56.8	57.1			
TSR	92.1		90.9	91.5			
% VIS. STRIPPING	<10	----->			<10	----->	
% BROKEN AGG.	<10	----->			<10	----->	

Tested By: CW
Date: 5/8/15

Reviewed By: AH
Date: 5/12/15

MODIFIED LOTTMAN

SPEC 2360 MIX TYPE SPWEA340C 7% DATE 5/28/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	1		4		2		3	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3754.7		3753.5		3756.8		3756.9	
SSD WT.	3763.3		3758.9		3764.5		3764.4	
WT. IN H2O	2113.0		2108.7		2114.3		2110.8	
VOLUME	1650.3		1650.2		1650.2		1653.6	
BULK Sp. Gr.	2.275		2.275	2.275	2.277		2.272	2.274
MAX Sp. Gr.	2.451		2.451	2.451	2.451		2.451	2.451
% AIR VOIDS	7.2		7.2	7.2	7.1		7.3	7.2
VOLUME AIR VOIDS	118.39		118.78	118.59				
LOAD, POUNDS					2040		2040	2040

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3828.5		3829.0	
WT. IN H2O	2174.8		2178.2	
VOLUME	1653.7		1650.8	
VOL. OF ABS. H2O	73.8		75.5	
% SATURATION	62.3		63.6	62.9
% SWELL	0.21		0.04	0.1

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.65		150.2			
THICKNESS	94.950		95.020			
SSD WT.	3820.8		3824.1			
WT. IN H2O.	2162.3		2165.6			
VOLUME	1658.5		1658.5			
VOL. OF ABS. H2O	66.1		70.6			
% SATURATION	55.8		59.4			
% SWELL	0.50		0.50	0.50		
LOAD IN POUNDS	1645		1645	1645		
DRY STRENGTH					58.8	58.8 58.8
WET STRENGTH	47.5		47.3	47.4		
TSR	80.9		80.5	80.7		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 5/8/15

Reviewed By: AH
Date: 5/12/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340B 7% DATE

5/7/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	2		3		1		4	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3786.8		3780.7		3746.0		3782.0	
SSD WT.	3794.3		3786.9		3759.3		3790.4	
WT. IN H2O	2141.2		2135.2		2106.1		2144.4	
VOLUME	1653.1		1651.7		1653.2		1646.0	
BULK Sp. Gr.	2.291		2.289	2.290	2.266		2.298	2.282
MAX Sp. Gr.	2.451		2.451	2.451	2.451		2.451	2.451
% AIR VOIDS	6.5		6.6	6.6	7.6		6.3	6.9
VOLUME AIR VOIDS	108.10		109.19	108.64				
LOAD, POUNDS					2295		2133	2214

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3858.1		3851.9	
WT. IN H2O	2204.1		2193.5	
VOLUME	1654.0		1658.4	
VOL. OF ABS. H2O	71.3		71.2	
% SATURATION	66.0		65.2	65.6
% SWELL	0.05		0.41	0.2

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.95		150.09				
THICKNESS	94.920		94.930				
SSD WT.	3788.1		3779.7				
WT. IN H2O.	2192.6		2184.3				
VOLUME	1595.5		1595.4				
VOL. OF ABS. H2O	1.3		-1.0				
% SATURATION	1.2		-0.9				
% SWELL	-3.48		-3.41	-3.45			
LOAD IN POUNDS	1994		1970	1982			
DRY STRENGTH					66.1		61.5 63.8
WET STRENGTH	57.5		56.8	57.2			
TSR	90.2		89.0	89.6			
% VIS. STRIPPING	<10	----->			<10	----->	
% BROKEN AGG.	<10	----->			<10	----->	

Tested By: CW
Date: 5/8/15

Reviewed By: AH
Date: 5/12/15

MODIFIED LOTTMAN

SPEC 2360 MIX TYPE SPWEA340C 11% DATE 5/28/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	1	2	3	4
DIAMETER	150	150	150	150
THICKNESS	95.00	95	95.00	95.00
DRY WT. IN AIR	3564.4	3561.1	3564.5	3561.6
SSD WT.	3586.0	3576.0	3578.5	3576.2
WT. IN H2O	1935.9	1941.2	1934.8	1919.5
VOLUME	1650.1	1634.8	1643.7	1656.7
BULK Sp. Gr.	2.160	2.178	2.169	2.159
MAX Sp. Gr.	2.438	2.438	2.438	2.438
% AIR VOIDS	11.4	10.7	11.1	11.8
VOLUME AIR VOIDS	188.08	174.14	181.11	
LOAD, POUNDS			1367	1413

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3688.0	3675.0
WT. IN H2O	2013.0	2038.6
VOLUME	1675.0	1636.4
VOL. OF ABS. H2O	123.6	113.9
% SATURATION	65.7	65.4
% SWELL	1.51	0.10

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.74	149.58
THICKNESS	94.280	94.720
SSD WT.	3647.6	3644.9
WT. IN H2O.	2005.7	2016.8
VOLUME	1641.9	1628.1
VOL. OF ABS. H2O	83.2	83.8
% SATURATION	44.2	48.1
% SWELL	-0.50	-0.41
LOAD IN POUNDS	1062	1086
DRY STRENGTH		39.4
WET STRENGTH	30.9	31.5
TSR	77.1	78.6
% VIS. STRIPPING	<10	<10
% BROKEN AGG.	<10	<10

Tested By: DK
Date: 6/2/15

Reviewed By: AH
Date: 6/2/15

MODIFIED LOTTMAN

SPEC 2360 MIX TYPE SPWEA340C 7% DATE 5/28/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	1		4		2		3	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3754.7		3753.5		3756.8		3756.9	
SSD WT.	3763.3		3758.9		3764.5		3764.4	
WT. IN H2O	2113.0		2108.7		2114.3		2110.8	
VOLUME	1650.3		1650.2		1650.2		1653.6	
BULK Sp. Gr.	2.275		2.275	2.275	2.277		2.272	2.274
MAX Sp. Gr.	2.451		2.451	2.451	2.451		2.451	2.451
% AIR VOIDS	7.2		7.2	7.2	7.1		7.3	7.2
VOLUME AIR VOIDS	118.39		118.78	118.59				
LOAD, POUNDS					2040		2040	2040

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3828.5		3829.0	
WT. IN H2O	2174.8		2178.2	
VOLUME	1653.7		1650.8	
VOL. OF ABS. H2O	73.8		75.5	
% SATURATION	62.3		63.6	62.9
% SWELL	0.21		0.04	0.1

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.65		150.2			
THICKNESS	94.950		95.020			
SSD WT.	3820.8		3824.1			
WT. IN H2O.	2162.3		2165.6			
VOLUME	1658.5		1658.5			
VOL. OF ABS. H2O	66.1		70.6			
% SATURATION	55.8		59.4			
% SWELL	0.50		0.50	0.50		
LOAD IN POUNDS	1645		1645	1645		
DRY STRENGTH					58.8	58.8
WET STRENGTH	47.5		47.3	47.4		
TSR	80.9		80.5	80.7		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 5/8/15

Reviewed By: AH
Date: 5/12/15

MODIFIED LOTTMAN

SPEC 2360 MIX TYPE SPWEA340B 11% DATE 5/7/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	1		3		2		4	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3587.7		3591.1		3588.7		3592.0	
SSD WT.	3597.0		3602.0		3600.1		3604.3	
WT. IN H2O	1950.9		1958.0		1961.0		1960.2	
VOLUME	1646.1		1644.0		1639.1		1644.1	
BULK Sp. Gr.	2.180		2.184	2.182	2.189		2.185	2.187
MAX Sp. Gr.	2.451		2.451	2.451	2.451		2.451	2.451
% AIR VOIDS	11.1		10.9	11.0	10.7		10.9	10.8
VOLUME AIR VOIDS	182.33		178.84	180.59				
LOAD, POUNDS					2249		2296	2273

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3706.4		3707.5	
WT. IN H2O	2052.2		2051.5	
VOLUME	1654.2		1656.0	
VOL. OF ABS. H2O	118.7		116.4	
% SATURATION	65.1		65.1	65.1
% SWELL	0.49		0.73	0.6

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150.1		149.95			
THICKNESS	94.780		94.500			
SSD WT.	3672.2		3676.8			
WT. IN H2O.	2029.5		2029.2			
VOLUME	1642.7		1647.6			
VOL. OF ABS. H2O	84.5		85.7			
% SATURATION	46.3		47.9			
% SWELL	-0.21		0.22	0.01		
LOAD IN POUNDS	1529		1529	1529		
DRY STRENGTH					64.8	66.2 65.5
WET STRENGTH	44.1		44.3	44.2		
TSR	67.4		67.7	67.5		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 5/8/15

Reviewed By: AH
Date: 5/12/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340C 11% DATE

5/28/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.	150		150		150		150	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3564.4		3561.1		3564.5		3561.6	
SSD WT.	3586.0		3576.0		3578.5		3576.2	
WT. IN H2O	1935.9		1941.2		1934.8		1919.5	
VOLUME	1650.1		1634.8		1643.7		1656.7	
BULK Sp. Gr.	2.160		2.178	2.169	2.169		2.150	2.159
MAX Sp. Gr.	2.438		2.438	2.438	2.438		2.438	2.438
% AIR VOIDS	11.4		10.7	11.0	11.1		11.8	11.4
VOLUME AIR VOIDS	188.08		174.14	181.11				
LOAD, POUNDS					1367		1413	1390

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3688.0		3675.0	
WT. IN H2O	2013.0		2038.6	
VOLUME	1675.0		1636.4	
VOL. OF ABS. H2O	123.6		113.9	
% SATURATION	65.7		65.4	65.6
% SWELL	1.51		0.10	0.8

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.74		149.58			
THICKNESS	94.280		94.720			
SSD WT.	3647.6		3644.9			
WT. IN H2O.	2005.7		2016.8			
VOLUME	1641.9		1628.1			
VOL. OF ABS. H2O	83.2		83.8			
% SATURATION	44.2		48.1			
% SWELL	-0.50		-0.41	-0.45		
LOAD IN POUNDS	1062		1086	1074		
DRY STRENGTH					39.4	40.7
WET STRENGTH	30.9		31.5	31.2		40.1
TSR	77.1		78.6	77.9		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: DK
Date: 6/2/15

Reviewed By: AH
Date: 6/2/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340B 11% DATE

5/7/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.								
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3569.3		3576.9		3566.3		3570.7	
SSD WT.	3579.8		3586.9		3578.1		3582.2	
WT. IN H2O	1930.5		1939.7		1924.6		1934.4	
VOLUME	1649.3		1647.2		1653.5		1647.8	
BULK Sp. Gr.	2.164		2.172	2.168	2.157		2.167	2.162
MAX Sp. Gr.	2.438		2.438	2.438	2.438		2.438	2.438
% AIR VOIDS	11.2		10.9	11.1	11.5		11.1	11.3
VOLUME AIR VOIDS	185.27		180.05	182.66				
LOAD, POUNDS					1947		1924	1936

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3691.0		3695.0	
WT. IN H2O	2037.0		2041.1	
VOLUME	1654.0		1653.9	
VOL. OF ABS. H2O	121.7		118.1	
% SATURATION	65.7		65.6	65.6
% SWELL	0.28		0.41	0.3

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.85		149.91			
THICKNESS	94.900		94.800			
SSD WT.	3664.9		3658.5			
WT. IN H2O.	2010.6		2018.2			
VOLUME	1654.3		1640.3			
VOL. OF ABS. H2O	95.6		81.6			
% SATURATION	51.6		45.3			
% SWELL	0.30		-0.42	-0.06		
LOAD IN POUNDS	1250		1297	1274		
DRY STRENGTH					56.1	55.5 55.8
WET STRENGTH	36.1		37.5	36.8		
TSR	64.7		67.2	66.0		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 5/8/15

Reviewed By: AH
Date: 5/12/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340C PM 11 DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	1		2		3		4	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3596.5		3583.9		3584.4		3584.5	
SSD WT.	3609.0		3592.9		3607.3		3607.3	
WT. IN H2O	1965.5		1945.0		1962.4		1960.2	
VOLUME	1643.5		1647.9		1644.9		1647.1	
BULK Sp. Gr.	2.188		2.175	2.182	2.179		2.176	2.178
MAX Sp. Gr.	2.456		2.456	2.456	2.456		2.456	2.456
% AIR VOIDS	10.9		11.4	11.2	11.3		11.4	11.3
VOLUME AIR VOIDS	179.13		188.66	183.89				
LOAD, POUNDS					2272.3		2434	2353

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3719.6		3707.1	
WT. IN H2O	2078.6		2048.5	
VOLUME	1641.0		1658.6	
VOL. OF ABS. H2O	123.1		123.2	
% SATURATION	68.7		65.3	67.0
% SWELL	-0.15		0.65	0.2

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150.01		150.04				
THICKNESS	94.380		94.780				
SSD WT.	3709.0		3696.6				
WT. IN H2O.	2058.1		2041.1				
VOLUME	1650.9		1655.5				
VOL. OF ABS. H2O	112.5		112.7				
% SATURATION	62.8		59.7				
% SWELL	0.45		0.46	0.46			
LOAD IN POUNDS	1529		1413	1471			
DRY STRENGTH					65.5	70.2	67.8
WET STRENGTH	44.4		40.8	42.6			
TSR	65.4		60.2	62.8			
% VIS. STRIPPING	<10				<10		
% BROKEN AGG.	<10				<10		

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340C PM 7% DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.								
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3755.8		3755.1		3756.8		3755.9	
SSD WT.	3763.2		3764.8		3766.7		3764.2	
WT. IN H2O	2114.7		2113.6		2116.6		2116.7	
VOLUME	1648.5		1651.2		1650.1		1647.5	
BULK Sp. Gr.	2.278		2.274	2.276	2.277		2.280	2.278
MAX Sp. Gr.	2.456		2.456	2.456	2.456		2.456	2.456
% AIR VOIDS	7.2		7.4	7.3	7.3		7.2	7.2
VOLUME AIR VOIDS	119.27		122.25	120.76				
LOAD, POUNDS					3239		3216	3228

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3834.7		3836.7	
WT. IN H2O	2185.3		2184.5	
VOLUME	1649.4		1652.2	
VOL. OF ABS. H2O	78.9		81.6	
% SATURATION	66.2		66.7	66.5
% SWELL	0.05		0.06	0.1

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150		150			
THICKNESS	94.680		94.680			
SSD WT.	3826.6		3824.2			
WT. IN H2O.	2164.3		2161.7			
VOLUME	1662.3		1662.5			
VOL. OF ABS. H2O	70.8		69.1			
% SATURATION	59.4		56.5			
% SWELL	0.84		0.68	0.76		
LOAD IN POUNDS	2411		2434	2423		
DRY STRENGTH					93.4	92.7 93.0
WET STRENGTH	69.7		70.4	70.1		
TSR	75.0		75.7	75.3		
% VIS. STRIPPING	<10				<10	
% BROKEN AGG.	<10				<10	

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340B 7% DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.								
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3754.6		3751.8		3754.5		3755.9	
SSD WT.	3763.0		3758.6		3762.7		3764.2	
WT. IN H2O	2113.3		2115.0		2112.5		2116.7	
VOLUME	1649.7		1643.6		1650.2		1647.5	
BULK Sp. Gr.	2.276		2.283	2.279	2.275		2.280	2.277
MAX Sp. Gr.	2.456		2.456	2.456	2.456		2.456	2.456
% AIR VOIDS	7.3		7.1	7.2	7.4		7.2	7.3
VOLUME AIR VOIDS	120.95		115.99	118.47				
LOAD, POUNDS					2710		2733	2722

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3833.7		3827.9	
WT. IN H2O	2177.6		2183.1	
VOLUME	1656.1		1644.8	
VOL. OF ABS. H2O	79.1		76.1	
% SATURATION	65.4		65.6	65.5
% SWELL	0.39		0.07	0.2

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.99		150.01				
THICKNESS	95.020		94.150				
SSD WT.	3829.1		3825.9				
WT. IN H2O.	2169.5		2175.7				
VOLUME	1659.6		1650.2				
VOL. OF ABS. H2O	74.5		74.1				
% SATURATION	61.6		63.9				
% SWELL	0.60		0.40	0.50			
LOAD IN POUNDS	2179		2272	2226			
DRY STRENGTH					78.1		78.8 78.4
WET STRENGTH	62.8		66.1	64.4			
TSR	80.1		84.2	82.1			
% VIS. STRIPPING	<10	----->			<10	----->	
% BROKEN AGG.	<10	----->			<10	----->	

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA340B 11% DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.	150		150		150		150	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3586.8		3589.9		3591.9		3591.8	
SSD WT.	3609.0		3593.5		3607.3		3606.2	
WT. IN H2O	1962.5		1947.1		1964.0		1960.2	
VOLUME	1646.5		1646.4		1643.3		1646.0	
BULK Sp. Gr.	2.178		2.180	2.179	2.186		2.182	2.184
MAX Sp. Gr.	2.456		2.456	2.456	2.456		2.456	2.456
% AIR VOIDS	11.3		11.2	11.3	11.0		11.2	11.1
VOLUME AIR VOIDS	186.08		184.71	185.40				
LOAD, POUNDS					1900.7		1923.9	1912

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3712.6		3715.1	
WT. IN H2O	2068.4		2071.0	
VOLUME	1644.2		1644.1	
VOL. OF ABS. H2O	125.8		125.2	
% SATURATION	67.6		67.8	67.7
% SWELL	-0.14		-0.14	-0.1

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.83		150.03			
THICKNESS	94.370		94.600			
SSD WT.	3707.0		3700.1			
WT. IN H2O.	2060.7		2055.5			
VOLUME	1646.3		1644.6			
VOL. OF ABS. H2O	120.2		110.2			
% SATURATION	64.6		59.7			
% SWELL	-0.01		-0.11	-0.06		
LOAD IN POUNDS	1343		1390	1367		
DRY STRENGTH					54.8	55.5 55.1
WET STRENGTH	39.0		40.2	39.6		
TSR	70.8		73.0	71.9		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360 MIX TYPE SPWEA340B 7% DATE 4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.	150		150		150		150	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3754.6		3751.8		3754.5		3755.9	
SSD WT.	3763.0		3758.6		3762.7		3764.2	
WT. IN H2O	2113.3		2115.0		2112.5		2116.7	
VOLUME	1649.7		1643.6		1650.2		1647.5	
BULK Sp. Gr.	2.276		2.283	2.279	2.275		2.280	2.277
MAX Sp. Gr.	2.456		2.456	2.456	2.456		2.456	2.456
% AIR VOIDS	7.3		7.1	7.2	7.4		7.2	7.3
VOLUME AIR VOIDS	120.95		115.99	118.47				
LOAD, POUNDS					2710		2733	2722

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3833.7		3827.9	
WT. IN H2O	2177.6		2183.1	
VOLUME	1656.1		1644.8	
VOL. OF ABS. H2O	79.1		76.1	
% SATURATION	65.4		65.6	65.5
% SWELL	0.39		0.07	0.2

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	149.99		150.01			
THICKNESS	95.020		94.150			
SSD WT.	3829.1		3825.9			
WT. IN H2O.	2169.5		2175.7			
VOLUME	1659.6		1650.2			
VOL. OF ABS. H2O	74.5		74.1			
% SATURATION	61.6		63.9			
% SWELL	0.60		0.40	0.50		
LOAD IN POUNDS	2179		2272	2226		
DRY STRENGTH					78.1	78.8 78.4
WET STRENGTH	62.8		66.1	64.4		
TSR	80.1		84.2	82.1		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA330C PM 7% DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	3		4		1		2	
SAMPLE I.D.	150		150		150		150	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3732.7		3730.5		3702.0		3711.2	
SSD WT.	3742.6		3742.0		3714.0		3720.1	
WT. IN H2O	2096.5		2089.7		2067.0		2081.7	
VOLUME	1646.1		1652.3		1647.0		1638.4	
BULK Sp. Gr.	2.268		2.258	2.263	2.248		2.265	2.256
MAX Sp. Gr.	2.439		2.439	2.439	2.439		2.439	2.439
% AIR VOIDS	7.0		7.4	7.2	7.8		7.1	7.5
VOLUME AIR VOIDS	115.68		122.78	119.23				
LOAD, POUNDS					2917		2917	2917

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3811.1		3813.8	
WT. IN H2O	2166.1		2163.6	
VOLUME	1645.0		1650.2	
VOL. OF ABS. H2O	78.4		83.3	
% SATURATION	67.8		67.8	67.8
% SWELL	-0.07		-0.13	-0.1

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150.35		150.48			
THICKNESS	94.600		94.760			
SSD WT.	3816.5		3819.1			
WT. IN H2O.	2165.4		2164.0			
VOLUME	1651.1		1655.1			
VOL. OF ABS. H2O	83.8		88.6			
% SATURATION	72.4		72.2			
% SWELL	0.30		0.17	0.24		
LOAD IN POUNDS	2318.7		2202.6	2261		
DRY STRENGTH					84.1	84.1
WET STRENGTH	67.0		63.4	65.2		
TSR	79.6		75.5	77.5		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA330C PM 11 DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

SAMPLE I.D.	1		2		3		4	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3592.6		3596.4		3587.0		3586.9	
SSD WT.	3604.6		3608.9		3607.3		3597.3	
WT. IN H2O	1952.2		1957.5		1962.4		1956.2	
VOLUME	1652.4		1651.4		1644.9		1641.1	
BULK Sp. Gr.	2.174		2.178	2.176	2.181		2.186	2.183
MAX Sp. Gr.	2.439		2.439	2.439	2.439		2.439	2.439
% AIR VOIDS	10.9		10.7	10.8	10.6		10.4	10.5
VOLUME AIR VOIDS	179.42		176.86	178.14				
LOAD, POUNDS					2480		2457	2469

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3710.5		3711.4	
WT. IN H2O	2065.1		2075.9	
VOLUME	1645.4		1635.5	
VOL. OF ABS. H2O	117.9		115.0	
% SATURATION	65.7		65.0	65.4
% SWELL	-0.42		-0.96	-0.7

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150.15		150.08				
THICKNESS	94.840		94.440				
SSD WT.	3727.2		3722.4				
WT. IN H2O.	2069.1		2085.3				
VOLUME	1658.1		1637.1				
VOL. OF ABS. H2O	134.6		126.0				
% SATURATION	75.0		71.2				
% SWELL	0.34		-0.87	-0.26			
LOAD IN POUNDS	1622		1622	1622			
DRY STRENGTH					71.5	70.8	71.1
WET STRENGTH	46.8		47.0	46.9			
TSR	65.8		66.1	65.9			
% VIS. STRIPPING	<10				<10		
% BROKEN AGG.	<10				<10		

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA330B 7% DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.	150		150		150		150	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3729.4		3731.9		3723.9		3729.4	
SSD WT.	3739.3		3740.6		3736.6		3748.2	
WT. IN H2O	2087.4		2088.3		2082.1		2091.1	
VOLUME	1651.9		1652.3		1654.5		1657.1	
BULK Sp. Gr.	2.258		2.259	2.258	2.251		2.251	2.251
MAX Sp. Gr.	2.439		2.439	2.439	2.439		2.439	2.439
% AIR VOIDS	7.4		7.4	7.4	7.7		7.7	7.7
VOLUME AIR VOIDS	122.83		122.21	122.52				
LOAD, POUNDS					2411		2457	2434

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3809.2		3812.0	
WT. IN H2O	2159.1		2166.3	
VOLUME	1650.1		1645.7	
VOL. OF ABS. H2O	79.8		80.1	
% SATURATION	65.0		65.5	65.3
% SWELL	-0.11		-0.40	-0.3

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150.47		149.94			
THICKNESS	95.160		94.900			
SSD WT.	3822.2		3826.5			
WT. IN H2O.	2170.0		2175.9			
VOLUME	1652.2		1650.6			
VOL. OF ABS. H2O	92.8		94.6			
% SATURATION	75.6		77.4			
% SWELL	0.02		-0.10	-0.04		
LOAD IN POUNDS	2318.7		2434	2376		
DRY STRENGTH					69.5	70.8 70.2
WET STRENGTH	66.5		70.3	68.4		
TSR	94.8		100.1	97.5		
% VIS. STRIPPING	<10				<10	
% BROKEN AGG.	<10				<10	

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

MODIFIED LOTTMAN

SPEC 2360

MIX TYPE SPWEA330B 11% DATE

4/27/2015

TREATED SPECIMENS

UNTREATED SPECIMENS

	1		2		3		4	
SAMPLE I.D.	150		150		150		150	
DIAMETER	150		150		150		150	
THICKNESS	95.00		95		95.00		95.00	
DRY WT. IN AIR	3588.5		3588.3		3587.0		3586.9	
SSD WT.	3599.6		3608.9		3607.3		3597.3	
WT. IN H2O	1952.2		1948.5		1962.4		1956.2	
VOLUME	1647.4		1660.4		1644.9		1641.1	
BULK Sp. Gr.	2.178		2.161	2.170	2.181		2.186	2.183
MAX Sp. Gr.	2.439		2.439	2.439	2.439		2.439	2.439
% AIR VOIDS	10.7		11.4	11.0	10.6		10.4	10.5
VOLUME AIR VOIDS	176.10		189.18	182.64				
LOAD, POUNDS					1761.4		1993.6	1878

SATURATED FOR MIN. @ mm.Hg

SSD WT.	3705.4		3717.3	
WT. IN H2O	2068.4		2061.9	
VOLUME	1637.0		1655.4	
VOL. OF ABS. H2O	116.9		129.0	
% SATURATION	66.4		68.2	67.3
% SWELL	-0.63		-0.30	-0.5

BLOWS na

CONDITIONED 24 HOURS IN 140 DEGREE F. WATER

DIAMETER	150.55		150.85			
THICKNESS	94.350		94.180			
SSD WT.	3724.7		3740.1			
WT. IN H2O.	2083.1		2080.6			
VOLUME	1641.6		1659.5			
VOL. OF ABS. H2O	136.2		151.8			
% SATURATION	77.3		80.2			
% SWELL	-0.35		-0.05	-0.20		
LOAD IN POUNDS	1622		1459.5	1541		
DRY STRENGTH					50.8	57.5
WET STRENGTH	46.9		42.2	44.5		54.1
TSR	86.7		78.0	82.3		
% VIS. STRIPPING	<10	----->			<10	----->
% BROKEN AGG.	<10	----->			<10	----->

Tested By: CW
Date: 4/27/15

Reviewed By: AH
Date: 4/27/15

APPENDIX H

FIELD SITE SECTION PLANS AND INFORMATION

CONSTRUCTION PLANS FOR: IMPROVEMENT PROJECT 94-06 SOUTH CENTRAL AREA IMPROVEMENTS

CONSTRUCTION OF: AGGREGATE BASE, BITUMINOUS SURFACING, TRUNK SANITARY SEWER,
TRUNK WATERMAIN, STORM SEWER AND CURB & GUTTER.



LOCATION MAP

CONTRACTOR: **Bentley Construction**
Elk River, MN
SUBCONTRACTORS: **STURMUS & ASSOCIATES - PAVEMENT AND CURB & GUTTER - MINNEAPOLIS, MN**
ENGINEERING: **CITY OF BLAINE**
SURVEYING: **E. G. RUD & SONS INC. - CIRCLE DOUGLAS, MN**
CONSTRUCTION: **APR. 1994 - NOV. 1994**
AS-BUILT: **E. G. RUD & SONS INC. - P.O. BOX 100 - CITY OF BLAINE - NOV. 1994**



ENGINEERING DEPARTMENT
9150 Central Ave., N.E. Blaine, Minnesota 55434
Phone (612) 784-6700

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

John W. Kelly
Date: 7 July 99 Minnesota Registration No. 20672

INDEX TO PLANS

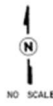
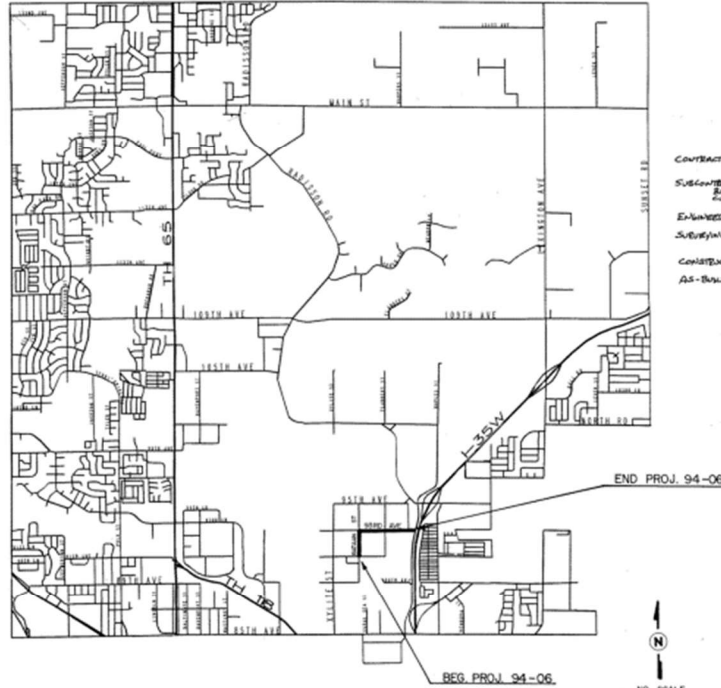
SHEET	DRAWING NO.
TITLE SHEET	1
TYPICAL SECTION, SIGNING & NOTES	2
DETAILS	3-7
SANITARY SEWER & WATERMAIN	8-10
STREET & STORM SEWER	11-13
X-SECTIONS	14-21

EXISTING

LEGEND	DESCRIPTION
	STORM SEWER & MANHOLE
	SANITARY SEWER & MANHOLE
	WATERMAIN, HYDRANT VALVE & MANHOLE
	CULVERT
	CATCH BASIN
	BULKHEAD
	UNDERGROUND TELEPHONE CABLE OR CONDUIT
	TELEPHONE MANHOLE
	UNDERGROUND ELECTRIC CABLE OR CONDUIT
	ELECTRIC MANHOLE
	GAS MAIN & VALVE
	STREET LIGHT
	MAILBOX
	SIGN (HWY, PARK, STOP, ETC.)
	STREET SIGN
	POWER POLE W/GUY WIRE
	TREE (DECIDUOUS)
	TREE (CONIFEROUS)
	BUSH-SHRUB
	HEDGE
	WOODED AREA
	FENCE
	GUARD RAIL
	DITCH
	TRAFFIC SIGNAL
	MANHOLE
	CONCRETE CURB & GUTTER
	BITUMINOUS CURB
	CONCRETE PAVEMENT
	BUILDING
	SECTION LINE
	QUARTER LINE
	SIXTEENTH LINE
	RIGHT OF WAY LINE

PROPOSED

	SLOPE EASEMENT
	CONSTRUCTION CENTERLINE
	RIGHT OF WAY
	STORM SEWER & MANHOLE
	SANITARY SEWER & MANHOLE
	WATERMAIN, HYDRANT VALVE & MANHOLE
	CULVERT
	CATCH BASIN
	BULKHEAD
	CONCRETE CURB & GUTTER



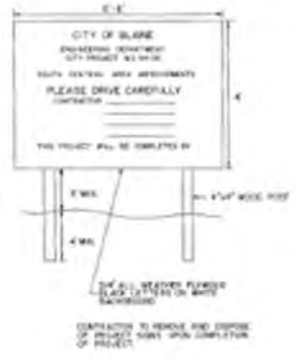
PLAN SET NO.

- SIGNING**
- ◆ STOP SIGN (S1)
 - ▼ FIELD SIGN (S2)
 - + STREET SIGN (S3)
 - ◆ PROJECT SIGN (S4)

NOTE: LOCATION OF SIGN WILL BE DETERMINED IN THE FIELD BY ENGINEER



SIGNING



PROJECT SIGN

STREET & SIDEWALK

ALL WORK SHALL BE CONFINED TO WITHIN THE R/W
 CONTRACTOR SHALL CLEAR & BRUSH OUT TO THE R/W UNLESS OTHERWISE DIRECTED BY THE ENGINEER
 SIGNING PREVIOUSLY INSTALLED, DAMAGED, MISSING, AND PLAIN SIGNAGE SHALL BE IN ACCORDANCE WITH THE JOB. IMMEDIATE REMOVAL OF UNIFORM TRAFFIC CONTROL DEVICES INCLUDING SIGNAGE & LIGHTS IS REQUIRED
 ALL ROAD APPROACHES SHALL BE CONFINED TO A WIDTH OF 2' FEET TO EACH SIDE OF CURB AND FINISH TO EXISTING GRADE UNLESS OTHERWISE NOTED
 AT ROAD APPROACHES, CONTRACTOR SHALL END SIDEWALK AT END OF PAVED. CLASS 5 SHALL BE PLACED WHEN WATERSHED INTO EXISTING DRIVEWAY
 CONTRACTOR SHALL INSTALL A 2" TAPER AT EACH OF CURB AND BUTTER
 CONTRACTOR SHALL SEE ALL DISTURBED AREAS ADJACENT TO EXISTING DRIVEWAYS AND DRIVE REMAINING AREAS LOCATIONS WILL BE DETERMINED IN FIELD. SIGN PRICES SHALL INCLUDE PLACING 4" TOPSOIL
 CONTRACTOR SHALL REMOVE ALL EXISTING DRIVE AND STREET MARKINGS. SIGNAGE SHALL BE DELIVERED TO BLAINE'S PUBLIC WORKS
 DRIVEWAYS WILL BE PAVED TO R/W LINE WITH 2" TYPE 4A WEAR AND 4" CLASS 5 SUBGRADE UNLESS SHOWN OTHERWISE
 CONTRACTOR SHALL VERIFY SLOPE OF CURB AT ALL DRIVEWAYS
 CONTRACTOR LISTS ARE DEFINED AS EXISTING R/W UNLESS SHOWN OTHERWISE
 CONCRETE DRIVEWAYS SHALL BE PLACED 6" IN DEPTH
 CLASS 5 FOR DRIVEWAYS & SIDEWALKS

GENERAL CONSTRUCTION NOTES

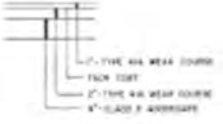
SANITARY, WATERMAIN & STORM SEWER

NOO EXTENSIONS OR ADJUSTMENTS NEED TO BE PLACED FORWARD AND SETS VALVE AT FINISHED GRADE IS NECESSARY
 ALL SANITARY AND WATERMAIN SERVICES SHALL END 5 FEET FROM R/W AND BE FULLY VENTED AS TO PREVIOUS SHEETS
 FLUSH FOR STORM SEWER ARE NECESSARY



NOTE: PLACE 2" OR 4" TOPSOIL C & S
 PLACE 2" OR 4" TOPSOIL WHERE NO 2" OR 4" IS SHOWN PLACED

NOTE: EXISTING SLOPE TO A 1% SLOPE
 FULL EXCAVATED AREA WITH GRANULAR MATERIAL



TYPICAL SECTION

EARTHWORK SUMMARY

- WEEK EXCAVATION - 1743 CY (EST)
- COMMON EXCAVATION - 1043 CY (EST)
- GRANULAR EMPAVEMENT - 2774 CY (EST)
- NOTE: USE SHORTRATE FACTOR OF 10% FOR NORMAL GRADES EX. TO 2"

ENGINEERING DEPARTMENT
 9150 Central Ave. NE, Blaine, Minnesota 55434
 Phone (612) 784-6700

DATE: _____
 REVISION: _____
 PROJECT NO: 04-06
 DESIGN BY: S. JENSEN
 CHECKED BY: S. JENSEN
 APPROVED BY: _____
 DATE: _____

SOUTH CENTRAL AREA IMPROVEMENTS
 TYPICAL SECTION, SIGNING & NOTES
 SHEET NO. 2 OF 2 SHEETS

**CONSTRUCTION PLANS FOR: IMPROVEMENT PROJECTS 94-06 A,B & D
SOUTH CENTRAL AREA IMPROVEMENTS**

**CONSTRUCTION OF: AGGREGATE BASE, BITUMINOUS SURFACING, CONCRETE CURB AND GUTTER,
SANITARY SEWER, WATERMAIN AND STORM SEWER**



LOCATION MAP

EXISTING	LEGEND
	STORM SEWER & MANHOLE
	SANITARY SEWER & MANHOLE
	WATERMAIN, HYDRANT VALVE & MANHOLE
	CATCH BASIN
	BULKHEAD
	UNDERGROUND TELEPHONE CABLE OR CONDUIT
	TELEPHONE MANHOLE
	UNDERGROUND ELECTRIC CABLE OR CONDUIT
	ELECTRIC MANHOLE
	GAS MAIN & VALVE
	STREET LIGHT
	WALLER
	SAW TOOTH PIPE, DEEP HOLE
	STREET SIGN
	FENCE POLE, UTILITY WIRE, TREE, UNDERGROUND
	TREE, UNDERGROUND
	BUSH, MANHOLE
	FENCE
	WOODED AREA
	GUARD RAIL
	DITCH
	TRAFFIC SIGNAL MANHOLE
	CONCRETE CURB & GUTTER
	BITUMINOUS CURB
	CONCRETE PAVEMENT
	BUILDING
	SECTION LINE
	QUARTER LINE
	SIDEWALK LINE
	RIGHT OF WAY LINE
	OVERHEAD ELECTRIC



PROPOSED	LEGEND
	SLOPE EASEMENT
	CONSTRUCTION CENTERLINE
	RIGHT OF WAY
	STORM SEWER & MANHOLE
	SANITARY SEWER & MANHOLE
	WATERMAIN, HYDRANT VALVE & MANHOLE
	CATCH BASIN
	BULKHEAD
	CONCRETE CURB & GUTTER
	SILT FENCE

Contracted: General Construction
Blaine, MN
Subcontractor: Blaine Construction Co., Inc.
Blaine, MN
Engineer: J.P. of Blaine
Blaine, MN
Contractor: J.P. of Blaine
Blaine, MN



ENGINEERING DEPARTMENT
9150 Central Ave., N.E. Blaine, Minnesota 55434
Phone (612) 754-6700

John M. Kelly
Professional Engineer No. 20373

INDEX TO PLANS

SHEET	DRAWING NO.
TITLE SHEET	1
TYPICAL SECTION, SIGNING, NOTES AND TEMPORARY MAILBOXES	2
DETAILS	3-7
SANITARY SEWER AND WATERMAIN	8-10
STREET AND STORM SEWER	11-13
DITCH CLEANING	14
X- SECTIONS	15-21



PLAN SET NO.



GENERAL CONSTRUCTION NOTES

STREET & SIGNING

ALL WORK SHALL BE CONFINED TO WITHIN THE R/W. CONTRACTOR SHALL CLEAR & GRUB OUT TO THE R/W UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

SIGNING, PAINTING, MARKING, TRAFFIC CONTROL DEVICES, AND FLAG PERSON SHALL BE IN ACCORDANCE WITH THE 2009 MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES INCLUDING APPENDIX B, (2012) SUPPLEMENT 2012.

EXISTING SIGNING SHALL REMAIN IN PLACE UNTIL NEW SIGNING IS INSTALLED.

THE CONTRACTOR SHALL PROVIDE AND MAINTAIN A TRAFFIC CONTROL PLAN AND HAVE ALL CONTROL DEVICES INSTALLED PRIOR TO THE BEGINNING OF ANY WORK.

CONTRACTOR SHALL INSTALL A 2" TUBE AT ENDS OF CURB AND 4" SIGN.

CONTRACTOR SHALL USE ALL DEFINED AREAS ADJACENT TO EXISTING HOUSES AND BEED REMAINING AREAS LOCATIONS WILL BE DETERMINED IN FIELD.

CONTRACTOR SHALL REMOVE ALL EXISTING SIGNS AND STREET MARKINGS. SIGNS SHALL BE DELIVERED TO BLAINE PUBLIC WORKS.

DRIVEWAYS WILL BE PAVED TO 6" R/W LINE WITH 2" FINE #4 BASE AND 4" CLASS 2 ASPHALT. 6" THICKNESS SPREAD OUT SHALL BE INCIDENTS.

CONTRACTOR SHALL SPREAD BACK OF CURB AT ALL DRIVEWAYS.

CONTRACTOR LAMPS ARE DEFINED AS EXISTING R/W UNLESS SHOWN OTHERWISE.

CLASS 3 FOR DRIVEWAYS - 100 TONS

TEMPORARY MARKINGS SHALL BE INSTALLED PRIOR TO RECONSTRUCTION AND THEY SHALL MEET ALL U.S. POSTAL SERVICE REQUIREMENTS.

SANITARY, WASTEWATER & STORM SEWERS

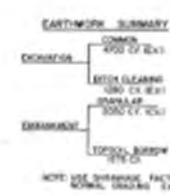
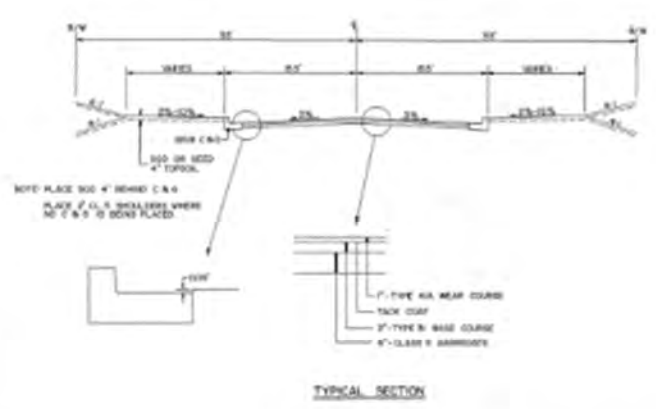
ANY EXTENSIONS OR ADJUSTMENTS NEEDING TO PLACE WASTEWATER AND SANITARY SHALL BE FINISHED BEFORE IS ACCIDENTAL.

ALL SANITARY AND WASTEWATER SERVICES SHALL END AT FRONT YARD. SANITARY AND WASTEWATER SHALL BE TO PREVENTIVE TRENCHES.

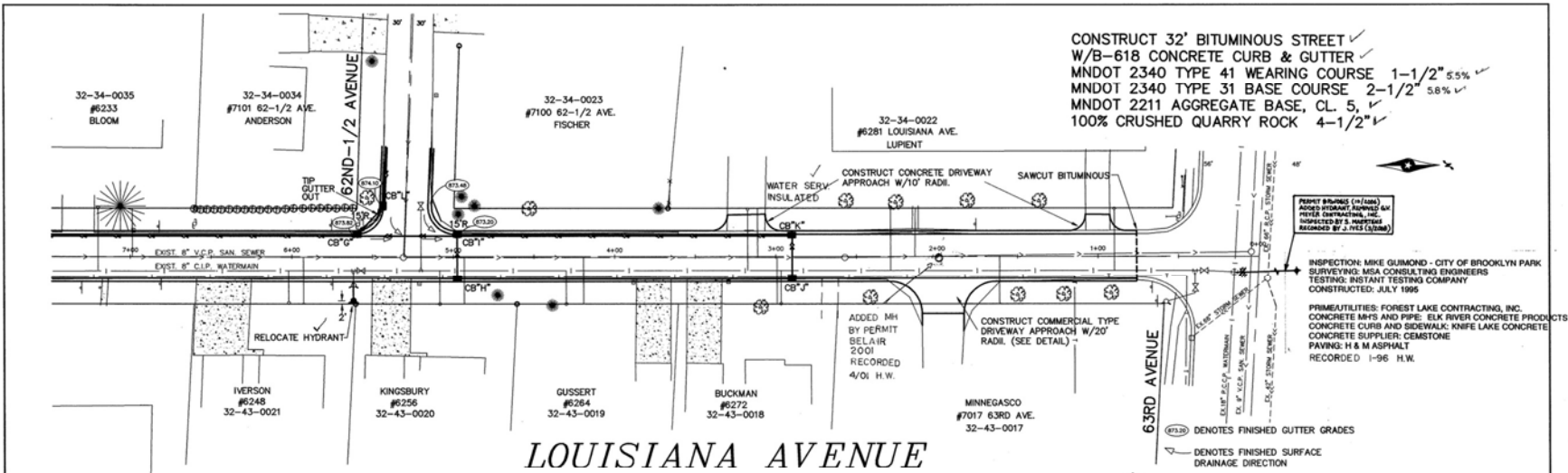
PLACES FOR STORM SEWERS ARE INDICATED.

STORM SEWERS LOCATING 1/4" DOWN TO NOT INCLUDE WHICH LOCATING APPROX AND SEPARATELY.

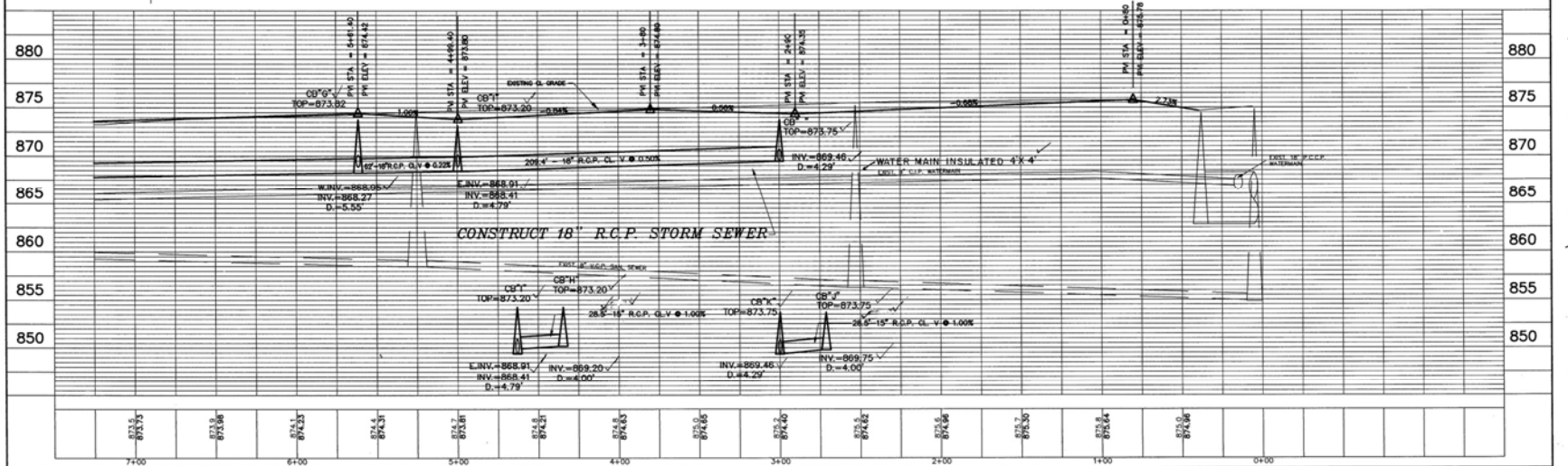
NOTE: EXACT SIGN LOCATIONS SHALL BE DETERMINED IN THE FIELD BY THE CONTRACTOR.



<p>ENGINEERING DEPARTMENT 9150 Central Ave., N.E. Blaine, Minnesota 55414 Phone (612) 784-6700</p>	<p>DATE: _____</p> <p>REVISION: _____</p>	PROJECT NO. 94-04	<p>SOUTH CENTRAL AREA IMPROVEMENTS TYPICAL SECTION, SIGNING & NOTES</p>
		<p>DESIGN BY: _____</p> <p>CHECKED BY: _____</p> <p>DATE: _____</p>	
			SHEET NO. 2 OF 21 SHEETS



LOUISIANA AVENUE



NO.	DATE	BY	CHKD	REVISION

**CITY OF BROOKLYN PARK
ENGINEERING DEPARTMENT**
5200 85TH AVE. N.
BROOKLYN PARK, MN 55443
PH# 612/493-8100
FAX# 612/493-8391

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
Robert C. Deane
DATE: 8-12-95 REG. NO. 19877
GARY H. BELOW, P.E. DIRECTOR OF ENGINEERING

**LOUISIANA AVENUE
63RD AVE. - 62-1/2 AVE.**

CITY PROJ. NO. ST-1142	DRAWN BY S.A.M.	DATE APPROVED 8-12-95	SHEET 4
CITY IMPROV. NO. 95-02	DESIGNED BY J.C.L.	HORIZ. SCALE 1"=30'	OF 6
STATE AID PROJ. NO.	CHECKED BY G.E.R.	VERT. SCALE 1"=5'	

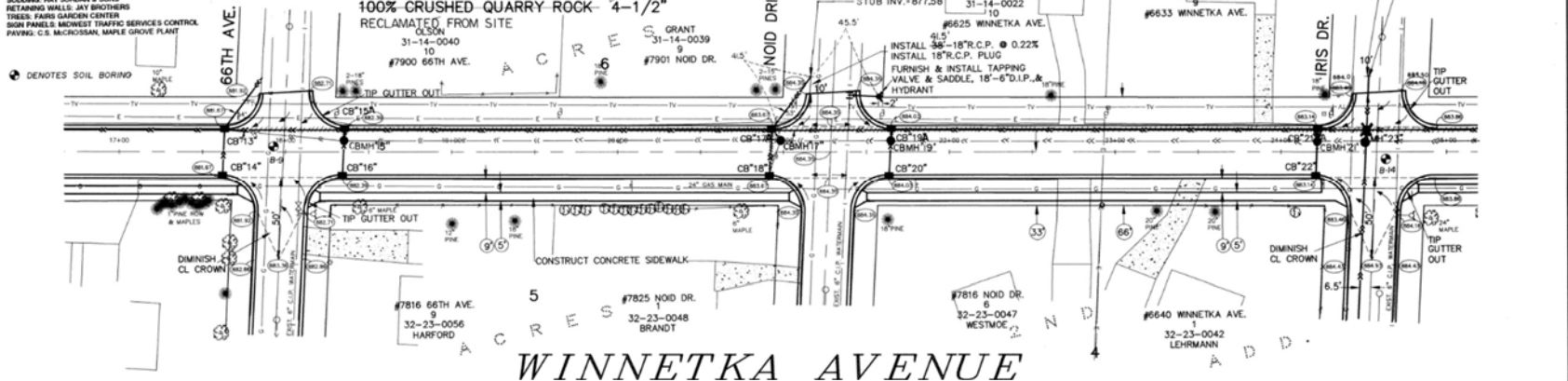
WATER MAIN MATERIALS
 GATE VALVES, WATEROUS
 HYDRANTS, WATEROUS
 RECORDED 1-96 BY T.K.

INSPECTION: CRAIG RUMAKO & MIKE GUMOND, CITY OF BROOKLYN PARK
 SURVEYING, M&A CONSULTING ENGINEERS
 TESTING: INSTANT TESTING COMPANY
 CONSTRUCTED: 1995

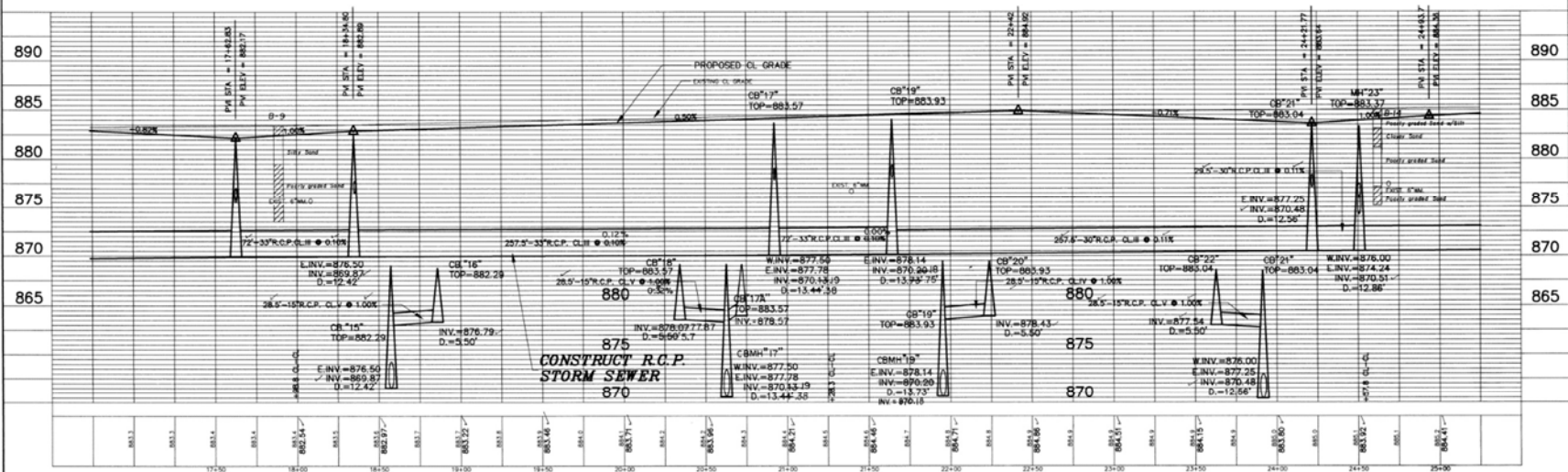
PRIMEAULTIER: S.R. WEIDMA
 CONCRETE MBTS & PIPE: ROYAL CONCRETE PRODUCTS, STACY
 CONCRETE CURBS & SIDEWALKS, WY STATE CURB & GUTTER
 CONCRETE SUPPLIER: APPLE VALLEY READY MIX
 SCOURING: RAY JOHNSON & SONS
 RETAINING WALLS: JAY BROTHERS
 TREES: PARIS GARDEN CENTER
 SIGN PANELS: MIDWEST TRAFFIC SERVICES CONTROL
 PAVING: C.S. MICROSSAN, MAPLE GROVE PLANT

CONSTRUCT 32' BITUMINOUS STREET
 W/B-618 CONCRETE CURB & GUTTER
 MNDOT 2340 TYPE 41A WEARING COURSE 1-1/2" 5% AC
 MNDOT 2340 TYPE 31A BASE COURSE 2-1/2" 3.7% AC
 MNDOT 2211 AGGREGATE BASE, CL. 5,
 100% CRUSHED QUARRY ROCK - 4-1/2"
 RECLAIMED FROM SITE

WINNETKA AVE. RADI SHALL BE 20'
 UNLESS OTHERWISE SPECIFIED



WINNETKA AVENUE



NO	DATE	BY	CHKD	REVISION

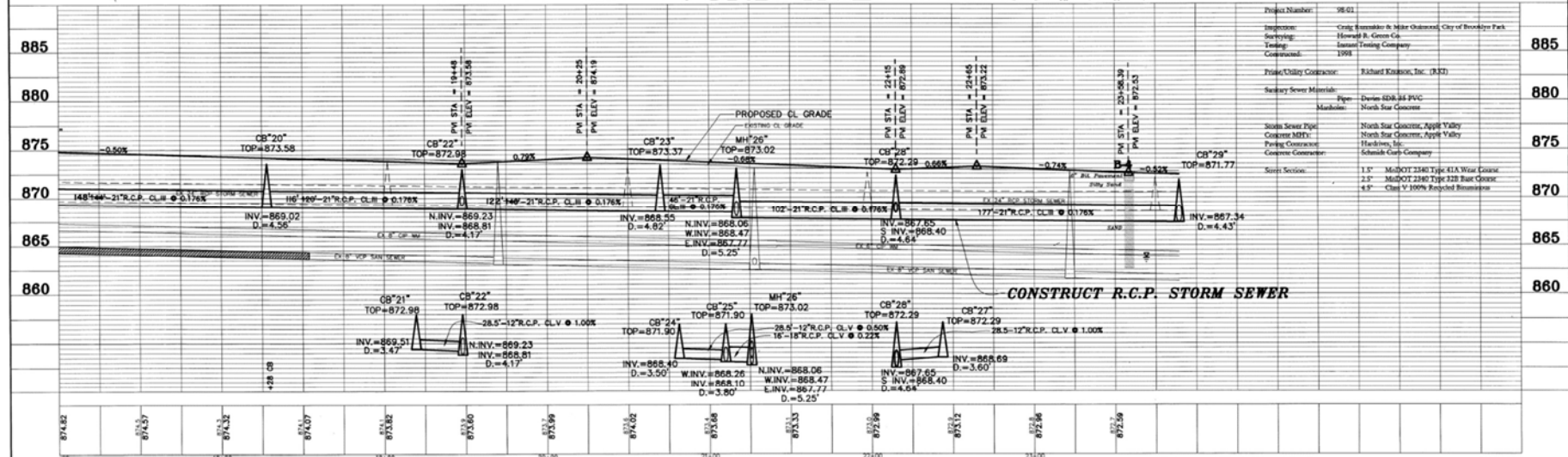
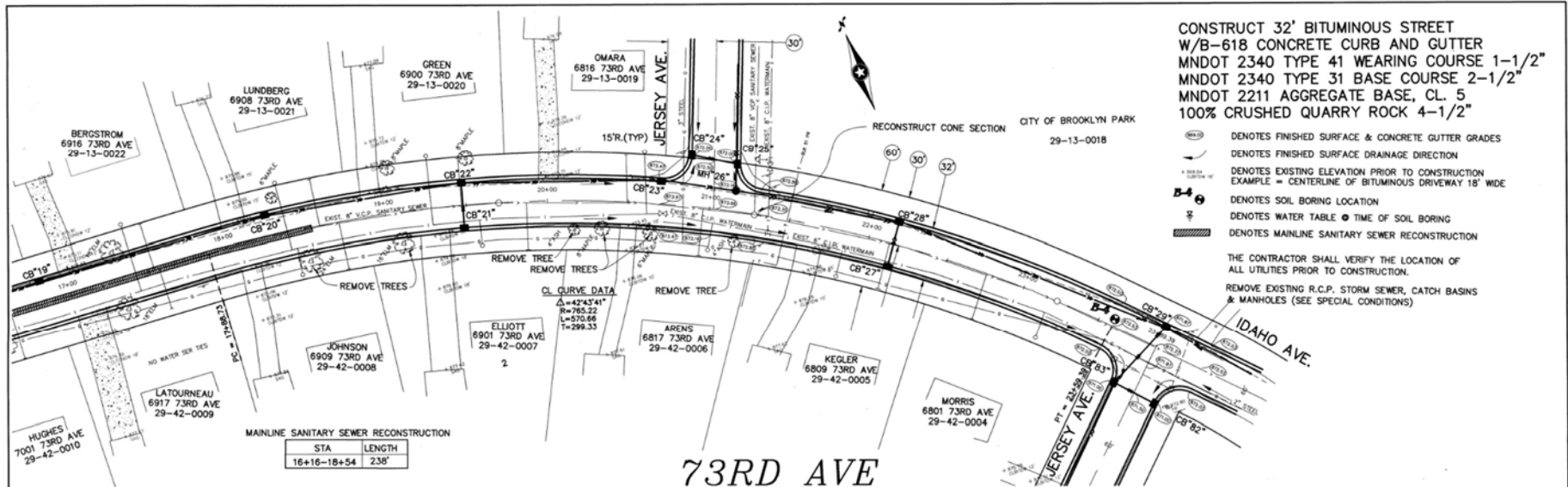
**CITY OF BROOKLYN PARK
 ENGINEERING DEPARTMENT**
 5200 85TH AVE. N.
 BROOKLYN PARK, MN, 55443
 PH# 612/483-8100
 FAX# 612/483-8391

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY
 DIRECT SUPERVISION AND THAT I AM A STATE REGISTERED PROFESSIONAL
 ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA
 DATE 3-20-99
 SIGNATURE: [Signature]
 TITLE: CHIEF ENGINEER

**WINNETKA AVENUE
 66TH AVE. - IRIS AVE.**

CITY PROJ. NO.
 ST-1137 PHASE I
 55-1144 PHASE I
 CITY IMPROV. NO.
 95-51
 STATE AID PROJ. NO.

DRAWN BY: K.A.W.
 DESIGNED BY: G.D.D. & K.C.L.
 CHECKED BY: G.E.B.
 DATE APPROVED: 3-20-99
 HORIZ. SCALE: 1"=30'
 VERT. SCALE: 1"=5'



Project Number:	98-01	885
Design:	Craig Remaker & Mike Oshinski, City of Brooklyn Park	885
Surveying:	Howard R. Green Co.	880
Testing:	Soan Testing Company	880
Completed:	1998	880
Prime/Utility Contractor:	Richard Krasovic, Inc. (R.K.I.)	875
Sanitary Sewer Material:	Durian 408-34 PVC	875
Manholes:	North Star Concrete	875
Storm Sewer Pipe:	North Star Concrete, Apple Valley	870
Contract MDE:	North Star Concrete, Apple Valley	870
Prime Contractor:	Hartkopf, Inc.	865
Concrete Contractor:	Schmidt-Cook Company	865
Street Section:	1.5" - MNDOT 2340 Type 41A Wearing Course	860
	2.5" - MNDOT 2340 Type 31 Base Course	860
	4.5" - Class V 100% Projected Bituminous	860

NO.	DATE	BY	CHKD	REVISION

CITY OF BROOKLYN PARK ENGINEERING

5200 85TH AVE. N.
BROOKLYN PARK, MN. 55443
PH# 612/493-8100
FAX# 612/493-8391

HEREBY CERTIFY THAT THE PLANS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE: 2-23-98 REG. NO. 23395

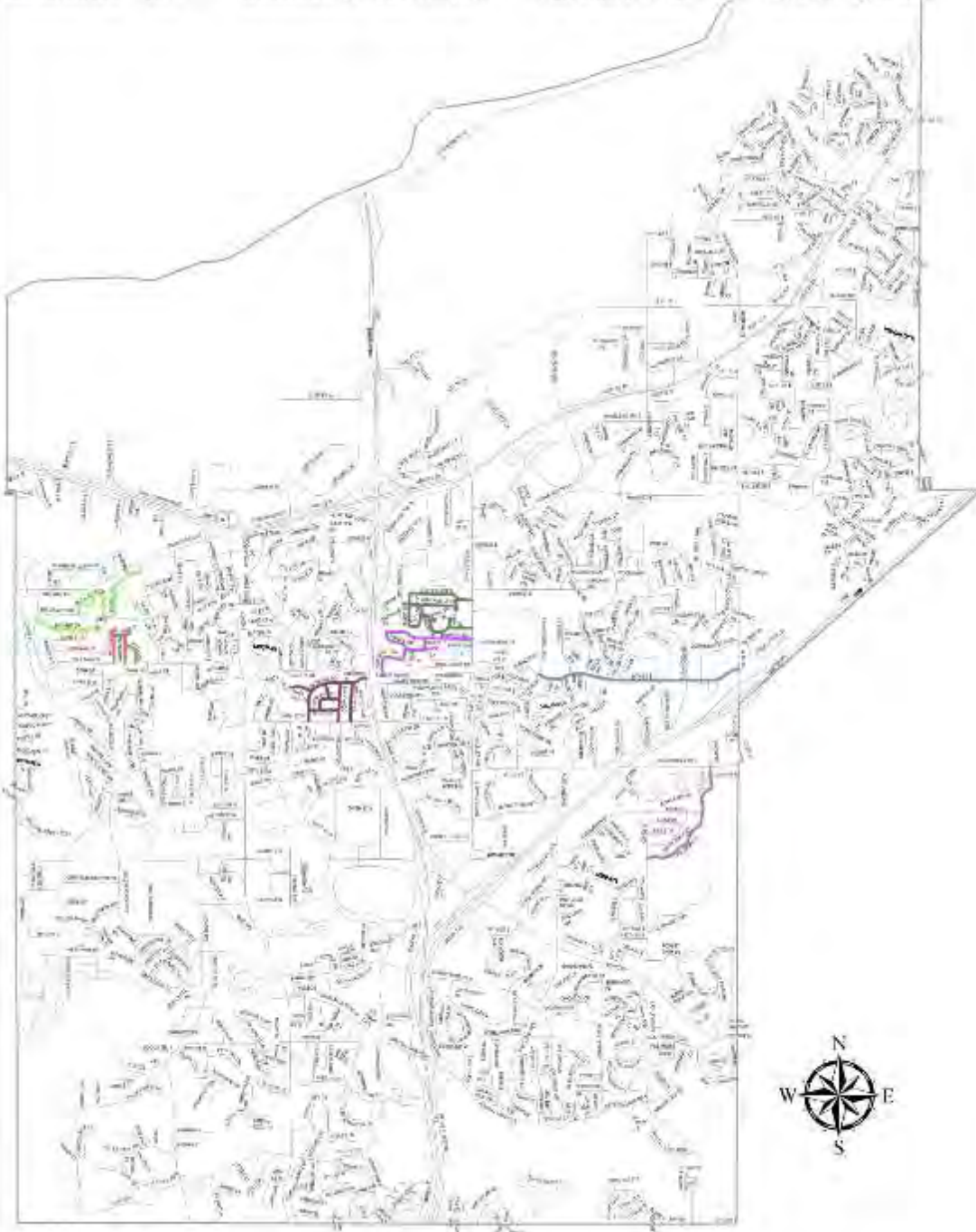
DORAN COLE, P.E. CITY ENGINEER

73RD AVE
W.BROADWAY - 350'± E. OF HARTKOPF LA.

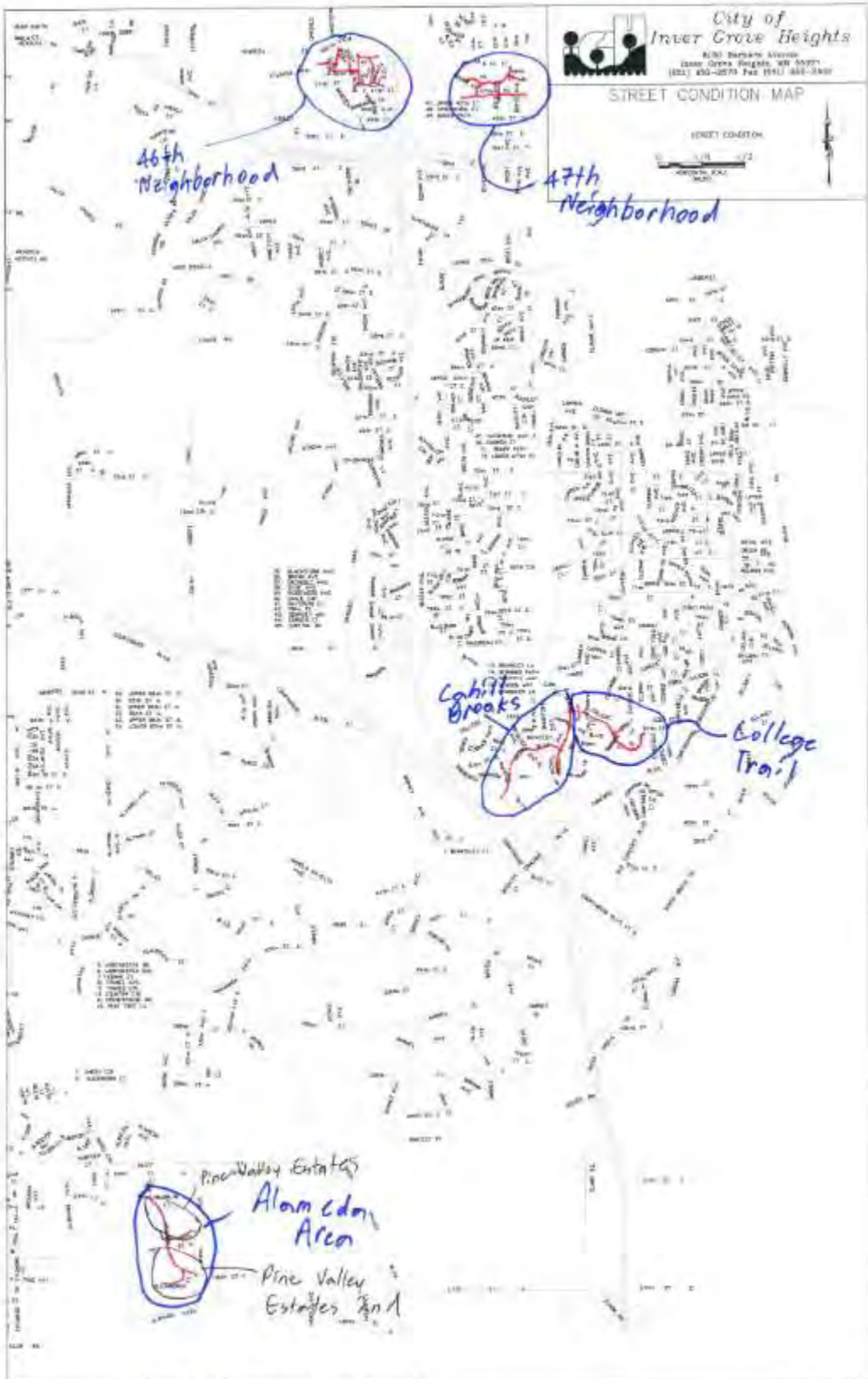
CITY PROJ. NO. ST-1222 PHASE I	DESIGNED BY KANKER/DOS	DATE APPROVED 2-23-98	SHEET 28 OF 92
CITY IMPROV. NO. 98-01	DESIGNED BY GDD/KCL	HORIZ. SCALE 1"=30'	
STATE AID PROJ. NO.	CHECKED BY DMC	VERT. SCALE 1"=5'	

City of Burnsville Stripping Under Seal Coat

Owner's Project Name	Owner's Project No.	General Contractor	Paving Contractor / Supplier	Spec	Paving Date	Stripping Observations
1950 Street Paving	90 Reson - 1	Progressive Contractors Inc.	Costa Asphalt / Alexander Const Co.	231 + 231	Base 6-5/01, Wear 6-7/02	Mod throughout project
1952 Street Paving	91 Reson - 1	Valley Paving, Inc.	Valley Paving Inc.	231 Type 31 & 41	Base 6-5/02, Wear 6-7/02 / Mod to Severe throughout project	
1952 Street Paving	92 Reson - 1	Ryan Contracting Inc.	McNamara Contracting Inc.	231 Type 31 & 41	Base 6-5/02, Wear 6-7/03 / mod Area Severe / Friction Light	
1993 Street Paving	93 Reson - 1	Remarc Knauman Inc.	McNamara - we think Valley	231 Type 31 & 41	Base 6-5/02, Wear 6-7/03 Severe throughout project	
1995 Street Paving	95-101	Valley Paving Inc.	Valley Paving Inc.	231 Type 31 & 41	Base 6-5/05, Wear 6-7/05 Light to Mod scattered	
1995 Street Paving	95-101	McNamara Contracting Inc.	McNamara Contracting Inc.	2 + 480 + 250 + 480 + 18	6/31/2005	Light along front - long wear - friction?



Map created by Burnsville Engineering Services on 07/20/05 using MicroStation Civil 3D v8.0.1



T:\PublicWorks\Engineering\PAVEMENT_MGMT_PROGRAM\2015\StreetConditions.mxd

REVISED: 9/17/2014

Listing of Historical Maintenance Projects

	<u>Date</u>	<u>Project Type</u>	<u>Strategy</u>
<u>BROOKS BOULEVARD</u>			
From	87TH STREET EAST		
To	BREWSTER AVENUE		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
	6/15/2010	Local	Crack Seal
	6/30/2011	Local	Crack Seal
From	BAXTER WAY		
To	87TH STREET EAST		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
From	BECHTEL AVENUE		
To	CAHILL AVENUE EAS		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
	6/15/2010	Local	Crack Seal
	6/30/2011	Local	Crack Seal
From	BEVERLY WAY		
To	BECHTEL AVENUE		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
	6/15/2010	Local	Crack Seal
	6/30/2011	Local	Crack Seal
From	BRANSON AVENUE		
To	BAXTER WAY		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
	6/15/2010	Local	Crack Seal
	6/30/2011	Local	Crack Seal
From	BREWSTER AVENUE		
To	BEVERLY WAY		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
	6/15/2010	Local	Crack Seal
From	BRODERICK BOULEV		
To	BRANSON AVENUE		
	6/1/1994	Global	Construction-AC
	9/17/2001	Local	Crack Seal
	6/5/2002	Global	Seal Coat
	9/30/2009	Global	Overlay 1
	6/15/2010	Local	Crack Seal

MINNESOTA DEPARTMENT OF TRANSPORTATION SIBLEY COUNTY

CONSTRUCTION PLAN FOR GRADING

LOCATED ON _____ BETWEEN _____ AND _____ (Geographic Description)
 FROM _____ TO _____ (Legal Description)

STATE AND PROJ. NO. _____

PROJ. NO.	DATE	BY	CHKD.

STATE AND PROJ. NO. _____

PROJ. NO.	DATE	BY	CHKD.

NOTE: ALL DIMENSIONS TO CENTERLINE UNLESS OTHERWISE NOTED.
 ALL DISTANCES TO BE MEASURED ALONG THE CENTERLINE OF THE ROAD.
 ALL DISTANCES TO BE MEASURED ALONG THE CENTERLINE OF THE ROAD.
 ALL DISTANCES TO BE MEASURED ALONG THE CENTERLINE OF THE ROAD.



PLANS SYMBOLS

Symbol	Description
...	...

UTILITIES SYMBOLS

Symbol	Description
...	...

NOTES

Symbol	Description
...	...

MINN. PROJ. NO. _____
 MINN. PROJ. NO. _____

INDEX

SHEET NO. 1	TITLE SHEET
SHEET NO. 2	ESTIMATED QUANTITIES & TYPICAL SECTIONS
SHEET NO. 3-7	PLAN SHEETS
SHEET NO. 8	PROFILES
SHEET NO. 9-10	CROSS-SECTIONS SHEETS

THIS PLAN CONTAINS _____ SHEETS

DESIGN DESIGNATION

PROJ. NO. _____
 PROJ. NO. _____
 PROJ. NO. _____
 PROJ. NO. _____
 PROJ. NO. _____

Functional Classification
 No. of Traffic Lanes _____ No. of Parking Lanes _____

Design Speed _____ MPH
 Based on Stopping Sight Distance
 Height of eye 5.5 Height of object 3.5
 Design Speed not achieved at:
 STA. _____
 STA. _____
 STA. _____

DATE _____
 COUNTY _____
 SHEET _____ OF _____

Prepared by _____
 Checked by _____
 Approved by _____



STATE AND PROJ. NO. _____
 STATE PROJ. NO. _____

AGGREGATE TEST REPORT - BITUMINOUS AGGREGATE Lab Nos: D7-BA97057
 Tested At: DISTRICT 7 Lab - Mankato, MN Submitted By: -57- EHLERS
 Project Nos: SF 72-609-17 (G.ISAKSON) Bridge Nos: NA
 -57- Geo-Code: 7211402533340 Pit: DUFFY
 Sampled From: -57- REC 7-97014 "BELT" PRODUCTION
 To Be Used For: -57- 3139-2331-31B-BA2 31LEVEL

Lab. No.	BA 97	57	FIELD	REQ'D.
Date Sampled		05/30/97		3139
Date Received		06/30/97		TYPE
Field ID/Result #		31LV112	32LV112	31B
19.0 mm (3/4") SIEVE		100	100	100-100
16.0 mm (5/8") SIEVE		99	98	
12.5 mm (1/2") SIEVE		96	96	
9.5 mm (3/8") SIEVE		92	92	
4.75 mm (#4) SIEVE		72	73	40-85
2.00 mm (#10) SIEVE		57	50	
0.850 mm (#20) SIEVE		40		
0.425 mm (#40) SIEVE		23	19	
0.180 mm (#80) SIEVE		8		
0.075 mm (#200) SIEV		4.5	4	2-8

NO QUALITY TESTS PERFORMED

MEETS REQUIREMENTS



 APPROVED BY

Copies: ~~PLT ENG~~
 PROJ ENG (2)

MINNESOTA DEPARTMENT OF TRANSPORTATION

CONSTRUCTION PLAN FOR 2009 BITUMINOUS SEAL COAT
 LOCATED ON CSAH 9, 10, 21, CR 117 & ARLINGTON SHOP LOT

COUNTY PROJECT 1101

GOVERNING SPECIFICATIONS

THE 2005 EDITION OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION
 STANDARD SPECIFICATIONS FOR CONSTRUCTION, SHALL GOVERN.

ALL TRAFFIC CONTROL DEVICES SHALL CONFORM TO THE LATEST EDITION OF
 THE MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES' (MUTCD),
 INCLUDING THE LATEST 'FIELD MANUAL FOR TEMPORARY TRAFFIC CONTROL ZONE
 LAYOUTS.'

CSAH 9 FROM TRUNK HIGHWAY 5 TO NORTH COUNTY LINE
 CSAH 10 FROM CSAH 3 SOUTH TO TRUNK HIGHWAY 15
 CSAH 21 FROM 13TH STREET EAST TO CSAH 12
 CR 117 FROM TRUNK HIGHWAY 5 TO 0.5 MILES NORTH
 SIBLEY COUNTY SHOP LOT AT ARLINGTON

SEE SHEETS 4-7 FOR LOCATION MAPS

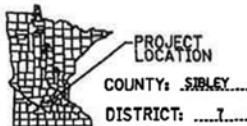
INDEX

SHEET NO.	SHEET DESCRIPTION
1	TITLE SHEET
2	ESTIMATED QUANTITIES/NOTES
3	TYPICAL SECTIONS
4-7	LOCATION MAPS
8-11	TRAFFIC CONTROL PLANS

THIS PLAN CONTAINS 11 SHEETS.

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR
 UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED
 PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE: Brett Benzkofer
 DATE: 4/23/09 LIC. NO. 25434 PRINT NAME: BRETT BENZKOEFER



SibleyCounty
 Public Works

SIBLEY COUNTY PUBLIC WORKS
 111 8TH STREET
 P.O. BOX 897
 GAYLORD, MN 55334
 P (507) 237.4092
 F (507) 237.4356
 www.co.sibley.mn.us

S.A.P. _____
 COUNTY PROJECT 1101 SHEET NO. 1 OF 11 SHEETS

2:17:28 PM
 4/23/2009
 S:\Pub\1101\Sorka\Highway\Project\1101\Des\gn\Sealcoat\plan\Sealcoat\TITLE SHEET.dgn

APPENDIX I

FIELD CORES AND FIELD CORE OPERATION PHOTOGRAPHS

Full core photographs can be found online at:

<ftp://ftp2.dot.state.mn.us/pub/outbound/researchservices/Chip%20Seal%20Research/>



Figure I-1. Coring operations and sample core extracted from the east end of 93rd Avenue in Blaine, MN



Figure I-2. Coring operations and sample core extracted from the east end of 93rd Avenue in Blaine, MN

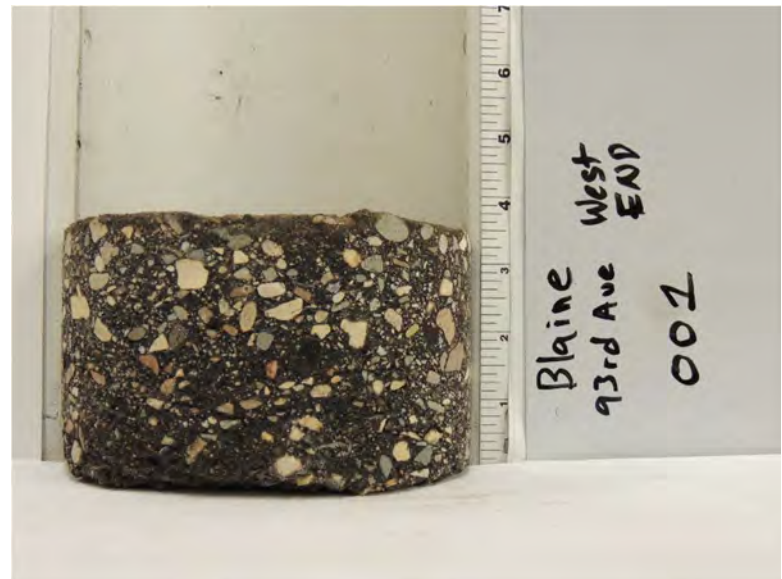




Figure I-3. Coring operations and sample core extracted from 73rd Avenue in Brooklyn Park, MN

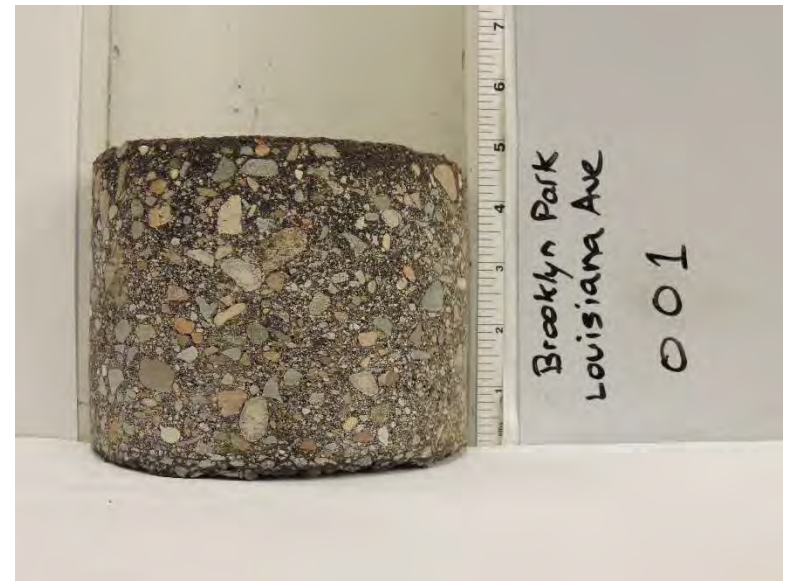


Figure I-4. Coring operations and sample core extracted from Louisiana Avenue in Brooklyn Park



Figure I-5. Coring operations and sample core extracted from Winnetka Avenue in Brooklyn Park, MN



Figure I-6. Coring operations and sample core extracted from 134th Street in Burnsville, MN



Figure I-7. Coring operations and sample core extracted from Heritage Circle in Burnsville, MN

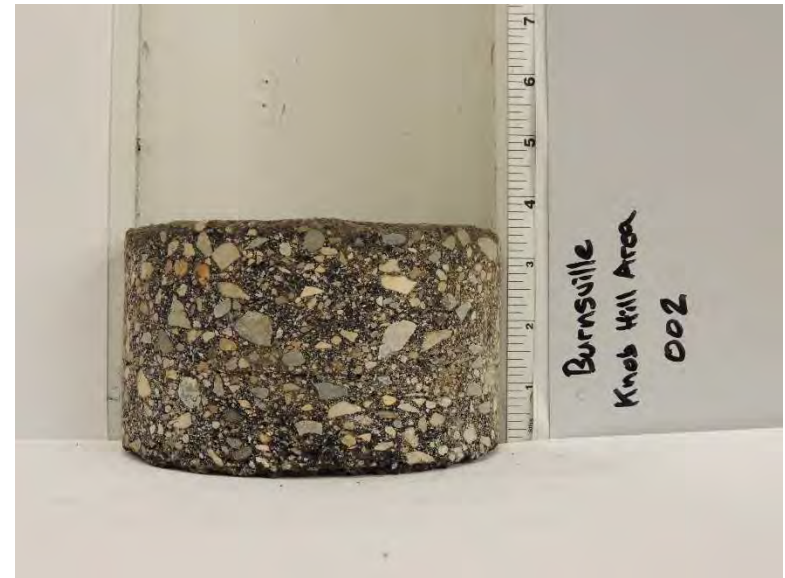


Figure I-8. Coring operations and sample core extracted from Knob Hill in Burnsville, MN



Figure I-9. Coring operations and sample core extracted from Hyde Ave in Cottage Grove, MN



Figure I-10. Coring operations and sample core extracted from Ingberg Trail in Cottage Grove, MN



Figure I-11. Coring operations and sample core extracted from Jensen Ave in Cottage Grove, MN



Figure I-12. Coring operations and sample core extracted from Brooks Blvd. in Inver Grove Heights, MN

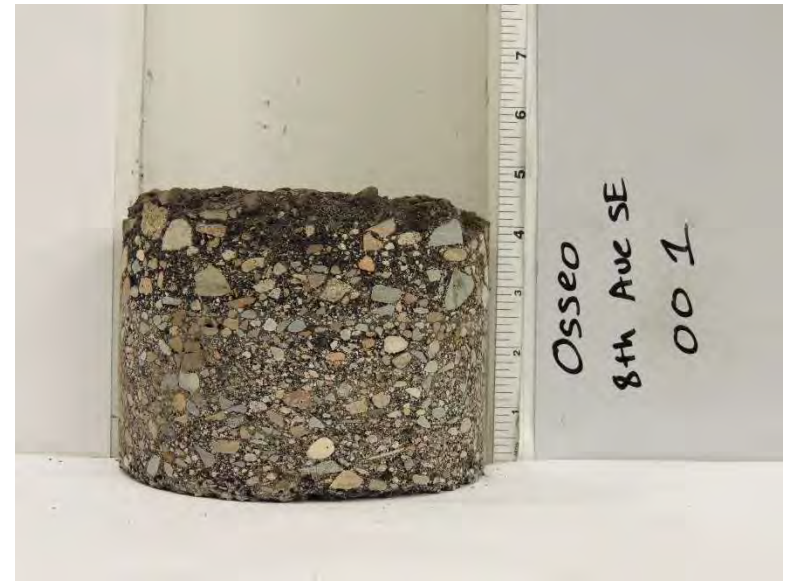


Figure I-13. Coring operations and sample core extracted from Osseo, MN



Figure I-14. Coring operations and sample core extracted from the north part of CSAH 9 in Sibley County, MN

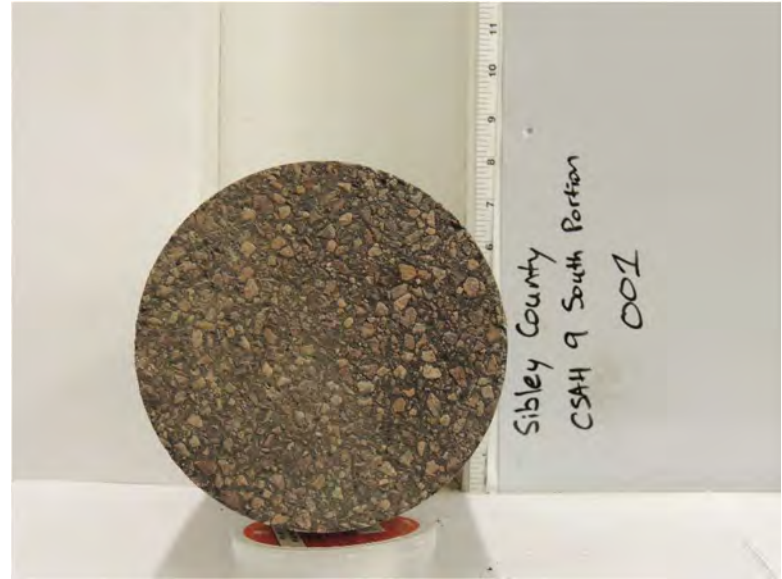


Figure I-15. Coring operations and sample core extracted from the south part of CSAH 9 in Sibley County, MN

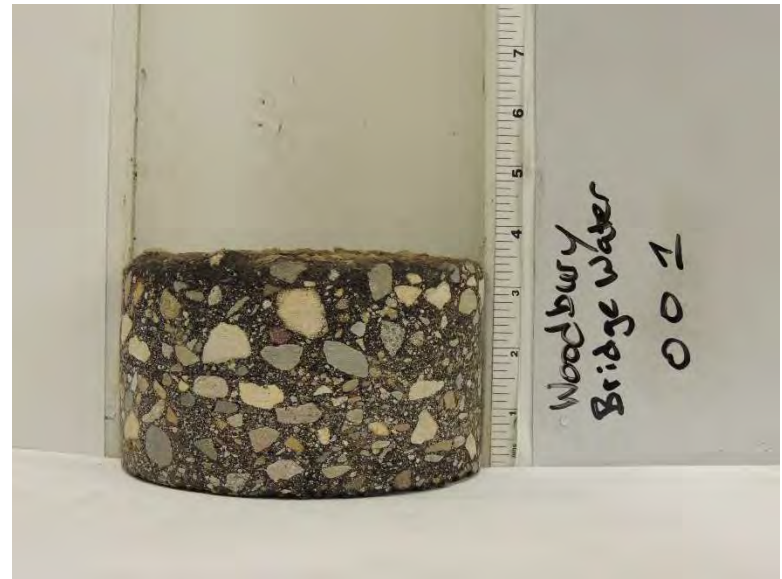


Figure I-16. Coring operations and sample core extracted from Bridgewater Road in Woodbury, MN



Figure I-17. Coring operations and sample core extracted from Newbury Alcove Cul de sac in Woodbury, MN

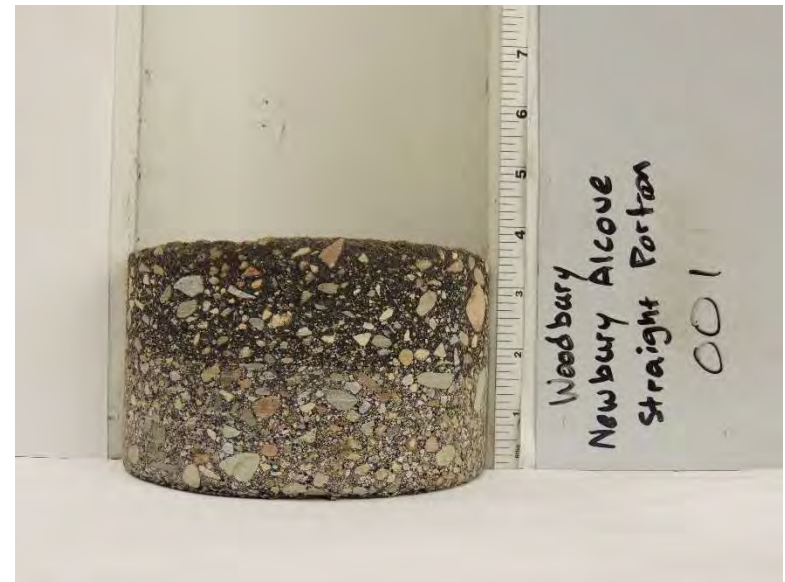


Figure I-18. Coring operations and sample core extracted from Newbury Alcove straight portion in Woodbury, MN

APPENDIX J

HAMBURG TEST PHOTOGRAPHS

Full core photographs can be found online at:

<ftp://ftp2.dot.state.mn.us/pub/outbound/researchservices/Chip%20Seal%20Research/>



Figure J-1. Paired specimen from the east end of 93rd Avenue in Blaine, MN, before Hamburg test



Figure J-2. Specimen from the west end of 93rd Avenue in Blaine, MN, before Hamburg test



Figure J-3. Specimen from 73rd Avenue in Brooklyn Park, MN, after Hamburg test



Figure J-4. Paired specimens from Louisiana Avenue in Brooklyn Park, MN, after Hamburg test



Figure J-5. Paired specimens from 134th Avenue in Burnsville, MN, before Hamburg test

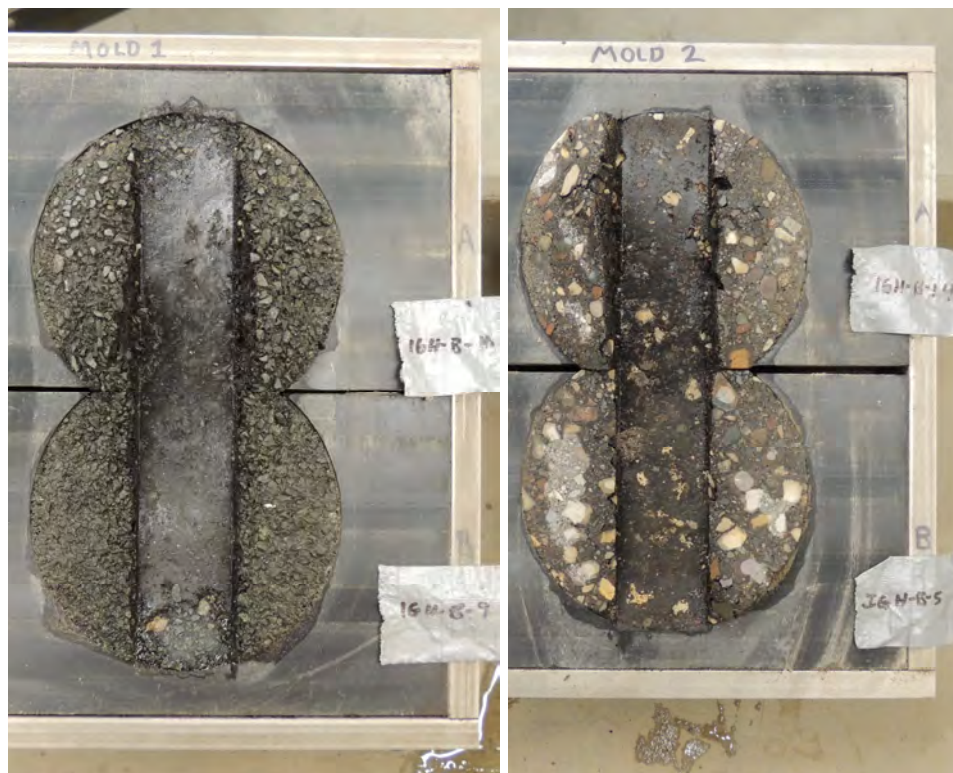


Figure J-6. Paired specimen from Brooks Blvd in Inver Grove Heights, MN, after Hamburg test

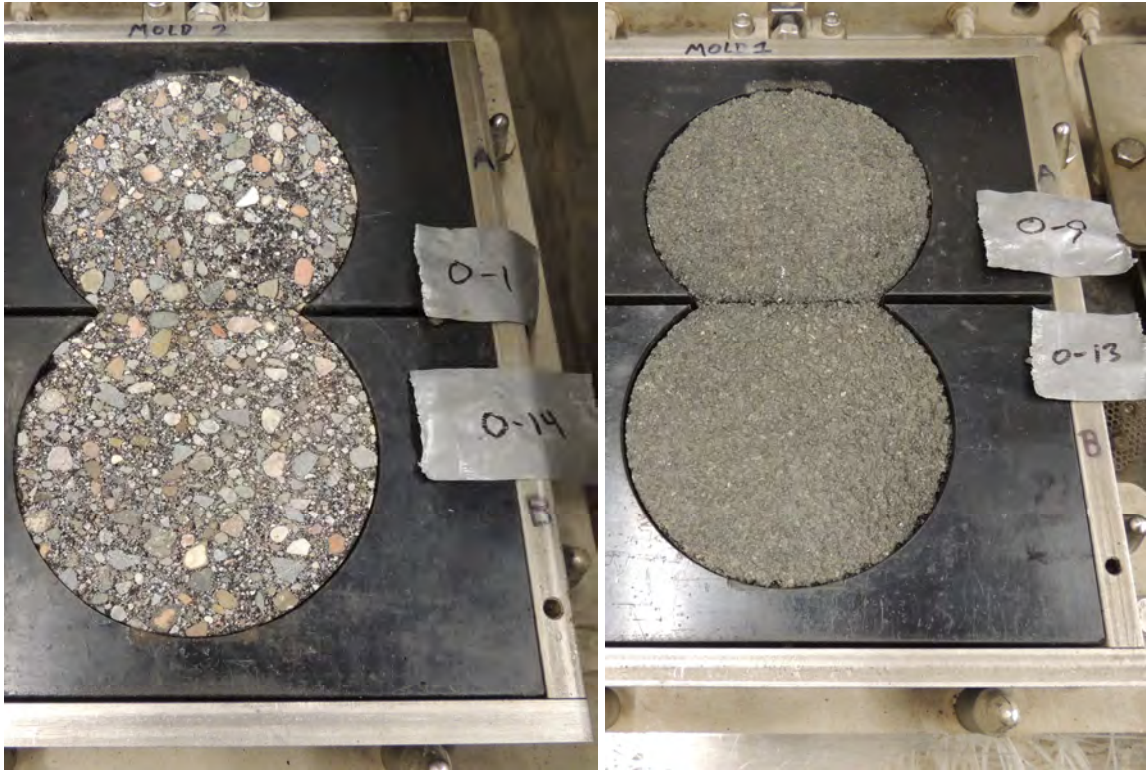


Figure J-7. Paired specimens from Osseo, MN, before Hamburg test

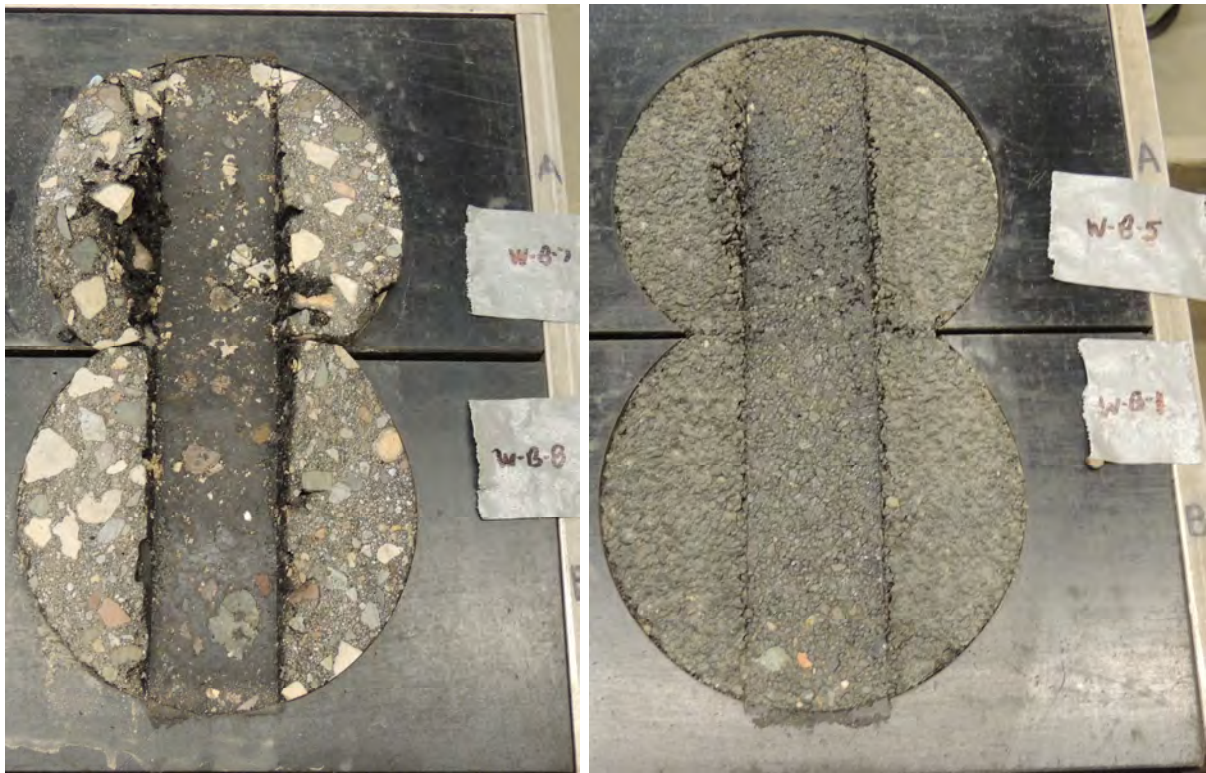


Figure J-8. Paired specimens from Bridgewater Road in Woodbury, MN, after Hamburg test

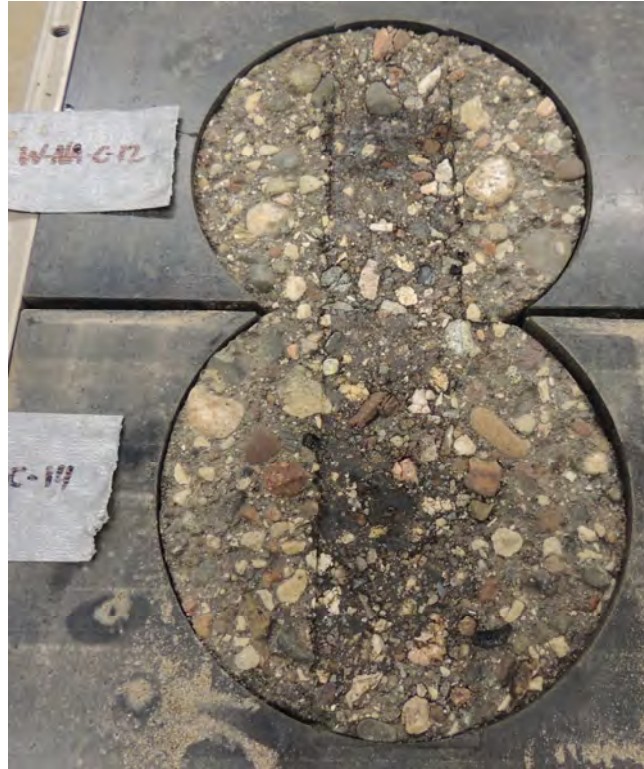


Figure J-9. Specimen without chip seal from Newbury Alcove Cul de Sac in Woodbury, MN, after Hamburg test

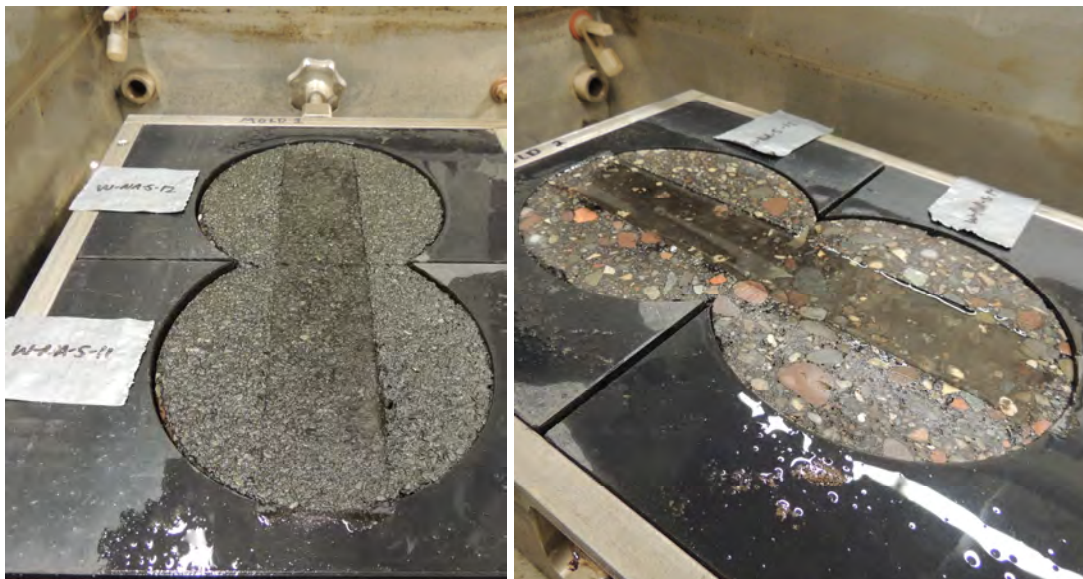


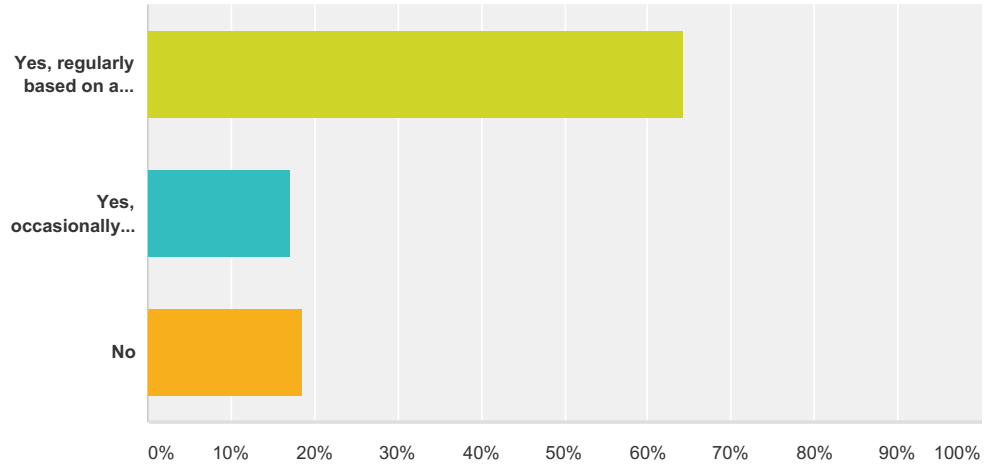
Figure J-10. Paired specimen from Newbury Alcove Straightaway in Woodbury, MN, after Hamburg test

APPENDIX K

CITY/COUNTY SURVEY AND RESPONSES

Q1 Are you currently using chipseals as part of your pavement maintenance program?

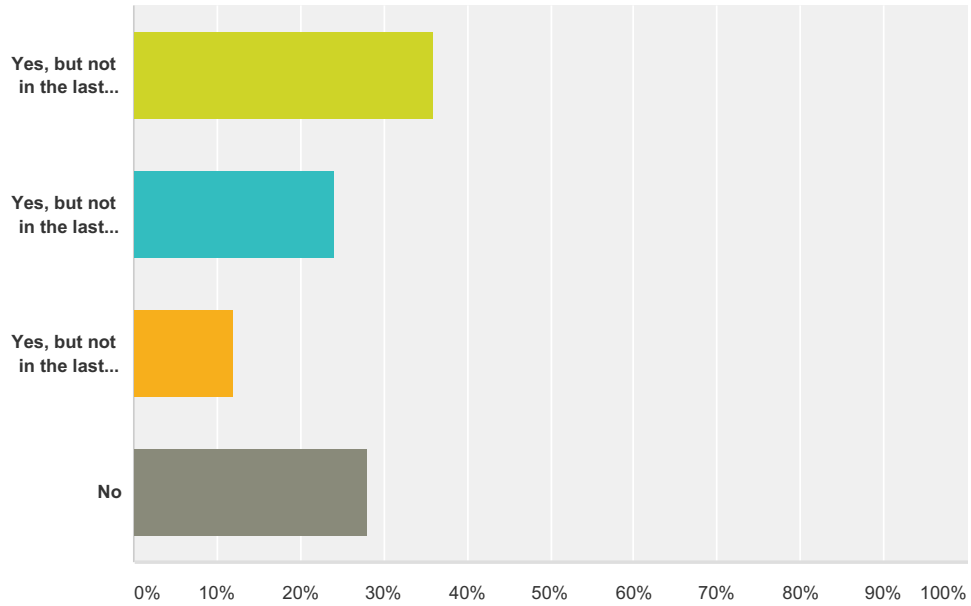
Answered: 129 Skipped: 0



Answer Choices	Responses
Yes, regularly based on a schedule for most roadways	64.34% 83
Yes, occasionally depending on pavement and traffic conditions	17.05% 22
No	18.60% 24
Total	129

Q2 Has your organization used chipseals in the past?

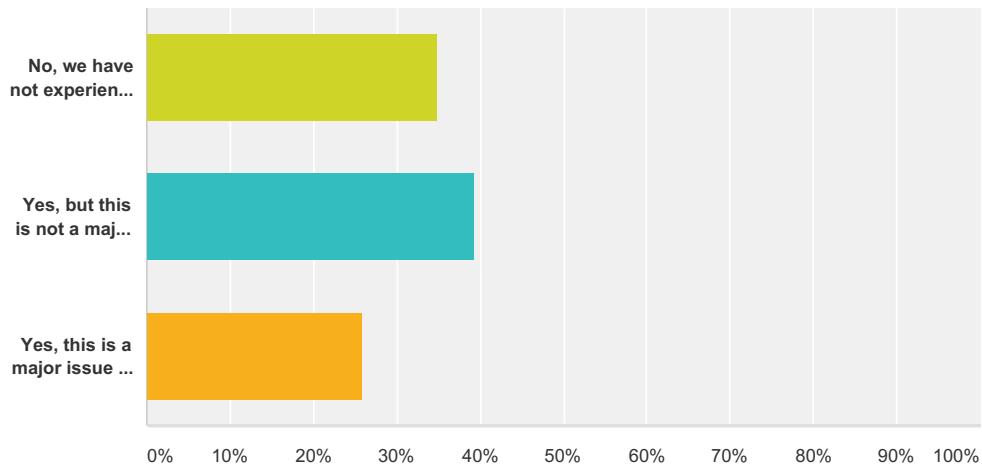
Answered: 25 Skipped: 104



Answer Choices	Responses
Yes, but not in the last approximately 5 years	36.00% 9
Yes, but not in the last approximately 10 years	24.00% 6
Yes, but not in the last approximately 20 years	12.00% 3
No	28.00% 7
Total	25

Q3 On roads where chipseals have been used, have you experienced any problems with stripping or or delamination of the chipseal with the underlying layer of asphalt?Stripping is defined as a loss in the asphalt/aggregate bond resulting in raveling, a shallow surface pothole, or delamination of the chipseal surface.

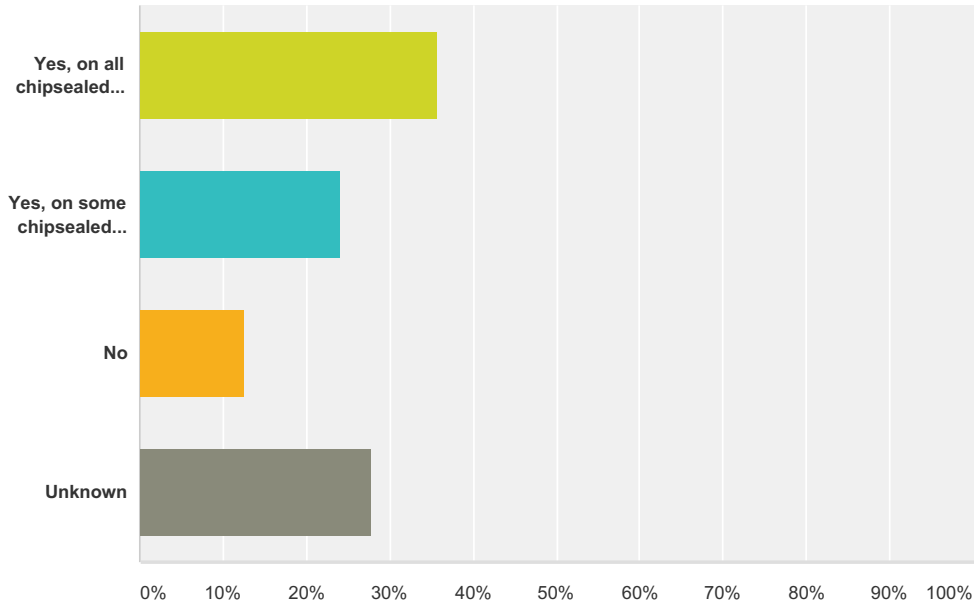
Answered: 112 Skipped: 17



Answer Choices	Responses
No, we have not experienced this issue	34.82% 39
Yes, but this is not a major issue on our roadway network	39.29% 44
Yes, this is a major issue on our roadway network	25.89% 29
Total	112

Q4 Do you use a polymer modified emulsion with your chipseals?

Answered: 112 Skipped: 17



Answer Choices	Responses	
Yes, on all chipsealed roadways	35.71%	40
Yes, on some chipsealed roadways	24.11%	27
No	12.50%	14
Unknown	27.68%	31
Total		112

Q5 When did you start specifying the polymer modified emulsion?

Answered: 51 Skipped: 78

#	Responses	Date
1	2005	10/28/2015 10:31 PM
2	Started doing cul-de-sacs a number of years ago. All streets this past year.	10/27/2015 12:41 PM
3	2000	10/26/2015 3:46 PM
4	?	10/24/2015 6:07 PM
5	unknown - at least 5 years	10/24/2015 10:06 AM
6	We reference MNDOT Spec 3151 & bid item is CRS-2. Not sure when MNDOT spec changed.	10/23/2015 2:26 PM
7	2008	10/22/2015 1:35 PM
8	2008	10/22/2015 10:46 AM
9	2008	10/22/2015 7:05 AM
10	2008	10/21/2015 10:26 PM
11	2014	10/21/2015 5:36 PM
12	2014	10/21/2015 4:38 PM
13	not known	10/21/2015 4:34 PM
14	5 to 10 years ago	10/21/2015 4:21 PM
15	2010	10/21/2015 2:51 PM
16	2010	10/21/2015 2:39 PM
17	2014	10/21/2015 12:01 PM
18	We have been using CRS2P for several years	10/21/2015 11:55 AM
19	2005	10/21/2015 11:35 AM
20	prior to my tenure	10/21/2015 11:30 AM
21	3 years ago	10/21/2015 11:25 AM
22	We use st. Louis County's Spec. They bid out our work	10/21/2015 11:05 AM
23	2005	10/21/2015 10:56 AM
24	2008	10/21/2015 10:53 AM
25	Not sure - likely more than 10 years ago. Used on cul-de-sac ends.	10/21/2015 10:51 AM
26	2014	10/21/2015 10:41 AM
27	2008	10/21/2015 10:30 AM
28	2010	10/21/2015 10:18 AM
29	2008	10/21/2015 10:14 AM
30	2004, for FA-3 chip seals only	10/21/2015 10:09 AM
31	Stopped chip sealing all together	10/21/2015 10:04 AM
32	On cul-de-sacs & High Volume Roads 2008	10/21/2015 10:02 AM
33	unknown	10/21/2015 9:36 AM
34	2012	10/21/2015 9:24 AM

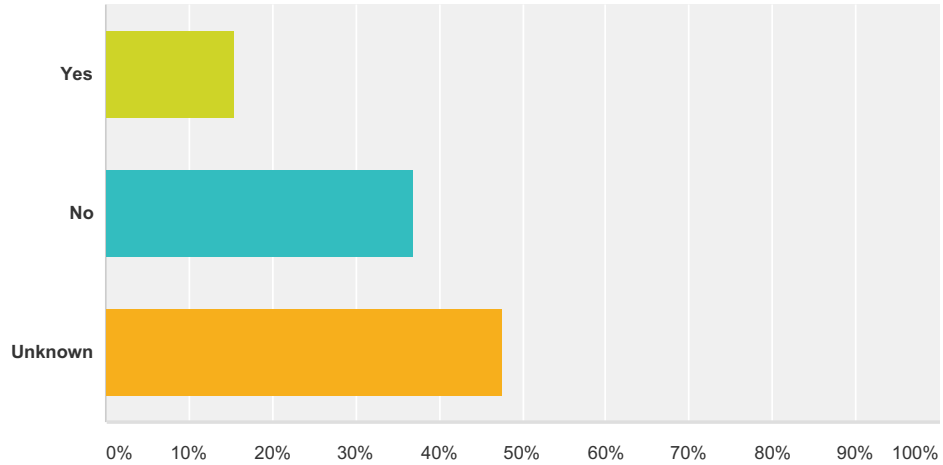
Chip Seal Usage

SurveyMonkey

35	2000	10/21/2015 9:22 AM
36	6 years ago.	10/21/2015 9:19 AM
37	we bid it every year, but typically don't use it because of the price difference. We use the cheaper oil with a cheaper chip. On a few occasions we've used a higher quality chip and have used the polymer emulsion. But not usually.	10/21/2015 9:14 AM
38	2012	10/21/2015 9:14 AM
39	2012	10/21/2015 9:12 AM
40	The City of Hastings has used CRS-2P oil since 2004.	10/21/2015 9:09 AM
41	2004	10/21/2015 9:08 AM
42	2014	10/21/2015 9:04 AM
43	2010	10/21/2015 9:03 AM
44	2009 or so	10/21/2015 9:02 AM
45	Don't know	10/21/2015 9:02 AM
46	over 10 years ago	10/21/2015 9:01 AM
47	yes, we used emulsion -but are not currently chip sealing	10/21/2015 9:00 AM
48	2014	10/21/2015 8:58 AM
49	2013	10/21/2015 8:57 AM
50	7-10 years ago maybe?	10/21/2015 8:55 AM
51	2015	10/21/2015 8:53 AM

Q6 Have you noticed any difference in the incidence of stripping/delamination on roads with polymer modified emulsion?

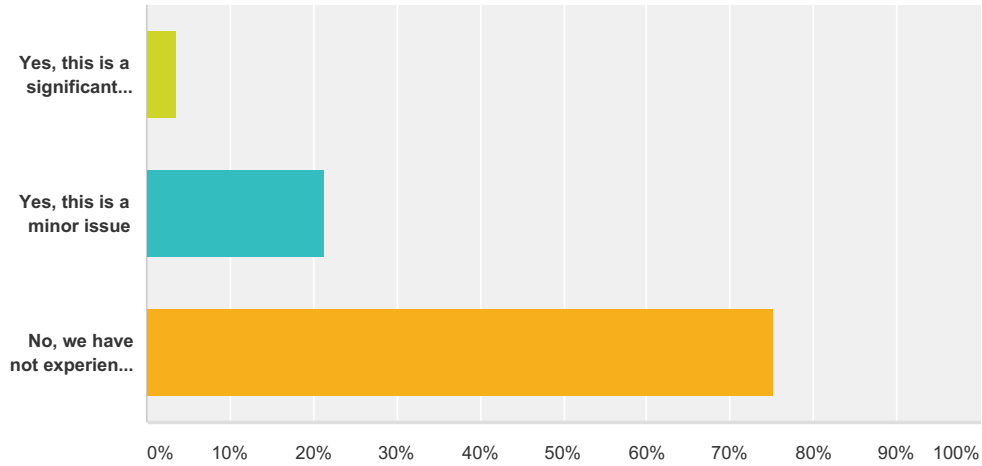
Answered: 65 Skipped: 64



Answer Choices	Responses	
Yes	15.38%	10
No	36.92%	24
Unknown	47.69%	31
Total		65

Q7 Do you have any pavements which are not chipsealed that are experiencing stripping failures? Stripping is defined as a loss in the asphalt/aggregate bond resulting in raveling, a shallow surface pothole, or delamination of the chipsealed surface.

Answered: 113 Skipped: 16



Answer Choices	Responses
Yes, this is a significant issue	3.54% 4
Yes, this is a minor issue	21.24% 24
No, we have not experienced stripping on non-chipsealed surfaces.	75.22% 85
Total	113

Q8 Is there anything else you'd like to share about your use or non-use of chipseals?

Answered: 34 Skipped: 95

RespondentID	StartDate	Is there anything else you'd like to share about your use or non-use of chipseals?
4273372900	10/21/2015	Almost appears to be worse on roads with multiple chip seals. Maybe something to do with moisture getting trapped between the chip seal and the wear course.
4273395006	10/21/2015	Based on analysis done on our streets by Tom Wood @ MnDOT, the failure seems to be due to high air voids in the wearing course (possibly due to poor compaction).
4273399156	10/21/2015	Chip seal stripping, from our experience, has been late in the chip seal's life (year 5-7). Our specification on tack material is for a CRS-2P/CRS-2 (MnDOT Spec 3151) with an FA-2 Modified 1/8" aggregate. Not entirely sure if the CRS-2P/CRS-2 material is a polymer modified emulsion or not.
4278472353	10/23/2015	I have observed that the quantity of road salt that is placed on the road in the winter, affects the amount and area where stripping failure occurs. Please contact me if you would like to discuss. By Paul Pearson, PE, Sambatek, Inc. (ppearson@sambatek.com)
4274077158	10/21/2015	I have told our City Council for last 2 years that we no longer should do seal coating. No plans to start it up again.
4273391423	10/21/2015	I'm torn between answering number 6 as "unknown" instead of "no." Most of our roads built since the 90s have been chip sealed. The roads which haven't been chip sealed are really old roads built in the 80s (or earlier) that are now dilapidated in more ways than one.
4274626934	10/21/2015	In general, Albert Lea has not experienced a problem with this.
4273379811	10/21/2015	In regard to 6, we have limited number of non seal coated streets thus no answer. We have experienced striping below seal coat on streets paved around 1997 which is prior to us specifying anti strip additives in the bit pavement mix. The seal coats on those streets appeared to do little to prevent stripping in the mix.
4273428867	10/21/2015	Lakeville has gone away from the use of chip seals primarily because of the raveling issue, but also because we have we have started using c-oil with our bituminous mix designs, and have seen less thermal cracking, and therefore can better manage surface failures with crack filling alone.
4273512769	10/21/2015	Lots of info about non-use that I would love to share! However, the use of chip seals should all come down to a simple question: did the use extend the life of a street and save money. In most cases and in my opinion, it cost cities millions more to use a chip seal vs. not using them. Even if there was just minor stripping and potholes, that cost still negates the benefits of using a chip seal. There are many cities that have not used chip seals and instead put the same money into crack filling and overlays. Their streets look great and they are not looking at spending millions to correct a problem that nobody can with 100% certainty tell us how to correct. If this answer to this question was known, Klayton would not have had to send this survey out.
4274195066	10/21/2015	Not finding chipseals indicated for the distresses associated with local roads. Our focus is on routing and sealing cracks and reserving resources for thin overlays to extend pavement life when patching/ride/visuals prompt complaints. There is discussion from time to time whether some sort of surface treatment is desired by the community for aesthetic purposes.
4276394004	10/22/2015	Only 3 projects done-2008, 2014 & 2015. These are thin sealcoats with a fine FA-2 trap rock.
4273380854	10/21/2015	Our focus is now on mill and overlay as we are dedicating more money to addressing the chip seal issue.
4273393443	10/21/2015	Past practice was to chipseal to the amount budgeted, which resulted in a 50 year rotation on bit streets. We now budget based on a goal of 7 year rotation, with a budget reality of about 12.
4273378017	10/21/2015	Since chip seals have not been used in over 20 years, streets that were sealed have since been overlaid or reconstructed. Not able to give condition related to stripping as a result.

RespondentID	StartDate	Is there anything else you'd like to share about your use or non-use of chipseals?
4273459913	10/21/2015	Spring Lake Park is considering using polymer modified emulsion with our future chipseals.
4273638348	10/21/2015	The answer to question 6 is because we seal coat all of our roads. On question 2, I characterized the problem as "not a major issue" only because we are seeing the failures on roads that were constructed in the 1990's (give or take). Older roads are not showing signs of this type of failure, nor are newer roads.
4273401330	10/21/2015	The City did not have a proactive Pavement Management program until 2002. As a result, we did not have many paving projects in the 1990s. Also, we used to perform sealcoats using our own crews until 2000.
4276855573	10/22/2015	There has not been any stripping issues on our new pavements where we chose not to chip seal.
4273482462	10/21/2015	This is not scientific - the correlation between stripping and seal coating seems to be more associated with pavements in the late 80's and 90's. Previous to that there seems to be less of an issue. Again - not carefully documented or analyzed.
4276693172	10/22/2015	Typically this is bid as part of the City's material bids in the spring and administered and managed by the public works director. I have little say in which roads get treated and the frequency. The public works director does this on an as needed basis as funds are available.
4274773816	10/21/2015	Using the underbelly plows seems to have an effect on removing chip seals on the high spots of the road. We started using the polymer based oil last year and have not had enough time to see if it is better.
4273395125	10/21/2015	Very minor amount of stripping observed. Seemed to be in a few isolated, heavily shaded, flat grad sections. These observations are from WI
4273383483	10/21/2015	we are actually exploring using chip seals again.
4274663236	10/21/2015	We chip seal all newly constructed roadway surfaces within one year of completion.
4273573011	10/21/2015	We continue to chipseal roads that have previously been chipseal but will no long chipseal new pavements due to major issues. Feel free to contact me for more discussion.
4274407207	10/21/2015	We have decided to forgo second round of sealcoat between overlays (or between construction and first overlay) as of 2015.
4291598661	10/29/2015	We have greatly reduced the amount of chip sealing in the last 7 years due to the issues associated with stripping of the chip seal.
4273380373	10/21/2015	We have had success extending the life of our roads by using seal coating.
4273847397	10/21/2015	we have not experienced any stripping problems with our chipseals
4275194344	10/22/2015	We have stopped chipsealing because of the stripping failures. Very frustrating.
4275713929	10/22/2015	We heard about the stripping issues and decided not to use it. We are concerned about all forms of sealcoating.
4273775103	10/21/2015	We just started chip seals this year, so we don't have much history of failures.
4273454365	10/21/2015	We quit chip sealing when the failures occurred on the chip sealed roads and there were no failures on non-chip sealed roads of the same age.



Dynamic Group





Sodium St
Radium St



Tungsten St

NO PARKING
ON
COLLECTOR
DRIVEWAYS



**Bituminous Pavement Stripping Research Findings
City of Ramsey**

January 16, 2020

Findings and Practices of other Cities

- Andover
 - Moving away from sealcoating streets
 - Collects funds for first crackseal of new streets from developers
- Anoka
 - Sealcoating AND fog sealing all streets
 - Cracksealing streets one year before sealcoating/fog sealing
- Brooklyn Park
 - Significant stripping issues since early 2010's
 - More input will be obtained January 17
- Coon Rapids
 - Administers Northwest Metro Pavement Management Group (JPA)
 - Planning to try faster curing fog seal emulsion offered by FHR this year (CQS-1hd50)
 - Crack filling only applied to collector streets (no sealcoats)
 - Sealcoating only applied to local streets
 - Fog sealing only applied to cul-de-sacs
- Saint Michael
 - Stripping issues experienced since mid-2010's.
 - Stopped sealcoating streets 4 years ago.
 - Applying Reclamite to streets with wear course (new and overlays) \leq 2 years old.
- Woodbury
 - Stripping issues first experienced in late 2000's.
 - Stopped sealcoating streets around 2009.
 - Replaced around 85 miles of residential street pavement since 2014
 - Adopted new mix design per MnDOT Tech Memo 17-sa-01
 - Applying Reclamite to all new pavement within 1 year

General Comments and Observations

- Stripping issues are observed more often after the second sealcoat.
- Once stripping is observed it continues to expand.
- Freeze thaw cycles accelerate stripping.
- Based on weather trends, northern climates should expect to experience increased;
 - Rain events each winter, resulting in greater saturation of pavements
 - Freeze-thaw events each winter
- Mill and infill is effective to repair stripping damage *if done before stripping progresses into pavement base course*.
- Pavement rejuvenators (Reclamite, Replay, etc.);
 - Penetrate into pavements roughly 3/8-inch
 - Replace maltenes in oxidized pavements
 - Effectively seal pavement surfaces
 - Numerous U.S. cities have used for decades, including Chicago

Local Road Research Board (LRRB) Pavement Stripping Research Conclusions and Recommendations

- 2013-08 Stripping of Hot-Mix Asphalt Pavements under Chip Seals (Wood & Cole, MnDOT)
 - Conclusions: Stripping of HMA pavement after application of chip seal caused by areas of high air voids or low density.

Bituminous Pavement Stripping Research Findings

City of Ramsey

January 16, 2020

- Recommendations: Agencies should use specified density methods to ensure proper uniform compaction of HMA paving. Three options for addressing existing streets with low density and high air voids variability include:
 1. Do nothing and allow pavement to fail prematurely.
 2. Chip seal early in pavement life, preferably within first 4 years, to keep pavement structure as dry as possible to limit moisture damage.
 3. Fog seal pavement with a CSS-1h diluted to one part water and one part emulsion.
- 2017-35 Prevention of Stripping Under Chip Seals (David L. Rettner, AET)
 - Conclusions:
 1. Study could not verify conclusions of 2013 LRRB research that high air voids is the primary cause of stripping (Wood & Cole, 2013).
 2. Study unable to identify mix designs or construction practices that correlated with incidence of stripping (e.g., bituminous mixture, contractor, geographic location, or year of construction).
 3. Primary conclusion of study is that while stripping under chip seals is a concern, it cannot be addressed with a simple mix design or paving rule of thumb.
 - Recommendations:
 1. Stripping under chip seals may be due to trapped moisture and water vapor between the chip seal and the asphalt pavement. This phenomenon would be similar to stripping behavior observed in conventional overlays of asphalt (Kandhal & Rickards, 2001).
 2. Ensure appropriate drainage in chip-sealed pavements. Utilization of subsurface drainage will reduce the probability of saturated subbase and base layers, which will reduce the amount of moisture moving through pavement.
 3. Minimize trapped water vapor between chip seal and the underlying asphalt. If first lift of pavement is damaged due to insufficient structural capacity to withstand heavy loads, the pavement may already have significant microscopic sized cracks that allow water vapor to be transmitted from subgrade soils into the pavement and be trapped. Causes of this cracking can include staggered construction of bituminous pavement layers across multiple construction seasons subjecting pavement to heavy loads while not at full strength.
 4. Explore use of thin bituminous overlays, approximately five-eighths inches in thickness, as an alternative to chip seal treatments. In Texas, these fine-mix overlays have shown promise as a surface treatment on oxidized pavement and as a surface treatment to extend the life of roadways exhibiting signs of stripping. Studies have shown these thin overlays can extend the service life by an additional three to five years before a mill-and-overlay is required.
 5. Maintain better municipal records on both the paving contractor and paving materials. While many city and county engineers were able to provide valuable detail on their chip-sealed roads for this study, the results and conclusions were limited by a lack of information (see Section 3.4). Detailed records of contractor and materials would benefit future research efforts and municipal efforts to maintain roads.
- NS462 – Is Seal Coating Counterproductive or Not?
 - Study not yet complete.

Public Works Committee

5.3.

Meeting Date: 01/21/2020

By: Bruce Westby, Engineering/Public Works

Title:

Consider City Council Recommendation to Accept Feasibility Report for 2020 Pavement Overlay Improvements, Improvement Project No. 20-02

Purpose/Background:

Purpose:

The purpose of this case is to consider providing a City Council recommendation to accept the Feasibility Report for 2020 Pavement Overlay Improvements, Improvement Project No. 20-02.

Background:

Pavement and Surface Evaluation Rating (PASER) values are assigned annually to all public street segments. Street segments with a PASER value between 3 and 6 indicates the segments may be good candidates for overlays. Overlays are typically completed every 20 years on bituminous pavement sections, until such time that the street needs to be reconstructed.

Overlay improvements increase the structural capacity of the pavement section, and help prevent stormwater runoff from infiltrating into the underlying aggregate base and subgrade sections. Overlays are one tool the City uses to cost-effectively maintain streets over their serviceable life, which when properly constructed is anticipated to be 60 years.

Attached is a figure showing the street segments proposed to receive overlay improvements in 2020 per the 2020 – 2029 Capital Improvement Program (CIP). The streets are located in the following residential developments:

- Klemish and Flores
- Sunfish Square
- Sunfish Square 2nd Addition
- Windemere Woods
- Windemere Woods 2nd Addition

On December 10, 2019, the City Council ordered Staff to prepare a Feasibility Report to explore numerous aspects of the proposed improvements including whether they are feasible, necessary and cost-effective, whether they should be completed alone or in conjunction with other improvements, and to explore design options, if necessary. Estimated project costs and funding sources are also being explored in more detail than was done to develop the Capital Improvement Program (CIP). A preliminary project schedule is also being developed within the Feasibility Report.

(This paragraph was modified January 17th) A copy of the draft Feasibility Report is attached. In summary, the proposed improvements were not found to be feasible and cost-effective from an engineering standpoint, and Staff does not support construction of the 2020 bituminous overlays as identified within the current CIP. These streets would be most cost-effectively maintained by reconstructing them after such time as their PASER ratings fall to a rating of 3 or below. Instead, Staff recommends reviewing the current CIP to identify other street segments for 2020 mill and overlay improvements based on available funding, and authorizing Staff to prepare a new Feasibility Report for proposed 2020 mill and overlay improvements under City Improvement Project No. 20-02.

The proposed improvements are designated as City Improvement Project #20-02, 2020 Overlay Improvements.

Timeframe:

Staff estimates 20 minutes will be required to present this case and respond to questions.

Observations/Alternatives:**Observations:**

No ground penetrating radar or pavement coring data existed for these streets and Staff had intended to complete field reviews and to research as-built plans and other documentation to determine if any of the street segments had degraded to the point that mill and overlay improvements were no longer feasible, meaning the street required reconstruction instead.

While reviewing as-built plans it was determined that the existing pavement sections were generally constructed with less than 3½ inches of pavement, which makes it difficult to complete mill and overlay improvements. Staff therefore contacted WSB and Associates to order pavement corings along each street segment to verify pavement section thicknesses. The corings revealed that the bituminous pavement sections generally varied between 2 and 3 inches. This would make it difficult to complete a standard mill and overlay project. In addition, the corings revealed significant degradation of the pavement in most areas meaning the pavement structure was inadequate to support an overlay in most areas. Staff met with Mr. Thomas Wood from WSB on January 16th to discuss the pavement coring results and options for moving this project forward. Three options were generally identified as being feasible.

The first option would be to repair damaged curb and gutter and complete a variable-depth mill and paving project in 2020 by milling all existing pavements to full depth, then leveling, shaping and compacting the underlying aggregate base, then paving all streets with about 2½ -inches of new bituminous pavement. The cost for this option would be significantly more than a standard 2-inch mill and overlay, and the resulting anticipated pavement life would be roughly 25 years.

The second option would be to repair damaged curb and gutter and reconstruct the streets using a full-depth reclamation process in 2020. Though the cost for this option would be significantly more than the first option, the resulting anticipated pavement life would be 60 years.

The third option would be to wait to reconstruct the streets until the end of the useful life of the pavement, which is estimated to be 5 to 10 years out.

(This paragraph was modified January 17th) Staff recommends the third option as noted in the draft Feasibility Report. If the Feasibility Report is accepted as is, the City Council will be approving Staff's recommendations to not mill and overlay the streets identified within the 2020 - 2029 CIP, but instead review the current CIP to identify other streets that are the best candidates for 2020 mill and overlay improvements based on available funding sources, and authorize Staff to prepare a new Feasibility Report for proposed 2020 mill and overlay improvements under City Improvement Project No. 20-02.

This winter and spring, Staff intends to review our current pavement rating system and processes for adding pavement management projects to the Capital Improvement Plan (CIP) to ensure that projects included in the CIP moving forward are identified accurately and can be constructed as proposed.

Before the pavement coring results were received and Staff was able to discuss the findings with Mr. Wood from WSB, notices were mailed to property owners having direct access to streets proposed to receive mill and overlay improvements inviting them to a public engagement workshop on Wednesday, January 22nd. The purpose of the workshop was to explain the need for and scope of the proposed improvements, anticipated construction impacts, estimated costs, proposed funding program, and preliminary project schedule. Based on the findings of the pavement corings and Staff's discussions with Mr. Wood from WSB, a second letter was mailed to the same property owners on January 17th canceling the workshop for January 22nd.

Alternatives:

Alternative #1 – Motion to recommend City Council acceptance of the Feasibility Report for the 2020 Pavement

Overlay Improvements, Improvement Project No. 20-02.

Alternative #2 – Motion of other.

Funding Source:

The Feasibility Report was prepared in-house as part of Staff's normal duties.

Recommendation:

Staff recommends alternative #1.

Action:

Motion to recommend City Council acceptance of the Feasibility Report for the 2020 Pavement Overlay Improvements, Improvement Project No. 20-02.

Attachments

2020 Overlays Map

Draft Feas Rpt IP2002

Form Review

Inbox

Grant Riemer
Kurt Ulrich
Bruce Westby (Originator)
Form Started By: Bruce Westby
Final Approval Date: 01/17/2020

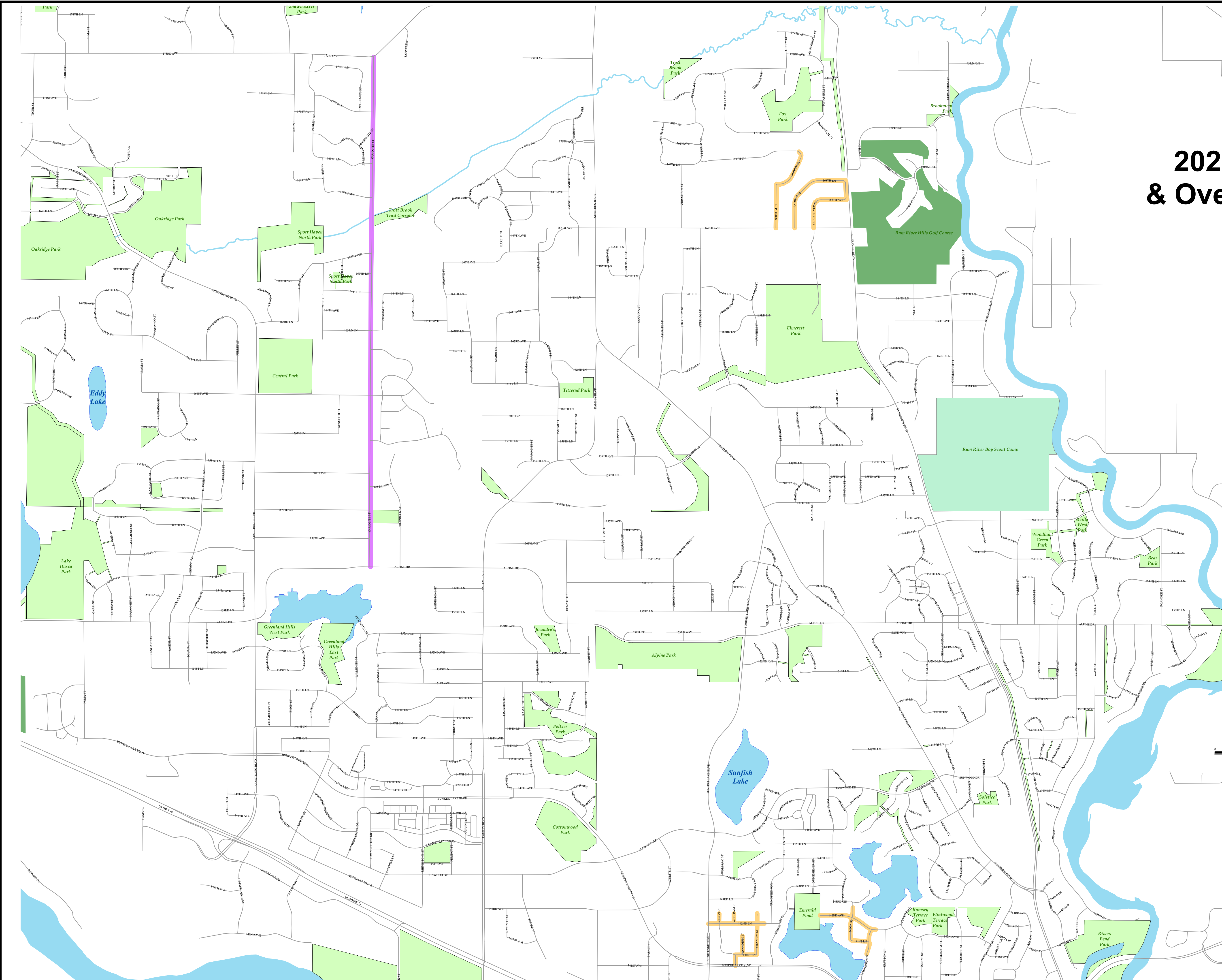
Reviewed By

MaryJo Warner
Kurt Ulrich
Bruce Westby

Date

01/16/2020 04:03 PM
01/16/2020 04:10 PM
01/17/2020 02:21 PM
Started On: 01/14/2020 08:12 AM

Draft 2020 Reconstruction & Overlay Improvements



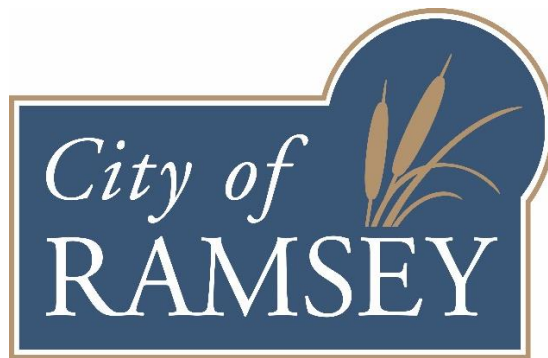
Legend	
	Road_Centerlines
	Overlays
	Reconstruction
	ScoutCamp
	Golf_Courses
	Parks
	Rivers
	Lakes_Ponds
	Creeks

December 2019

FEASIBILITY REPORT

2020 PAVEMENT OVERLAY IMPROVEMENTS

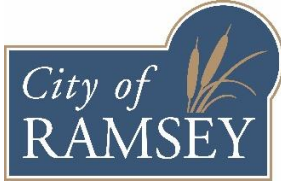
CITY IMPROVEMENT PROJECT NO. 20-02



January 20, 2020

Prepared By:

**City of Ramsey
Engineering Department
7550 Sunwood Drive NW
Ramsey, MN 55303
763-433-9839
763-433-9848 (Fax)**



January 17, 2020

Honorable Mayor and City Council
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

Re: Feasibility Report – City of Ramsey Improvement Project #20-02
2020 Pavement Overlay Improvements

Dear Mayor and City Council Members:

Transmitted herewith is a Feasibility Report for the proposed 2020 Pavement Overlay Improvements, Improvement Project No. 20-02.

The report examines the feasibility of completing 2-inch bituminous pavement mill and overlay improvements on approximately 19,612 square yards of bituminous pavement on 1.51 miles of public streets in three residential neighborhoods within the City, and necessary appurtenant improvements.

This Feasibility Report examines the scope of the proposed improvements, explores estimated costs and available funding sources, defines a preliminary project schedule, and determines the necessity, feasibility and general cost-effectiveness of the proposed improvements, including any alternate designs, as well as whether the improvements would best be completed separately or in conjunction with another project.

I would be happy to discuss this report with you at your convenience. Please feel free to contact me at 763-433-9825 or bwestby@cityoframsey.com with any questions.

Sincerely,
City of Ramsey

Bruce Westby, PE
City Engineer

Enclosure

C: Kurt Ulrich, City Administrator
Joe Feriancek, Civil Engineer II

CERTIFICATION

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Bruce Westby, PE

Date: January 17, 2020

License No. 40116

I hereby certify that this plan, specification or report was reviewed for Quality Control and Quality Assurance purposes and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Joe Feriancek, PE

Date: January 17, 2020

License No. 57095

TITLE SHEET
LETTER OF TRANSMITTAL
CERTIFICATION SHEET
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Appendix A

- Project Scope – Klemish, Klemish & Flores
- Project Scope – Sunfish Square, Sunfish Square 2nd
- Project Scope – Windemere Woods, Windemere Woods 2nd

Appendix B

- Opinion of Probable Costs

Appendix C

- Street Segment Summary

Appendix D

- WSB Pavement Forensics Report

1. EXECUTIVE SUMMARY

City Improvement Project 20-02 proposed to complete 2-inch bituminous pavement mill and overlay improvements to numerous public street segments within the City of Ramsey, including other associated appurtenant improvements as outlined in this report. Approximately 19,612 square yards of bituminous pavement on 1.51 miles of public streets in the City were proposed to receive bituminous pavement overlay improvements in 2020 per the City's 10-Year Capital Improvement Program (CIP). The street segments are located in the residential neighborhoods of Klemish, Klemish & Flores, Sunfish Square, Sunfish Square 2nd, Windemere Woods, Windemere Woods 2nd.

Appendix A includes exhibits showing the proposed project areas.

City Staff typically rates the pavement sections of all city streets on an annual basis using the Pavement Surface Evaluation and Rating (PASER) system. The last three years of PASER rating for each street segment proposed to receive an overlay with this project is included in the street segments summary found in *Appendix B*.

On December 10, 2019, the Ramsey City Council ordered this feasibility report which explores the necessity, feasibility and cost-effectiveness of the proposed improvements by examining the scope of the improvements, exploring estimated costs and available funding sources, and determining whether the improvements should be completed as proposed or in connection with other improvements.

The engineer's opinion of probable costs for the project as proposed is \$538,661.97. Estimated costs include 10% contingency costs, plus 14% indirect costs for administrative, engineering, finance and legal costs.

The improvements proposed with this project are identified in the City's current 10-year Capital Improvement Program, and can be funded using a combination of Road Reconstruction Funds, special assessments to benefitting properties, and Stormwater Funds. *Appendix C* includes a detailed opinion of probable costs.

The proposed improvements were not found to be feasible and cost-effective from an engineering standpoint, and Staff does not support construction of the 2020 bituminous overlays as proposed herein. The proposed street segments would be most cost-effectively reconstructed after such time as their PASER ratings fall to a 3 or below. Instead, Staff recommends reviewing the current CIP to identify other street segments for 2020 mill and overlay improvements based on available funding, and authorizing Staff to prepare a new Feasibility Report for proposed 2020 mill and overlay improvements under City Improvement Project No. 20-02.

2. INTRODUCTION

2.1 Authorization

Preparation of this feasibility report was authorized by the Ramsey City Council on December 10, 2019

2.2 Program Overview

This project is designated as 2020 Pavement Overlay Improvements, Improvement Project No. 20-02.

This feasibility report explores proposed bituminous pavement mill and overlay improvements to approximately 19,612 square yards of public streets within several residential neighborhoods of the City. The street segments were proposed to receive 2-inch bituminous mill and overlay improvements. Associated appurtenant improvements were also proposed to be completed as necessary and as outlined in this report.

Maps showing the scope of the proposed improvements are included in *Appendix A*.

2.3 Scope

The scope of this report addresses proposed mill and overlay improvements to approximately 19,612 square yards of public streets within several residential neighborhoods of the City as shown in *Appendix A*.

3. EXISTING CONDITIONS

3.1 Existing Streets

3.1.a Klemish, Klemish & Flores neighborhood

The existing right-of-ways along the street segments proposed in the 10-year CIP to receive overlays as part of this project generally are 66-feet in width. The paved street width is 24-feet as measured from the edge of bituminous. All streets in this project were constructed as a rural section, with bituminous pavement and ditches.

The streets segments proposed to receive overlays in 2020 have 2018 PASER ratings of 5, with the exception of Sodium Street which had one section of pavement with a 2018 PASER rating of 8. In 2019 these PASER ratings fell to 3, with the exception of Sodium Street which half the street was rated a 4 and the other half 5. Staff determined this neighborhood was structurally beyond an overlay improvement, with the exception of Sodium Street.

WSB was employed to complete a pavement forensics, which included pavement corings of the proposed overlay street segments. This included 2 corings on Sodium Street; both cores were in poor condition, which showed degradation and deterioration. The WSB pavement forensics report is included in *Appendix D* of this report.

Based on the manner in which the existing pavement is deteriorating, Staff does not support completing an overlay improvement for the Klemish and Klemish & Flores neighborhood. The existing streets are still serviceable with moderate maintenance patching. Staff recommends not completing a more involved full-depth reclamation (FDR) or reconstruction project at this time.

3.1.b Sunfish Square, Sunfish Square 2nd neighborhood

The existing right-of-ways along the street segments proposed in the 10-year CIP to receive overlays as part of this project generally are 60-feet in width. The paved street width is 31-feet as measured from the back-of-curb. All streets in this project were constructed with bituminous pavement and concrete curbing, and many of the street segments contain storm sewer.

The street segments proposed to receive overlays in 2020 in the Sunfish Square and Sunfish Square 2nd subdivisions had 2017 PASER ratings of 7, and 2018 PASER ratings of 5. Staff did not rate these street segments in 2019. When visually inspecting the street segments in December, Staff felt there would be several areas which would require full-depth patching, and the overlay would likely have high amounts of reflective cracking.

WSB was employed to complete a pavement forensics, which included 6 pavement corings spread out among the street segments. Of the 6 corings, 4 were in good condition, 1 was starting to show signs of deterioration, and 1 was in poor condition showing deterioration. The bituminous depth ranged from 2 to 3-inches thick, with 3.5 to 4.5-inches of aggregate below.

The WSB pavement forensics report is included in *Appendix D* of this report.

The street segments were all constructed in 1994 through 1995, and in their 25 to 26-year lifespan have received 3 sealcoats and no overlays. Most of the streets within this neighborhood would still be a candidate for an overlay, in conjunction with full-depth patching, but not all. Staff does not recommend selectively completing overlay improvements on street segments within the same neighborhood, and does not support completing an overlay improvement on the Sunfish Square and Sunfish Square 2nd neighborhoods at this time. With the limited financial resources of the City, Staff recommends maintaining the existing streets until such time as they have degraded to a level requiring reconstruction.

3.1.c Windemere Woods, Windemere Woods 2nd neighborhood

The existing right-of-ways along the street segments proposed in the 10-year CIP to receive overlays as part of this project generally are 60-feet in width. The paved street width is 31-feet as measured from the back-of-curb. All streets in this project were constructed with bituminous pavement and concrete curbing, and many of the street segments contain storm sewer.

The street segments proposed to receive overlays in 2020 in the Windemere Woods and Windemere Woods 2nd subdivisions had 2017 PASER ratings of 8, 2018 PASER ratings varied from 5 to 8, and 2019 ratings varied from 3 to 7. When visually inspecting the street segments in December, Staff felt there were large areas which would require full-depth patching, particularly Magnesium Street, which would require several hundred feet of full-depth patching and full curb and gutter replacement.

WSB was employed to complete a pavement forensics, which included 4 pavement corings spread out among the street segments. Of the 4 corings, 2 were in good condition, 1 was in poor condition showing deterioration, and 1 was in very poor condition being severely deteriorated. The bituminous depth ranged from 2 to 3.25-inches thick, with 4 to 4.5-inches of aggregate below. The WSB pavement forensics report is included in *Appendix D* of this report.

The street segments were all constructed in 1992, and in their 28-year lifespan have received 3 sealcoats and no overlays. Half of the streets are well beyond overlay improvements, while the other half could still be overlaid with bituminous patching. Staff does not recommend selectively completing overlay improvements on street segments within the same neighborhood, and does not support completing overlay improvements on the Sunfish Square and Sunfish Square 2nd neighborhoods at this time. With the limited financial resources of the City, Staff recommends maintaining the existing streets until such time as they have degraded to a level requiring reconstruction.

3.2 Utilities

3.2.a Watermain

Watermain exists under all streets within the Sunfish Square, Sunfish Square 2nd, Windemere Woods, and Windemere Woods 2nd neighborhoods. No improvements to the watermain is proposed in conjunction with this project. Watermain does not exist under any of the streets within the Klemish, and Klemish & Flores neighborhoods.

3.2.b Sanitary Sewer

Sanitary Sewer exists under all the streets within the Sunfish Square, Sunfish Square 2nd, Windemere Woods, and Windemere Woods 2nd neighborhoods. No improvements to the sanitary sewer is proposed in conjunction with this project. Sanitary Sewer does not exist under any of the streets within the Klemish, and Klemish & Flores neighborhoods.

3.2.c Storm Sewer/Drainage

Storm sewer exists under several of the streets within the Sunfish Square, Sunfish Square 2nd, Windemere Woods, and Windemere Woods 2nd neighborhoods, but it is not proposed to complete any significant repairs or storm sewer construction as part of this project. Drainage within the Klemish, and Klemish & Flores neighborhood is handled with ditching, and is not proposed to be improved as part of this project.

4. CONSIDERED IMPROVEMENTS

4.1 Project Area Selection

The City's 10-year Capital Improvement Program calls for proposed 2020 overlay improvements on several street segments in the Klemish, Klemish & Flores, Sunfish Square, Sunfish Square 2nd, Windemere Woods, and Windemere Woods 2nd residential neighborhoods. In total, approximately 19,612 square yards of pavement was proposed to receive overlay improvements in 2020. The scope of these proposed improvements is included in **Appendix A** of this report.

4.2 Pavement Condition Evaluations/Ratings

City Staff generally evaluates and rates the pavement conditions of all city streets on an annual basis using the Pavement Surface Evaluation and Rating (PASER) system. This system requires a visual evaluation of each pavement surface, which is reflected by a 0 to 10 scale, with 10 being a new street. The PASER Ratings of the streets proposed for 2020 overlays fell significantly from 2017 when they were originally placed in the CIP to 2019. Ratings were generally 5 for Klemish/Klemish & Flores, 7 for Sunfish Square/Sunfish Square 2nd, and 8 for Windemere Woods/Windemere Woods 2nd in 2017. By 2019 these ratings fell to a range of 3 to 7, with rating point drops by as many as 5 on some street segments. A PASER rating summary of the proposed street segments is included in **Appendix B** of this report.

4.3 Bituminous Overlay Review

Staff reviewed this project from the traditional overlay procedure. The rural sections in the Klemish, and Klemish & Flores neighborhood, has previously received an overlay. Staff proposed to complete a 6 to 7-foot edge mill of the pavement, down to 2-inches along the outside edge of the pavement, followed by a 2-inch bituminous overlay. This allows the edge of the pavement to match existing driveways, and builds up the crown of the road. The urban sections in the Sunfish Square, and Windemere Woods neighborhoods proposed to receive a 2-inch mill, followed by a 2-inch bituminous overlay. While reviewing the proposed streets, Staff discovered the pavement has deteriorated in several areas, beyond the point where a bituminous overlay is feasible.

An engineer's estimate was completed for the proposed project areas, with the exception of all of Klemish outside of Sodium Street. To complete the bituminous overlay as described above, the project costs are estimated to be \$538,661.97.

Staff felt this was not a cost-effective solution, given the poor condition of the streets, which in general are distressed beyond a typical bituminous overlay treatment.

4.4 Full-Depth Reclamation

In the recent past, including the 2017 and 2018 reconstruction programs, streets with similar conditions received full-depth reclamation treatments. This included grinding up the existing bituminous pavement and underlying aggregate base, after which 3.5-inches of the reclaimed material is removed with the remaining used as new aggregate base. Then 3.5-inches of new bituminous pavement is placed on top. In general, the streets are still at the stage where with maintenance, Staff feels they can be useful for 5 to 10 years to come, and the City's limited funds can be spent on streets which are better candidates for overlays, or are ready for reconstruction.

An engineer's estimate was completed for the proposed project areas, with the exception of all of Klemish outside of Sodium Street. To complete the full-depth reclamation as described above, the project costs are estimated to be \$751,863.92.

Staff felt this was not a cost-effective solution, and given the limited funding available there are other City streets which are at the proper condition for overlay treatments.

5. CONCLUSIONS AND RECOMMENDATIONS

This feasibility report explores proposed bituminous pavement overlay improvements to approximately 19,612 square yards of public streets in 2020. The street segments were proposed to receive 2-inch bituminous overlays, in conjunction with milling and full-depth patching as needed. Full-depth reclamation options were also looked at for the proposed street segments as a possible alternative to the poor conditions found during Staff review of the streets.

It is the recommendation of City Staff that the 2020 mill and overlay improvements as proposed in the current CIP not be completed under City Improvement Project No. 20-02 since these improvements are not generally feasible or cost-effective from an engineering standpoint. Instead, Staff recommends reviewing the current CIP to identify other street segments as the best candidates for 2020 mill and overlay improvements based on available funding sources, and authorizing Staff to prepare a new Feasibility Report for proposed 2020 mill and overlay improvements under City Improvement Project No. 20-02.

DRAFT

APPENDIX A

Project Scope – Klemish, Klemish & Flores

Project Scope – Sunfish Square, Sunfish Square 2nd

Project Scope – Windemere Woods, Windemere Woods 2nd

DRAFT



STATE HIGHWAY No. 47

KLEMISH / KLEMISH & FLORES PROJECT SCOPE





SUNFISH SQUARE 1ST & 2ND PROJECT SCOPE





**WINDEMERE WOODS 1ST & 2ND
PROJECT SCOPE**



APPENDIX B

Street Segment History

DRAFT

APPENDIX C

Engineer's Estimate

DRAFT

20-02 2020 Street Overlay Improvements						
Engineer's Estimate						
All Areas						
ITEM No.	MNDOT No.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	COST EXTENSION
1	2021.501	MOBILIZATION (5%)	LS	1	\$ 20,400.00	\$ 20,400.00
2	2231.604	BITUMINOUS PATCH	SY	2,470	\$ 20.00	\$ 49,400.00
3	2232.501	EDGE MILL BITUMINOUS PAVEMENT 7' X (0" - 2")	SY	3,140	\$ 2.00	\$ 6,280.00
4	2232.501	MILL BITUMINOUS PAVEMENT	SY	19,610	\$ 1.50	\$ 29,415.00
5	2357.502	BITUMINOUS MATERIAL FOR TACK COAT	GAL	1,760	\$ 3.00	\$ 5,280.00
6	2360.501	TYPE SP 9.5 WEARING COURSE MIXTURE (SPWEA340C) (2.0")	TON	2,770	\$ 90.00	\$ 249,300.00
7	2506.602	RESET CATCH BASIN / MANHOLE CASTING	EA	14	\$ 1,000.00	\$ 14,000.00
8	2531.501	REMOVE & REPLACE CONCRETE CURB & GUTTER DESIGN SURMOUNTABLE	LF	840	\$ 50.00	\$ 42,000.00
9	2531.604	REMOVE & REPLACE 7" CONCRETE VALLEY GUTTER	SY	131	\$ 80.00	\$ 10,480.00
10	2563.601	TRAFFIC CONTROL	LS	1	\$ 3,000.00	\$ 3,000.00
<i>Non-Assessable Construction Cost</i>						\$ 49,400.00
<i>Street Construction Cost</i>						\$ 366,155.00
<i>Storm Sewer Construction Cost</i>						\$ 14,000.00
<i>2020 Overlay Program Construction Cost</i>						\$ 429,555.00
<i>10% Contingency Cost</i>						\$ 42,955.50
2020 Overlay Program Project Cost (14% Indirect Cost)						\$ 538,661.97
<i>Total Project Assessments (25% of Assessable Cost)</i>						\$ 120,589.90
Miles	0.38	Klemish / Klemish & Flores Individual Assessment (20 Properties)				\$ 1,054.30
Miles	0.38	Sunfish Square Individual Assessment (33 Properties)				\$ 991.50
Miles	0.15	Sunfish Square 2nd Individual Assessment (34 Properties)				\$ 516.60
Miles	0.31	Windemere Woods Individual Assessment (28 Properties)				\$ 1,005.00
Miles	0.29	Windemere Woods 2nd Individual Assessment (25 Properties)				\$ 843.20
Total Miles	1.51					
<i>Stormwater Utility Fund</i>						\$ 13,167.00
Road Reconstruction / Overlay Fund						\$ 404,905.07

20-02 2020 Street Overlay Improvements
Engineer's Estimate - Assuming Full Depth Reclamation (FDR)

<i>All Areas</i>						
ITEM No.	MNDOT No.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT COST	COST EXTENSION
1	2021.501	MOBILIZATION (5%)	LS	1	\$ 25,000.00	\$ 25,000.00
2	2215.501	BITUMINOUS PAVEMENT RECLAMATION (FULL DEPTH)	SY	25,130	\$ 1.25	\$ 31,412.50
3	2331.607	HAUL AND DISPOSE BIT PAVEMENT RECLAMATION (LV)	CY	3,050	\$ 15.00	\$ 45,750.00
4	2357.502	BITUMINOUS MATERIAL FOR TACK COAT	GAL	1,760	\$ 3.00	\$ 5,280.00
5	2360.502	TYPE SP 12.5 NON-WEARING COURSE MIXTURE (SPNWB330C) (2.0")	TON	2,770	\$ 85.00	\$ 235,450.00
6	2360.501	TYPE SP 9.5 WEARING COURSE MIXTURE (SPWEA340C) (1.5")	TON	2,080	\$ 90.00	\$ 187,200.00
7	2506.602	RESET CATCH BASIN / MANHOLE CASTING	EA	14	\$ 1,000.00	\$ 14,000.00
8	2531.501	REMOVE & REPLACE CONCRETE CURB & GUTTER DESIGN SURMOUNTABLE	LF	840	\$ 50.00	\$ 42,000.00
9	2531.604	REMOVE & REPLACE 7" CONCRETE VALLEY GUTTER	SY	131	\$ 80.00	\$ 10,480.00
10	2563.601	TRAFFIC CONTROL	LS	1	\$ 3,000.00	\$ 3,000.00
<i>Street Constructon Cost</i>						\$ 585,572.50
<i>Storm Sewer Construction Cost</i>						\$ 14,000.00
<i>2020 Overlay Program Construction Cost</i>						\$ 599,572.50
<i>10% Contingency Cost</i>						\$ 59,957.25
2020 Overlay Program Project Cost (14% Indirect Cost)						\$ 751,863.92
<i>Total Project Assessments (25% of Assessable Cost)</i>						\$ 187,964.00
Miles	0.38	Klemish / Klemish & Flores Individual Assessment (20 Properties)				\$ 1,849.20
Miles	0.38	Sunfish Square Individual Assessment (33 Properties)				\$ 1,543.00
Miles	0.15	Sunfish Square 2nd Individual Assessment (34 Properties)				\$ 775.30
Miles	0.31	Windemere Woods Individual Assessment (28 Properties)				\$ 1,441.10
Miles	0.29	Windemere Woods 2nd Individual Assessment (25 Properties)				\$ 1,334.00
Total Miles	1.51					
<i>Stormwater Utility Fund</i>						\$ 13,167.00
Road Reconstruction / Overlay Fund						\$ 550,732.92

APPENDIX D

WSB Pavement Forensics Report

DRAFT

Public Works Committee

6. 1.

Meeting Date: 01/21/2020

By: Bruce Westby, Engineering/Public Works

Title:

Receive Update on Bunker Lake Boulevard Reconstruction - Armstrong Boulevard to Ramsey Boulevard

Purpose/Background:

Purpose:

The purpose of this case is to receive an update on the Bunker Lake Boulevard Reconstruction project between Armstrong Boulevard and Ramsey Boulevard, including attempts to amend the Ramsey Town Center Joint Powers Agreement.

Background:

In April of 2005, a Joint Powers Agreement (JPA) was executed between the City of Ramsey and Anoka County defining required public works improvements related to the Ramsey Town Center development, now referred to as The COR. Two amendments have been executed since, one in February of 2009, and the other in February of 2012. A copy of the executed JPA, including the two amendments, is attached.

The required public works improvements, which total slightly more than \$13,000,000 in 2005 dollars, are generally intended to be constructed in four separate phases per the JPA. Individual project cost summaries are included in Schedules A through C. The JPA outlines the requirements of each party as related to the design and construction of the improvements, allowable use and access to County-owned properties and highways, and other terms and conditions.

Phase 1 identifies required improvements to Ramsey Boulevard from Highway 10 to 1,000 feet north of Bunker Lake Boulevard including expansion to a four lane divided highway with turn lanes and signal system modifications at Highway 10, railway crossing upgrades, and signal systems installed at Sunwood Drive and Bunker Lake Boulevard. **This work has been completed.**

Phase 2 identifies required improvements to Armstrong Boulevard from Highway 10 to 1,000 feet north of Bunker Lake Boulevard including expansion to a four lane divided highway with turn lanes and signal system modifications at Highway 10, railway crossing upgrades, and signal systems installed at Sunwood Drive and Bunker Lake Boulevard. **This work has been completed.**

Phase 3 is one of the larger and more costly improvements required by the JPA. This work includes the expansion of Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard to a four lane divided highway with turn lanes and construction of signal systems at Center Street and Sunwood Drive. This project was estimated to cost \$3,170,109 in 2005. **This work has not been completed and was originally intended to be completed in 2007 based on anticipated development, but was delayed when development slowed in the late 2000's.**

Phase 4 identifies required improvements to Sunfish Lake Boulevard from Highway 10 to 1,000 feet north of Bunker Lake Boulevard including expansion to a four lane divided highway with turn lanes and signal system modifications at Highway 10, railway crossing upgrades, and a signal system installed at Bunker Lake Boulevard. **This work has been completed.**

In the fall of 2019, Anoka County Highway Department staff informed City staff they want to expand Bunker Lake Boulevard to a four lane divided highway between Sunfish Lake Boulevard and Armstrong Boulevard in anticipation of the need for a reliever route due to the work proposed to Highway 10 through the cities of Coon

Rapids (adding a third lane to Highway 10 in each direction) and Anoka (the Anoka Solution improvements). Anoka County is starting to explore their right of way needs related to expanding Bunker Lake Boulevard between Sunfish Lake Boulevard and Ramsey Boulevard, and asked that the City of Ramsey begin designing the required improvements for Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard per the JPA.

City Staff then began developing a Request for Proposals (RFP) to solicit engineering services for completing a traffic study and preparing plans and specifications for improvements to Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard. Before presenting a draft RFP to the City Council to request authorization to solicit proposals from Anoka County approved engineering consultants, the Public Works Committee was asked to recommend City Council approval of the request on November 19, 2019.

While addressing the Public Works Committee on November 19th, the Committee asked Staff why the City would be responsible for paying and improving a County road. It was also noted that the Committee wanted to better understand the reasoning for the terms within the JPA that require the City to finance and construct County Road 116 / Bunker Lake Boulevard, and that if the City is responsible for building and financing the improvements, the City should have additional say in which access points are allowed onto the roadway. The Committee ultimately directed Staff to gather additional information on the history of the terms and conditions in the JPA, and to discuss options with Anoka County related to renegotiating the JPA, working together to find efficiencies, and opportunities for additional access onto Bunker Lake Boulevard.

City Staff contacted the City's former Public Works Director who was primarily charged with executing the JPA on behalf of the City of Ramsey, to inquire why the City agreed to upgrade the County Road to a 4-lane section. His response was that this was the proposed design per the mitigation section (Appendix C) of The COR AUAR (see italicized text below).

ITEM 21. TRANSPORTATION

Bunker Lake Boulevard (formerly Industry Avenue)—widen to five lane cross section west of Ramsey Boulevard to provide two through lanes in each direction and a left turn lane/center median.

City Staff also contacted Anoka County Engineer Joe MacPherson per the Committee's direction. He said he was open the idea of discussing the renegotiation of terms within the JPA regarding the reconstruction of Bunker Lake Boulevard and the number of allowable accesses to it, but first he wanted to review the JPA with some of his staff. City staff is still waiting for a return call.

Timeframe:

Staff anticipates this case will take approximately 15 minutes to present and respond to questions.

Observations/Alternatives:

Additional information, if available, will be presented during the meeting. There is no set schedule at this time for moving this item forward so Staff plans to present new information to the Committee each month as it becomes available.

Funding Source:

Attached is a copy of the project summary sheet from the adopted 2020 – 2029 CIP, which identifies estimated project costs and proposed funding sources.

Recommendation:

N/A

Action:

This case is informational only. No action is required at this time.

Attachments

RTC JPA

2020-2029 CIP Project Sheet

BLB Aerial Image

Form Review

Inbox

Grant Riemer

Kurt Ulrich

Form Started By: Bruce Westby

Final Approval Date: 01/16/2020

Reviewed By

MaryJo Warner

Kurt Ulrich

Date

01/16/2020 04:03 PM

01/16/2020 04:09 PM

Started On: 01/14/2020 08:10 AM



COPY

Anoka County Contract No. 2005-0516

**JOINT POWERS AGREEMENT
BETWEEN ANOKA COUNTY AND THE CITY OF RAMSEY
FOR THE PUBLIC WORKS IMPROVEMENTS
RELATED TO THE RAMSEY TOWN CENTER DEVELOPMENT
RAMSEY, MINNESOTA**

This Agreement is made and entered into this 12th day of April, 2005, by and between the County of Anoka, a political subdivision of the State of Minnesota, 2100 3rd Avenue North, Anoka, Minnesota 55303, hereinafter referred to as the "County," and the City of Ramsey, 15153 Nowthen Boulevard, Ramsey, Minnesota 55303, hereinafter referred to as the "City."

WITNESSETH:

WHEREAS, the City has entered into a development agreement with Ramsey Town Center, L.L.C. for the development of the Ramsey Town Center (hereinafter referred to as "RTC") between Trunk Highway 10, County Road No. 116, County State Aid Highway 83, and County Road No. 56, which project would require the major reconstruction and expansion of both County and State highways, as well as construction and extension of utilities to serve the RTC and surrounding areas; and,

WHEREAS, the RTC development is intense and will have a substantial impact on the movement of traffic on Trunk Highway 10, County Road No. 56, County State Aid Highway No. 83, and County Road No. 116 in the City of Ramsey as well as impacts on County State Aid Highway No. 57 in the City of Ramsey; and,

WHEREAS, because of the substantial development, significant improvements need to be made to the highway/road infrastructure; and,

WHEREAS, the City does not have sufficient funds available to pay for the cost of the improvements necessary for the development of the RTC; and,

WHEREAS, the City has proposed to use funds generated by RTC together with funds to be contributed by the County as hereinafter set forth, and other funds of and available to the City, to pay for said improvements; and,

WHEREAS, the parties hereto have agreed in principal as to the nature and extent of the improvements to be made, which improvements are described in Schedules A, B, and C (the Schedules), which are attached hereto and incorporated herein by reference and which are hereinafter collectively referred to as the "Improvements"; and,

Y100

WHEREAS, the parties hereto agree that the cost of certain of the Improvements be shared by the parties; and,

WHEREAS, the parties have agreed that it is in their best interest that the City undertake the construction of the Improvements on behalf of both parties, except as provided herein; and,

WHEREAS, Minn. Stat. § 471.59 authorizes political subdivisions of the State to enter into joint powers agreements for the joint exercise of powers common to each;

NOW, THEREFORE, it is mutually stipulated and agreed as follows:

1. PURPOSE

The parties have joined together for the purpose of constructing and/or reconstructing the roadways, drainage, trails, sidewalk, traffic control systems with EVP, as well as other utilities on a portion of County State Aid Highway No. 83 and County Road Nos. 116 and 56 and other improvements as described in the Schedules and to share in the cost of certain of said improvements, as provided hereinafter.

2. METHOD

The City shall provide all engineering services, and shall cause the construction of the Improvements referred to in the Schedules in conformance with plans and specifications to be prepared by the City and approved in writing by the County as to the Improvements to be made to the County highway system, except for those projects where the County is the lead agency as hereinafter provided. All design on County State Aid Highways and County Roads shall be based on a County approved Traffic Analysis and a sketch plan which clearly shows projected peak hour turning volumes and lane configuration at all intersections. The letting of bids and acceptance of all bid proposals shall be done by the City, except as hereinafter provided. All plans and specifications submitted to the County for review and approval shall include a detailed traffic control plan for all state and county roadways involved in the reconstruction projects. The plans and specifications must include a requirement for the contractor to obtain permits from both the state and county prior to commencing work on the facilities controlled by the State or County from the appropriate agency. All plans and specifications must be submitted to the County for review and comment a minimum of sixty (60) days prior to the advertisement for bids for work which impacts any of the county facilities located in and around the proposed development.

3. USE OF COUNTY PROPERTY

- A. The County agrees to accommodate the storm water pipe and storage ponds for the RTC development on property located south of T.H. 10. Three issues need to be resolved to the satisfaction of the County by the City. First, the site has been secured with the intention of building a river crossing approach on that property. Secondly, the existence of a five year "License Agreement" with Diamonds Sports Bar and Grill for the use of the property for special events. There is at least an expectation that Diamonds Sports Bar and Grill would be compensated for their costs, should the property be unavailable to them for the initial five year period ending February 2008. Third, the alternate use of that property from the County perspective would be as replacement property for a County project related to "4-F" or "6-F" encroachment elsewhere in the County.
- B. The City is to agree that they will be responsible to find, design, construct and pay for drainage and storage alternatives if the river crossing is built in this corridor.
- C. The City will facilitate the cancellation of the five-year parking agreement with Gary Gruber at Diamonds Sports Bar and Grill. At a minimum, the City must obtain a letter from Diamonds Sports Bar and Grill which allows the County to rescind the existing license agreement between the County and Diamonds Sports Bar and Grill at no cost to the County.
- D. The City will assist the County in finding suitable replacement property for 4F or 6F encroachments on other park land for a potential river crossing between Dayton and Ramsey, regardless of the alignment. The City's responsibility in the procurement of replacement property for 4F or 6F impacts will be limited to the acquisition of 4.47 acres of replacement property with a value of not less than \$447,000.

4. ACCESS TO COUNTY HIGHWAY

- A. Only three (3) full turn accesses will be allowed from the RTC development to Bunker Lake Boulevard (C.R. 116). These accesses will line up with accesses on the north side of Bunker Lake Boulevard (C.R. 116) for a total of six access points as directed in the Highway 116 Corridor Study. No additional right-in, right-out accesses onto Bunker Lake Boulevard (C.R. 116) are being allowed at this time. This provision is in agreement with the original Joint Powers Agreement between the City and the County at the time the roadway (C.R. 116) was constructed.
- B. A total of three accesses are acceptable along the west side of Ramsey Boulevard (C.R. 56) as follows:

- (1) A full access with Sunwood Drive, a three quarter turn access at what is to be known as Ramsey Parkway (northbound Ramsey Boulevard left onto westbound Ramsey Parkway). The City would close the left turn movements onto Ramsey Parkway at Ramsey Boulevards when traffic operation issues arise. No signalization will be requested at this location.
 - (2) A three quarter turn access located in the south east corner of the development property will be used for emergency vehicles (left turns out of the RTC eastbound to northbound Ramsey Boulevard). The City would post the access as emergency only and would be committed to stop illegal use by issuing tickets or installing a gate. This access point would be posted and special consideration would be given to the use of a traffic control device (i.e. gate or stop arm) to prohibit unauthorized use.
 - (3) No additional full access points will be allowed on the east side of Ramsey Blvd.
- C. A total of two accesses along the east side of Armstrong Boulevard (C.S.A.H. 83) as follows:
- (1) A full-turn access where Sunwood Drive exits the RTC development onto Armstrong Boulevard (C.S.A.H. 83), and a three quarter turn at what is to be known as Ramsey Parkway (southbound Armstrong Boulevard left onto Ramsey Parkway). The City would close the left turn movements onto Ramsey Parkway at Armstrong Boulevards when traffic operation issues arise. No signalization will be requested at this location.
 - (2) No additional full access points will be allowed along the west side of Armstrong Blvd.
- D. Future signal systems at Sunwood Drive and Armstrong Boulevard and at Sunwood Drive and Ramsey Boulevard may need railroad pre-emption so that the queue at the signals does not back up over the tracks (northbound green prior to train arrival). The City will coordinate this design with the BNSF Rail Road and MnDOT. The County's position is that these signals should be coordinated with the respective railroad signals and Traffic control signals on TH 10. This may require the County and City to enter into a separate agreement with BNSF and MnDOT.

5. PHASES

The Improvements shall be constructed in phases, as follows:

- A. Phase I (2005) - Phase one of the project includes the following components:

- (1) Ramsey Boulevard is improved to a four lane divided highway from T.H. 10 to 1,000 feet north of Bunker Lake Boulevard.. This project includes signal modifications at T.H. 10 and railroad crossing upgrades (signal and surface).
- (2) A full traffic actuated signal is installed at Ramsey Boulevard and Bunker Lake Boulevard and at Ramsey Boulevard and Sunwood Drive with right and left turn lanes as required for all approaches to the intersection.
- (3) Turn lanes (both left and right) will be added on Bunker Lake Boulevard at Town Center Drive.
- (4) Left turn lanes as required for south bound traffic and a right turn lane for north bound traffic will be added on Armstrong Boulevard at Sunwood Drive.
- (5) Several city streets will be constructed south of Bunker Lake Boulevard.

B. Phase II (2006) - Phase two of the project includes the following components:

- (1) Armstrong Boulevard is reconstructed from T.H. 10 to 1,000 feet north of Bunker Lake Boulevard to a four lane divided roadway. This project includes signal modifications at T.H. 10 and railroad crossing upgrades (signal and surface).
- (2) Full traffic actuated signal systems would be installed at the intersections of Bunker Lake Boulevard and Armstrong Boulevard, and at Armstrong Boulevard and Sunwood Drive. All signals on Bunker Lake Boulevard shall be interconnected with an interconnect system compatible with other County interconnects.

C. Phase III (2007) - Phase three of the project includes the following components:

- (1) Bunker Lake Boulevard is reconstructed to a four lane divided roadway from Armstrong Boulevard to 1,000 feet west of Ramsey Boulevard (C.R. 56).
- (2) Full traffic actuated signal systems would be installed at the intersection of Bunker Lake Boulevard and Town Center Drive, Bunker Lake Boulevard at Sunfish Lake Boulevard. All signals on Bunker Lake Boulevard shall be interconnected with an interconnect system compatible with other County interconnects.
- (3) The County will consider the addition of a full traffic actuated signal system at the intersection of Bunker Lake Boulevard and Sunwood Drive following receipt of additional traffic information to justify said signal system.
- (4) The remaining City streets south of Bunker Lake Boulevard would be constructed. Town Center Drive north of Bunker Lake Boulevard will be

constructed. The City will insure that only six full accesses will connect to Bunker Lake Boulevard between Armstrong Boulevard and Ramsey Boulevard, with a four-legged intersection counting as two accesses. This provision is in agreement with the original Joint Powers Agreement between the City and the County at the time the roadway was constructed.

(5) Any modification of the signals existing on the project as a result of prior construction.

- D. Phase IV (2007) - Phase four of the project includes the following components: Sunfish Lake Boulevard is reconstructed to a four lane divided roadway from T.H. 10 to 1000 feet north of Bunker Lake Blvd. (C.R. 116). This project includes signal improvements at C.R. 116 and C.R./C.S.A.H. 57 and at T.H. 10 and C.S.A.H. 57 and a railroad crossing upgrade to the crossing surface and signal. The County will be the lead agency on this project.

6. TERMS

- A. The RTC design shall provide a pedestrian bridge over U.S. Highway 10, connecting the RTC development to Mississippi West Regional Park. This should be aligned with the proposed trail through the treatment pond south of U.S. Highway 10. This section does not prohibit the City from seeking other sources of funding to assist in construction of the pedestrian bridge.
- B. The design of the Ramsey Boulevard and U.S. Highway 10 intersection must also accommodate vehicular connection between the park and Ramsey Boulevard, south of Highway 10. Ingress/egress to the park is to be constructed with turn lanes and stacking from Highway 10 to the park entrance and from the park entrance to Highway 10.
- C. The proposed settling pond, treatment pond, and infiltration ponds should be designed in such a manner as to meet the following objectives:
- (1) Grade a "bench" to accommodate a future trail with a minimum width of 10 feet, plus 2-foot shoulders; provide holding capacity to accommodate a 100 year flood event without over-topping the trail; and
 - (2) Incorporate native plant materials that are suitable to the conditions of the site and provide an aesthetic park-like appeal; and
 - (3) Use an outlet structure at the Mississippi River which minimizes visual and physical intrusion in the park.

- D. The view shed from the park to the RTC development should be considered. To the extent possible, plant materials should be used to screen the view of buildings or other man-made structures. Consideration of evening uses of the park should also be considered in lighting of the RTC development. Light cast into the park or that is visible from the park will have a long-term detrimental impact on use of the park for evening activities.
- E. The RTC design should preserve a wildlife corridor between Lake Itaska and the Mississippi River. To that end, provisions should be made in the design, development of the RTC and the future park to ensure continuity in both the alignment and natural characteristics of the wildlife corridor.
- F. The City shall facilitate meetings prior to detailed design, to explore possibilities for achieving harmony in the architectural vernacular between the RTC development and the future park development, particularly where the two projects will interface, e.g. lighting, site furnishings, landscaping, etc.
- G. The design of the storm sewer system throughout the development and along the outfall to the Mississippi River will provide for adequate capacity for the county roadways in and around the development area including all roadways and ditches that now naturally drain toward the intersections of Bunker Lake Boulevard (C.R. 116) with Armstrong Boulevard (C.S.A.H. 83) and Ramsey Boulevard (C.R. 56), along with all county highways and intersections between Bunker Lake Boulevard and Highway 10, inclusive of Armstrong Boulevard and Ramsey Boulevard. Adequate storage and drainage systems will be provided by the City for the ultimate section of each of those roadways listed above in their final configuration as anticipated by this Agreement.

7. COSTS

- A. The contract cost of the work, or if the work is not contracted the cost of all labor, materials, normal engineering costs, equipment rental required to do the work and right-of-way acquisition costs shall constitute the actual "construction costs" and shall be so referred to herein. Total Construction Costs shall include construction costs and administrative costs such as bonding expenses, legal expenses and engineering fees, provided however, that said administrative costs shall not exceed 26 percent (26%) of the construction costs. "Estimated total construction costs" are good faith projections of costs which will be incurred for the projects.

B. Total estimated construction cost of the Improvements described in the Schedules is \$13,050,372.08. These figures are based on the City estimates included in the "Summary of Estimated Project Costs for the Ramsey Town Center Improvements" which is incorporated herein by reference. The project costs shall be paid for by special assessments, City funds, State funds, Federal funds and County contributions as hereinafter provided. The projects for which the costs are to be shared by the County and the City, the estimated total cost of each project, and the County participation in each project is listed in the Schedules of this Agreement.

C. The estimated costs for the signal projects are \$2,801,250 of which \$1,012,500 is on T.H. 10. The remaining \$1,788,750 in estimated signal costs are on County highways. Since only two of the signal systems on the County highway system are warranted, the County will not participate in paying for the cost of construction of the unwarranted signals. The county will participate in construction of and will provide ongoing maintenance for the signal systems at Armstrong Boulevard (CSAH 83) at Bunker Lake Boulevard (C.R. 116) and Sunfish Lake Boulevard (CSAH/CR 57) at Bunker Lake Boulevard (CSAH 116), in accordance with the County cost sharing policy.

(1) The City shall submit plans for each signal system, including EVP, to the County for review and approval sixty (60) days prior to the advertising for bids. The City shall pay to the County a plan review fee of \$1,000 for each signal plan submitted.

(2) At a rate of six percent (6%) of the actual construction costs, the County shall provide construction observation for the construction of the signal system. The County shall have final authority to accept all roadway and signal work done within the county right of way. The estimated cost to the City for construction observation is \$107,325.

(3) The City shall be responsible for all remaining construction and engineering costs.

(4) The cost participation is summarized below:

Anoka County:	\$0
City of Ramsey, Signal Construction Inspection:	\$107,325
City of Ramsey:	ALL REMAINING COSTS

(5) The total cost to the City for the signal inspection is estimated at \$107,325.

(6) Upon award of the contract for each signal, the City shall pay to the County, upon written demand by the County, ninety five percent (95%) of its portion of

the cost of inspection of the signal system. The City's share of the cost of the project shall include only construction engineering expense and does not include administrative expenses incurred by the County.

8. CONSULTANT SERVICES

The City shall contract with a qualified consulting firm with significant experience in the design of high-speed highways. The City shall not contract with a consultant until the qualifications of said consultant are reviewed by and approved in writing by the appropriate staff of the Anoka County Highway Department. The proposed Improvements contemplated by this Agreement on T.H. 10, C.S.A.H. 83, C.R. 116, C.R. 56 and C.S.A.H./C.R. 57 are in fact highway improvements. The design of highways is considerably different from the design of city streets and the County needs to be assured that the consultant engaged by the City are experienced in the design of highways. While the City retains the oversight for the direction given the consultants hired for these projects, the County, by entering into this Joint Powers Agreement is assured by the City that the roadways designed and built under this agreement will conform to the standards for County State Aid Highway and County Roads in Anoka County. Critical factors in design include but are not limited to: the cross section of the roadway, the transfer slope of the roadways, super elevation in curves, turn lane and taper lengths for lane changes and turn lane introductions, curb height and type, and median and edge of road drainage.

The City shall provide or contract with a qualified consulting firm, with significant and proper experience with respect to the construction and construction administration of county highways. Additionally, the city shall provide an adequate number of individuals to provide the amount of construction inspection and administration. All inspection, control of material and associated documentation for construction are to be performed in accordance with the approved construction plans, current MnDOT specifications and technical memorandums, and/or special provisions. All inspectors shall be MnDOT certified as it pertains to the operations that is being inspected. County concurrence must be obtained prior to the City authorizing Change Orders, Work Orders and/or Supplemental Agreements that significantly increase the County's cost participation.

At all times, while work is actually being performed, the City, or contracted consultant, shall have at the site of work a competent individual(s) who is (are):

Thoroughly experienced in the type of work being performed.

Authorized and fully capable of inspecting, overseeing and documenting the work in progress. Capable of reading and thoroughly understanding the plans, specification and all other pertinent documentation.

Authorized to receive instructions from the Engineer.

Should the County feel, at any time, that these requirements are not being met, the County shall have the right to request replacement of the inspection personnel.

9. DISBURSEMENT OF FUNDS

The County shall pay to the City the County's portion of the actual construction costs of each project in the form of an annual payment. The first payment amount is \$266,070.76 based on an interest rate of 4.5 percent interest per year and a principal of \$4,334,000 for 30 years, the payment thereafter will be \$338,510.26 based on the balance of \$4,262,959.05 after the first payment, at 4.5 percent interest per year over 19 years. In addition the County will obtain the \$247,500 in Federal funds and apply it to the BNSF crossing improvement on Sunfish Lake Blvd. (CSAH 57). All funds disbursed by the County or City pursuant to this Agreement shall be disbursed by each entity pursuant to the method provided by law. This payment shall be made each year for twenty years on January 31 of each year. The first payment will be due on January 31, 2006.

The County shall be the lead agency on the Sunfish Lake Blvd. (CSAH 57) project. The City shall pay to the County the City's share of the actual construction cost of the work within forty-five days of the receipt of a claim voucher, containing such information as the City may reasonably require, representing that payments have been made for right of way, or on a contract or contracts for the projects outlined in this agreement.

10. CONTRACTS AND PURCHASES

All contracts let and purchases made pursuant to this Agreement shall be made by the City in conformance to the State laws.

11. CONTRACTOR INDEMNIFICATION AND INSURANCE

- A. The City shall include the following wording in all of its agreements with its contractors for the design and contract services of the Improvements described in the Schedules:

“The Contractor agrees that it will hold harmless, indemnify, and defend the County of Anoka, its commissioners, officers, agents and employees against any and all claims, expenses (including attorneys fees), losses, damages or lawsuits for damages arising from or related to providing or failing to provide services hereunder, including but not limited to the negligence of the Contractor.”

In addition, all contractors providing the design and contract services of the Improvements described herein shall obtain the insurance coverage as described in Schedule D, which is attached hereto and incorporated herein by reference.

- B. The City shall include the following wording in all of its Agreements with its contractors for the construction of the Improvements described in the Schedules:

“The Contractor agrees that it will hold harmless, indemnify, and defend the County of Anoka, its commissioners, officers, agents and employees against any and all claims, expenses (including attorneys fees), losses, damages or lawsuits for damages arising from or related to providing or failing to provide services hereunder, including but not limited to the negligence of the Contractor.”

In addition, all contractors providing the construction of the Improvements described herein shall obtain the insurance coverage as described in Schedule E, which is attached hereto and incorporated herein by reference.

Prior to execution, all contracts shall be forwarded to the Anoka County Attorney’s office for approval as to the requirements of this section.

12. TERMINATION OF AGREEMENT BY THE COUNTY

- A. The County may terminate this Agreement if the City, and the Developer of the Ramsey Town Center (RTC) do not enter into a development agreement on or before the date of this agreement which agreement provides for the development of a RTC. RTC means a unified, concentrated development having the following characteristics:

- (1) Commercial mixed use development occupying a minimum of 1.0 million gross square feet of space; and
- (2) Transit station suitable for conversion to a commuter rail station; and
- (3) A minimum of 1,500 units of medium and high density residential units

- B. The City shall provide copies of all agreements with the Developer of RTC. The County may terminate this agreement with the City if the City modifies, alters or changes any of the terms or conditions of its agreement with the Developer of the RTC.

13. TERM

This Agreement shall continue until (1) it is terminated as provided herein, or (2) until the construction provided for herein is completed and payments provided for herein are made, whichever of (1) or (2) shall first occur. Maintenance portions of this Agreement shall not terminate unless a subsequent agreement, specifically approved by the governing bodies of both parties, replaces this Agreement.

14. STRICT ACCOUNTABILITY

A strict accounting shall be made of all funds and report of all receipts and disbursements shall be made upon request by either party.

15. RIGHT OF WAY

The City shall acquire the majority of the right of way needed for this project as part of their development process. The City shall notify the County of any right of way needs not acquired through the City process a minimum of 12 months prior to the need for said right of way.

The County then shall acquire said right of way, from private property owners, that is required for the construction of the County Highway improvements through either direct purchase or condemnation. The City shall reimburse the County all costs incurred by the County in acquiring the necessary parcels. Reimbursable costs include, but are not limited to, the purchase price, recording fees, appraisal fees, attorney fees, and all costs incurred by the County in acquiring the parcels through eminent domain (hereinafter collectively referred to as "Land Acquisition Costs"). These costs shall not include County staff time.

Upon written demand by the County, the City shall pay to the County the appraised value portion of the Land Acquisition Costs. Upon final completion of the each parcel acquisition, the City shall pay for all remaining Land Acquisition Costs within 30 days after receipt of an invoice from the County documenting the expenses incurred.

After construction has been completed, the City shall convey the property it acquired to widen/improve the county highways by warranty deed to the County.

16. SIGNALIZATION POWER

The City shall at their sole expense, install or cause the installation of an adequate electrical power source to the service cabinet for all signalized intersections including any necessary extension of power lines. The City shall be the lead agency in this matter. Upon completion of said traffic control signal installations, the ongoing cost of the electrical power to the signal shall be the sole cost and expense of the City.

17. MAINTENANCE

Maintenance of the completed water main, sanitary sewer, storm sewer (except catch basins and catch basin leads on county highways), detention basins (including ponds and their outlet structures and any grit chambers/collectors including the "Vetch Stormwater Treatment System") shall be the sole obligation of the City.

The County will maintain the County State Aid Highways and County Roads following completion of the construction and during winter suspension of work so long as the road surface is bituminous. If for any reason the road surface is not hard surfaced by winter suspension of work the City shall maintain the road surface continuously until work resumes.

Maintenance of all trails and sidewalks, including snow plowing, shall be the sole responsibility of the City.

Maintenance of streetlights and cost of electrical power to the streetlights shall be the sole obligation of the City.

Maintenance of all city streets shall be the solid obligation of the City.

The City shall be responsible to maintain all medians which the City has designated for plantings. Maintenance shall be performed in accordance with the "Anoka County Highway Department Landscape/Streetscape Guidelines dated June 2000." If the City does not comply with these

guidelines, the County at any time may remove all plantings and landscaping items and replace with hard surfacing in its place. The City shall be billed by the County for all costs incurred.

Nothing in this Agreement shall affect the terms and conditions of the Maintenance Agreement between the State of Minnesota, the City, and the County for the signals located at the intersections of T.H. 10 with C.R. 56, Ramsey Boulevard and T.H. 10 at the intersection with C.S.A.H. 83 (Armstrong Boulevard).

Maintenance of the completed signal systems at the intersections of Bunker Lake Boulevard (C.R. 116) at Armstrong Boulevard (CSAH 83) and Bunker Lake Boulevard at Sunfish Lake Boulevard shall be the sole obligation of the County except that the city shall provide the electrical power at these locations. The exception being that the City shall reimburse the County for maintaining the luminaries and EVP.

This Agreement contemplates the installation of several unwarranted signal systems. These traffic signals are located at the intersections of Armstrong Boulevard and Sunwood Drive, Bunker Lake Boulevard and Town Center Drive, Bunker Lake Boulevard and Ramsey Boulevard, and Ramsey Boulevard and Sunwood Drive, and the possibility for a signal system exists at the intersection of Sunwood Drive and Bunker Lake Boulevard. None of these signal systems are currently warranted under the standard warranting procedure. Consequently, the cost of maintenance of these traffic signals falls entirely to the City of Ramsey and the City will be billed on a quarterly basis for the maintenance of said signal systems by the County, in accordance with the following:

Maintenance of the completed signals and signal equipment shall be performed by the County at the sole obligation of the City.

The County shall perform and maintain the traffic signal controller, traffic signal and pedestrian indications, loop detectors and associated wiring of the said traffic control signals and bill the costs to the City on a quarterly basis for all costs incurred.

Painting of the traffic signals, if standard colors are used, shall be the sole obligation of the City. Timing of the traffic signals shall be determined by the County.

Only the County shall have access to the controller cabinets.

The traffic control signals shall be the property of the County.

The City shall be responsible for maintenance of the luminaries, luminary relamping, and luminary painting.

All maintenance of the EVP Systems shall be completed by the County. The City shall be billed by the County on a quarterly basis for all incurred costs at all locations.

EVP Emitter Units may be installed on and used only by Emergency Vehicles responding to an emergency, as defined in Minnesota Statutes §169.01, Subdivision 5, and §169.03. The City shall provide a list to the County Traffic Engineer, or the County's duly appointed representative, of all such vehicles with emitter units on an annual basis.

Malfunctions of the EVP Systems shall be immediately reported to the County.

All timing of said EVP Systems shall be determined by the County.

In the event said EVP Systems or components are, in the opinion of the County, being misused, or the conditions set forth are violated, and such misuse or violation continues after receipt by the City of written notice thereof from the County, the County shall remove the EVP Systems. Upon removal of the EVP Systems pursuant to this paragraph, the field wiring, cabinet wiring, detector receiver, infrared detector heads and indicator lamps and all other components shall become the property of the County.

18. NOTICE

For purposes of delivery of any notices hereunder, the notice shall be effective if delivered to the County Administrator of Anoka County, 2100 3rd Avenue North, Anoka, Minnesota 55303, on behalf of the County, and the City Administrator of Ramsey, 15153 Nowthen Boulevard North West, Ramsey, Minnesota 55303, on behalf of the City.

19. INDEMNIFICATION

The City and the County mutually agree to indemnify and hold harmless each other from any claims, losses, costs, expenses or damages resulting from the acts or omissions of the respective officers, agents or employees relating to activities conducted by either party under this Agreement.

20. ENTIRE AGREEMENT REQUIREMENT OF A WRITING

It is understood and agreed that the entire agreement of the parties is contained herein and that this Agreement supersedes all oral agreements and all negotiations between the parties relating to the subject matter thereof, as well as any previous agreement presently in effect between the parties to the subject matter thereof. Any alterations, variations, or modifications of the provisions of this Agreement shall be valid only when they have been reduced to writing and duly signed by the parties.

IN WITNESS WHEREOF, the parties of this Agreement have hereto set their hands on the dates written below:

COUNTY OF ANOKA

By: Margaret Langfeld
Margaret Langfeld Chair
County Board of Commissioners

Dated: 5/12/05

CITY OF RAMSEY

By: San H. Linn
Title: Mayor

Dated: 4-26-2005

ATTEST

By: John Jay McLinden
John "Jay" McLinden
County Administrator

Dated: 5/12/05

By: James Shanna
Title: City Administrator
Dated: 4-26-2005

RECOMMENDED FOR APPROVAL

By: Douglas W. Fischer
Douglas W. Fischer, P.E.
County Engineer

Dated: 5/11/05

By: _____
Title: _____
Dated: _____

APPROVED AS TO FORM

By: Dan Klint
Dan Klint
Assistant County Attorney

Dated: 5-12-05

By: _____
Title: _____
Dated: _____

Schedule A – Improvements to County Highway

<u>ESTIMATED TOTAL PROJECT</u>	<u>COST</u>	<u>COUNTY SUBTOTALS</u>	<u>COUNTY PARTICIPATION</u>
C.S.A.H. No. 83	\$1,991,400.53	\$1,123,650.00	
COUNTY ROAD 56	\$2,689,002.90	\$1,350,450.00	
C.S.A.H. No. 57	\$ 847,500.00	\$ 678,900.00	
COUNTY ROAD 116	\$3,170,109.15	\$1,228,500.00	
Subtotal Schedule A	\$8,698,012.58		\$4,134,000
Federal funds obtained by the County for BNSF Crossing On Sunfish Lake Blvd. (CSAH 57)			\$ 247,500

Schedule B – Traffic Signals

Ramsey Blvd (C.R.56) at Bunker Lake Blvd. (C.R. 116)	\$ 200,000.00	\$0
Bunker Lake Blvd. (C.R. 116) at "N" Street	\$ 200,000.00	\$0
Armstrong Blvd. (C.S.A.H. 83) at Bunker Lake Blvd (C.R. 116)	\$ 200,000.00	\$100,000
Armstrong Blvd. (C.S.A.H. 83) at Sunwood Drive	\$ 175,000.00	\$0
Bunker Lake Blvd. (C.R. 116) at "A" Street	NOT ALLOWED \$0.	\$0
Bunker Lake Blvd. (C.R. 116) at "B" Street	NOT ALLOWED \$0	\$0
Ramsey Blvd. (C.R. 56) at Sunwood Dr..	\$ 175,000.00	\$0
Sunwood Dr at Industry Ave (C.R. 116)	\$ 175,000.00	\$0
Bunker Lake Blvd. (C.R. 116) at Sunfish Lake Blvd. (C.S.A.H./C.R. 57)	\$ 200,000.00	\$100,000
T.H. 10 at Armstrong Blvd. (C.R. 83)	\$ 250,000.00	\$0
T.H. 10 at Ramsey Blvd. (C.R. 56)	\$ 250,000.00	\$0
T.H. 10 at Sunfish Lake Blvd. (C.S.A.H. 57)	\$ 250,000.00	\$0
	\$2,075,000.00	\$0
OVERHEAD & CONTINGENCY:	\$ 726,250.00	\$0

Subtotal B – Traffic Signals:

\$2,801,250.00

\$200,000

Schedule C – Trunk Storm Sewer Improvements & Outfall to River

Item	Description	Extension	
1.	Jack 60" Casing	\$78,000.00	
2.	Jack 48" RCP	\$126,000.00	
3.	48" Carrier Pipe	\$13,760.00	
4.	42" RC Pipe Sewer Design 3006 CL III	\$21,600.00	
5.	48" RC Pipe Sewer Design 3006 CL III	\$13,760.00	
6.	Jack 42" RCP	\$434,000.00	
7.	42" FES	\$3,200.00	
8.	48" FES	\$15,200.00	
9.	42" Outlet Structure	\$5,000.00	
10.	Skimmer Structure	\$12,000.00	
11.	Pond Liner	\$254,250.00	
12.	Sand Cushion	\$169,200.00	
13.	Storm Manhole	\$3,000.00	
	Subtotal:	\$1,148,970.00	\$0
	OVERHEAD & CONTINGENCY 35%:	\$402,139.50	<u>\$0</u>

Subtotal C – Trunk Storm Sewer Costs: \$1,551,109.50

MAXIMUM TOTAL COUNTY PARTICIPATION: \$4,581,500

**SCHEDULE D
INSURANCE REQUIREMENTS**

Bidders/contractors/consultants shall procure and maintain for the duration of the contract, insurance coverage for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the bidder/contractor/consultant, their agents, representatives, employees or subcontractors. **ANOKA COUNTY CONTRACT NUMBER:** _____

1. Minimum Scope of Insurance: Coverage shall be at least as broad as follows:

- 1.1 Insurance Services Office (ISO) Commercial General Liability coverage (occurrence form CG 00 01 or a substitute form providing equivalent coverage), and shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal injury, advertising, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract).
- 1.2 Business Automobile Liability coverage shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or substitute for providing equivalent liability coverage. Such insurance shall cover liability arising out of any auto (including owned, hired, and non-owned autos).
- 1.3 Workers' Compensation as required by the State of Minnesota, and Employer's Liability insurance.
- 1.4 Professional Liability or Errors and Omissions insurance appropriate for the profession. Coverage shall be maintained for at least two years following the completion of work.

2. Minimum Limits of Insurance: Bidder/contractor/consultant shall maintain **NO LESS THAN:**

- 2.1 Commercial General Liability (CGL) and if necessary, Commercial Umbrella Liability: \$1,000,000 each occurrence. If Commercial General Liability insurance contains a general aggregate limit, it shall apply separately to this project/location, or the general aggregate limit shall be twice the required occurrence limit.
- 2.2 Business Automobile Liability and if necessary, Commercial Umbrella Liability: \$1,000,000 each accident for bodily injury and property damage.
- 2.3 Employers Liability: as required by the State of Minnesota
- 2.4 Professional Liability or Errors and Omissions: \$1,000,000 per occurrence.

3. Deductibles and Self-Insured Retention

Any deductibles or self-insured retention must be declared to and approved by the County. At the option of the County, either: the insurer shall reduce or eliminate such deductibles or self-insured retention as respects Anoka County, agents, officers, directors, and employees; or the bidder/contractor/consultant shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses; or the bidder/contractor/consultant shall provide County-requested financial statements for the

purpose of verifying financial solvency, and acceptance of deductibles or self-insured retention based on this verification.

4. Other Insurance Provisions

- 4.1 The General Liability policy is to contain, or be endorsed to contain, the following provision: **Anoka County, its agents, officers, directors, and employees are to be covered as an additional insured for all liability coverages using ISO additional insured endorsement CG 20 10 or substitute providing equivalent coverage.** This insurance shall apply as primary insurance with respect to any other insurance or self-insurance program. The County's insurance shall be excess of the contractor/consultant's insurance and shall not contribute to it. The contractor/consultant's coverage shall contain no special limitations on the scope of protection afforded to the County, its agents, officers, directors, and employees.
- 4.2 Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the County, its officers, officials, employees or volunteers.
- 4.3 Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, or canceled by either party, reduced in coverage or in limits, or non-renewed, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the County.
- 4.4 The Contractor shall include all subcontractors as insured under its policies or furnish separate certificates and endorsements for each subcontractor where applicable. All coverage for subcontractors shall be subject to all of the requirements stated herein.
- 4.5 Each insurance policy shall include an endorsement that waives any claim or right in the nature of subrogation to recover against the County, its agents, officers, directors, and employees.

5. Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best rating of A:VII, unless otherwise acceptable to the County.

6. Verification of Coverage

Contractor shall furnish the County with certificates of insurance and original endorsements effecting coverage required by this clause. ***The certificate attached to this contract should be signed by a person authorized by that insurer to bind coverage on its behalf. A certificate other than the one attached may be used if coverages and endorsements match or exceed the coverages identified on the attached certificate.*** All certificates and endorsements are to be received and approved by the County before work commences. The County reserves the right to require complete, certified copies of all required insurance policies and endorsements at any time.

**SCHEDULE E
INSURANCE REQUIREMENTS**

Bidders/contractors/consultants shall procure and maintain for the duration of the contract, insurance coverage for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the bidder/contractor/consultant, their agents, representatives, employees or subcontractors. **ANOKA COUNTY CONTRACT NUMBER:** _____.

1. Minimum Scope of Insurance: Coverage shall be at least as broad as follows:

- 1.1 Insurance Services Office (ISO) Commercial General Liability coverage (occurrence form CG 00 01 or a substitute form providing equivalent coverage), and shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal-injury, advertising, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract).
- 1.2 Business Automobile Liability coverage shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or substitute for providing equivalent liability coverage. Such insurance shall cover liability arising out of any auto (including owned, hired, and non-owned autos).
- 1.3 Workers' Compensation as required by the State of Minnesota, and Employer's Liability insurance.
- 1.4 Umbrella Liability insurance.

2. Minimum Limits of Insurance: Bidder/contractor/consultant shall maintain **NO LESS THAN:**

- 2.1 Commercial General Liability (CGL) and if necessary, Commercial Umbrella Liability: \$2,000,000 each occurrence. If Commercial General Liability insurance contains a general aggregate limit, it shall apply separately to this project/location, or the general aggregate limit shall be twice the required occurrence limit.
- 2.2 Business Automobile Liability and if necessary, Commercial Umbrella Liability: \$2,000,000 each accident for bodily injury and property damage.
- 2.3 Employers Liability: \$1,000,000 for bodily injury or disease.
- 2.4 Umbrella Liability: \$1,000,000 each occurrence.

3. Deductibles and Self-Insured Retention

Any deductibles or self-insured retention must be declared to and approved by the County. At the option of the County, either: the insurer shall reduce or eliminate such deductibles or self-insured retention as respects Anoka County, agents, officers, directors, and employees; or the bidder/contractor/consultant shall procure a bond guaranteeing payment of losses and related investigations, claim administration and defense expenses; or the bidder/contractor/consultant

shall provide County-requested financial statements for the purpose of verifying financial solvency, and acceptance of deductibles or self-insured retention based on this verification.

4. Other Insurance Provisions

- 4.1 The General Liability policy is to contain, or be endorsed to contain, the following provision: **Anoka County, its agents, officers, directors, and employees are to be covered as an additional insured for all liability coverages using ISO additional insured endorsement CG 20 10 or substitute providing equivalent coverage.** This insurance shall apply as primary insurance with respect to any other insurance or self-insurance program. The County's insurance shall be excess of the contractor/consultant's insurance and shall not contribute to it. The contractor/consultant's coverage shall contain no special limitations on the scope of protection afforded to the County, its agents, officers, directors, and employees.
- 4.2 Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the County, its officers, officials, employees or volunteers.
- 4.3 Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, or canceled by either party, reduced in coverage or in limits, or non-renewed, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the County.
- 4.4 The Contractor shall include all subcontractors as insured under its policies or furnish separate certificates and endorsements for each subcontractor where applicable. All coverage for subcontractors shall be subject to all of the requirements stated herein.
- 4.5 Each insurance policy shall include an endorsement that waives any claim or right in the nature of subrogation to recover against the County, its agents, officers, directors, and employees.

5. Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best rating of A:VII, unless otherwise acceptable to the County.

6. Verification of Coverage

Contractor shall furnish the County with certificates of insurance and original endorsements effecting coverage required by this clause. ***The certificate attached to this contract should be signed by a person authorized by that insurer to bind coverage on its behalf. A certificate other than the one attached may be used if coverages and endorsements match or exceed the coverages identified on the attached certificate.*** All certificates and endorsements are to be received and approved by the County before work commences. The County reserves the right to require complete, certified copies of all required insurance policies and endorsements at any time.

**AMENDMENT NO. 1
TO JOINT POWERS AGREEMENT
BETWEEN ANOKA COUNTY AND THE CITY OF RAMSEY
FOR THE PUBLIC WORKS IMPROVEMENTS
RELATED TO THE RAMSEY TOWN CENTER DEVELOPMENT
RAMSEY, MINNESOTA**

THIS AMENDMENT is made this _____ day of February, 2009, the date of the signature of the parties notwithstanding, by and between the County of Anoka, a political subdivision of the State of Minnesota, 2100 Third Avenue, Anoka, Minnesota 55303, hereinafter referred to as the "County," and the City of Ramsey, 15153 Nowthen Boulevard, Ramsey, Minnesota 55303, hereinafter referred to as the "City."

WITNESSETH:

WHEREAS, the County wishes to amend its Joint Powers Agreement with the City for public works improvements related to the Ramsey Town Center Development, Ramsey, Minnesota dated May 12, 2005; and

WHEREAS, Paragraph 20 ENTIRE AGREEMENT REQUIREMENT OF A WRITING of said Agreement provides that any alterations, variations or modifications of the provisions of this Agreement shall be valid only when they have been reduced to writing and duly signed by the parties.

NOW, THEREFORE, in consideration of the mutual covenants hereinafter stated or contained in the Agreement, the parties do hereby agree as follows:

1. The parties agree to delete Section 5, B. in its entirety and replace it with the following:

1. The County and City agree that a grade separated interchange should be designed for the intersection of Trunk Highway 10 and Armstrong Boulevard. The County shall issue a request for proposals and contract for the preliminary design and environmental documentation for the grade separation. The County and City shall each pay 50% of the cost for the preliminary design and environmental documentation. Upon award of the contract for said work, the City shall pay to the County one-half of the cost of the contracted amount. Upon completion of the work the City shall pay the County one-half of any increase in the contract amount. If the actual contract price is less the contracted amount

the County shall reimburse the City one-half of the difference between the contracted amount and the actual contract price. Both the County and City agree to pursue all other funding sources to assist with the payment for the interchange project.

2. Only one access point to Armstrong Boulevard shall be allowed between Trunk Highway 10 and Bunker Lake Boulevard.
3. Full traffic actuated signal systems will be installed at the intersections of Bunker Lake Boulevard and Armstrong Boulevard, and at the intersection of West Ramsey Parkway. A grade separated crossing shall be constructed at the intersection of Armstrong Boulevard and Sunwood Drive. All signals on Bunker Lake Boulevard shall be interconnected with an interconnect system compatible with other County interconnects.

2. The parties agree to amend Paragraph 5.D. by adding the following:

The City shall provide the construction inspection with its own personnel. The City shall reimburse the County for all construction survey work and construction administration related to the project. Anoka County contract number 2007-0604 is a joint powers agreement between the City and County relating to the turnback of County Road 63. That joint powers agreement contemplates that the County will make a payment to the City in the amount of \$425,000.00. In lieu of making the payment under contract number 2007-0604, the County shall deduct said amount from the amount the City is required to reimburse the County under this agreement.

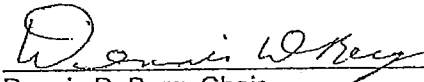
3. This Amendment is hereby made a part of and shall be amended to the Agreement of the parties.


4. All other terms and conditions of the original Agreement shall remain in full force and effect.

IN WITNESS WHEREOF, the parties have signed this Amendment on the dates written below.

COUNTY OF ANOKA

CITY OF RAMSEY

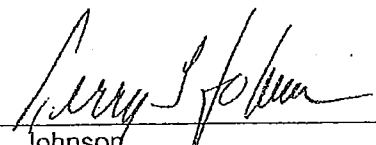
By: 
Dennis D. Berg, Chair
Board of Commissioners

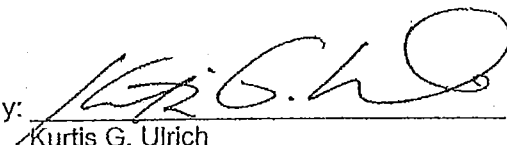
By: 
Bob Ramsey
Mayor

Dated: 4/7/09

Dated: 4-1-09

ATTEST

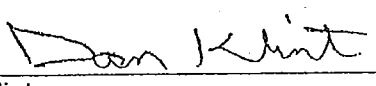
By: 
Terry L. Johnson
County Administrator

By: 
Kurtis G. Ulrich
City Administrator

Dated: 4/7/09

Dated: 4/1/09

APPROVED AS TO FORM

By: 
Dan Klint
Assistant County Attorney

Dated: 4-8-09

AMENDMENT NO. 2
TO JOINT POWERS AGREEMENT
BETWEEN ANOKA COUNTY AND THE CITY OF RAMSEY
FOR THE PUBLIC WORKS IMPROVEMENTS
RELATED TO THE RAMSEY TOWN CENTER DEVELOPMENT
RAMSEY, MINNESOTA

THIS AMENDMENT is made this _____ day of February, 2012, the date of the signature of the parties notwithstanding, by and between the County of Anoka, a political subdivision of the State of Minnesota, 2100 Third Avenue, Anoka, Minnesota 55303, hereinafter referred to as the "County," and the City of Ramsey, 15153 Nowthen Boulevard, Ramsey, Minnesota 55303, hereinafter referred to as the "City."

WITNESSETH:

WHEREAS, the County wishes to amend its Joint Powers Agreement with the City for public works improvements related to the Ramsey Town Center (RTC) Development, Ramsey, Minnesota dated May 12, 2005; and

WHEREAS, Paragraph 20 ENTIRE AGREEMENT REQUIREMENT OF A WRITING of said Agreement provides that any alterations, variations or modifications of the provisions of this Agreement shall be valid only when they have been reduced to writing and duly signed by the parties.

WHEREAS, the City has made improvements to the transportation system in and around the RTC (Currently referred to as "The COR"), that greatly improve the movement of traffic in the COR and on surrounding Streets and Highways and rail related safety improvements.

Whereas, the County has worked to improve the overall transportation system throughout Anoka County and wishes to participate in these additional system wide improvements.

NOW, THEREFORE, in consideration of the mutual covenants hereinafter stated or contained in the Agreement, the parties do hereby agree as follows:

1. The parties agree to add to Section 9. DISBURSEMENT OF FUNDS the following:

The County and City agree that the County shall pay to the City an additional Sum of \$1,700,000 as a lump sum payment to be used by the City for additional transportation improvements in the area of the RTC (COR). Said payment to be made after this amendment is fully executed and within 30 days of the County receiving an invoice from the City for that amount.

2. This Amendment is hereby made a part of and shall be amended to the Agreement of the parties.

-
3. All other terms and conditions of the original Agreement shall remain in full force and effect.

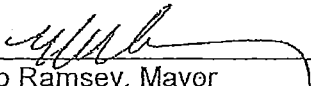
IN WITNESS WHEREOF, the parties have signed this Amendment on the dates written below.

COUNTY OF ANOKA

By: 
Rhonda Sivarajah, Chair
Board of Commissioners


Dated: 3-20-12

CITY OF RAMSEY

By: 
Bob Ramsey, Mayor

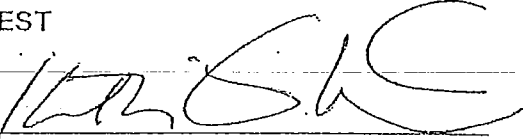
Dated: 3/8/12

ATTEST

By: 
Jerry Soma
County Administrator

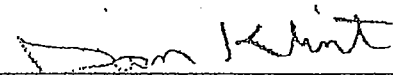
Dated: 3-20-12

ATTEST

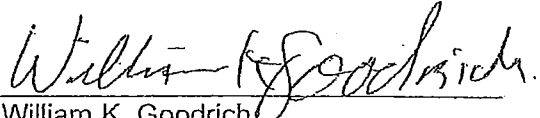
By: 
Kurtis Ulrich
City Administrator

Dated: 3/8/12

APPROVED AS TO FORM

By: 
Dan Klint
Assistant County Attorney

Dated: 3-21-12

By: 
William K. Goodrich
City of Ramsey City Attorney

Dated: 3/8/12

Capital Improvement Program

2020 *thru* 2029

City of Ramsey, Minnesota

Project #	04-STR-014
Project Name	COR Bunker Lake Blvd (Armstrong to Ramsey Blvd)

Department	Street Improvements
Contact	Unassigned
Type	Improvement
Useful Life	60 Years
Category	Street Improvement
Priority	4-New Addition (Med)
Status	Active

Total Cost \$5,020,000

Description
Upgrades Bunker Lake Blvd between Armstrong and Ramsey Blvds, necessitated by the COR Development. Upgrades include traffic signals at Town Center Drive.
Total Cost for Bunker Lake Blvd. = \$4,870,000
Street Improvements: \$3,650,000
Bunker & Sunwood Signal: \$350,000
Storm Water Improvements: \$530,000
Water Utility Improvements: \$340,000
Total Cost for Regional Roadway improvements = \$14,607,860 (Per JPA)

Justification
The construction of the COR will add additional traffic to Bunker Lake Blvd. This project will upgrade Bunker Lake Blvd to handle traffic from the COR.

Expenditures	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
Improvements Other than Building Cost	400,000	4,620,000									5,020,000
Total	400,000	4,620,000									5,020,000

Funding Sources	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
MSA		350,000									350,000
Tax Increment Fund #2		1,500,000									1,500,000
Tax Increment Fund #1		1,000,000									1,000,000
Storm Water Utility Fund		530,000									530,000
Street Light Utility Fund		150,000									150,000
Water Utility Fund		340,000									340,000
Tax Increment Fund #14 (BONDING)	400,000	750,000									1,150,000
Total	400,000	4,620,000									5,020,000



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community, LOCIS

Public Works Committee

6. 2.

Meeting Date: 01/21/2020

By: Bruce Westby, Engineering/Public Works

Title:

Staff Updates on Improvement Projects and Items of Interest

Purpose/Background:

The purpose of this case is to update the Public Works Committee on current and proposed improvement projects within the City, and on other items of interest to the Committee.

City Improvement Projects

- **The COR Regional Infiltration Basin (#18-09)**
 - Grading and storm sewer work complete
 - Lift station not operable; control panel installed January 2020
 - 8K CY sand stockpile proposed to be moved in spring 2020
 - 20K CY topsoil stockpile removed (River Walk Village debris backfill)
 - Processing Change Order #1 addressing excess topsoil removal/backfill
 - WMO Permit extended to June 30, 2020
- **Ford Brook Estates Street Reconstructions (#19-01)**
 - Punch list work and final payment in 2020
- **Wood Pond Hills and Chestnut Ridge Street Reconstructions (#19-03)**
 - Punch list work and final payment in 2020
- **RTC 9th Addition Pond Lining Improvements (#19-06)**
 - Construction complete
 - Punch list work and final payment in 2020
- **Wetland 114P Outlet Control Improvements (#19-07)**
 - Engineering Staff collecting topographic survey data this winter/spring
 - Construction proposed for 2020
- **Germanium Street Drainage Improvements (#19-09)**
 - Terminated by property owner request
- **Hedgehog Street Drainage Improvements (#19-10)**
 - First bids rejected due to high costs
 - Second bids will be advertised this winter
 - Construction in 2020
- **Variolite Street Reconstruction (#20-01)**
 - Final design / preparation of plans and specifications in progress
 - Detailed update provided during February PWC meeting

Anoka County Improvement Projects

- **Roundabout at Armstrong Boulevard/CSAH 83 and Alpine Drive**
 - Anoka County received \$1.35M in HSIP funds (est. project cost = \$1.5M)
 - Anoka County and City of Ramsey share is \$150,000 each (per \$1.5M est.)
 - Anoka County beginning project design in 2020
 - Construction is proposed to begin in 2022 pending City and County approvals, but Anoka County is considering moving construction up a year
- **CSAH 116 & TH 47 Intersection Improvements**
 - Constructing additional turn lanes to improve congestion and safety in 2021

MnDOT Improvement Projects

- **Ferry Street / Trunk Highway 47 Grade Separation @ BNSF Rail Crossing**
 - Preliminary design on hold - MnDOT exploring realignment of Highway 47 to remove S-curve at Anoka County fair grounds
 - TH 47 traffic study in progress
 - MnDOT may combine project with Anoka Solution improvements

Items of Interest

- **Northwest Metro Surface Water Supply Feasibility Study**
 - Study is roughly 90% complete
 - Member cities include Corcoran, Dayton, Ramsey and Rogers
 - MCES is funding 100% using Clean Water Funds
 - Completion anticipated February 2020
- **Centralized Water Treatment Facility Study**
 - Kickoff meeting held November 7, 2019
 - Data exchange in progress
 - Completion anticipated by June 2020
- **Ramsey Gateway Highway 10 Improvements**
 - Preferred vision layout complete
 - Additional updates to be provided during the meeting

Timeframe:

Staff estimates up to 10 minutes will be needed for updates and discussion.

Observations/Alternatives:

N/A

Funding Source:

N/A

Recommendation:

N/A

Action:

No formal action required. For Committee review and discussion purposes only.

Attachments

No file(s) attached.

Form Review

Inbox	Reviewed By	Date
Grant Riemer	Grant Riemer	01/16/2020 12:34 PM
Kurt Ulrich	Kurt Ulrich	01/16/2020 04:02 PM
Form Started By: Bruce Westby		Started On: 01/14/2020 08:02 AM
Final Approval Date: 01/16/2020		

Public Works Committee

6.3.

Meeting Date: 01/21/2020

By: Bruce Westby, Engineering/Public Works

Title:

Review Future Topics Calendar

Purpose/Background:

Attached is a calendar of future topics for review and discussion by the Public Works Committee. The calendar includes topics drawn from Committee requests received during meetings and/or unresolved topics previously discussed by the Committee. Calendar dates are subject to change based on the availability of information and required attendees, staff workload, and competing interests and objectives.

Timeframe:

Staff estimates less than 5 minutes will be necessary to review the future topics calendar and address questions.

Observations/Alternatives:

N/A

Funding Source:

N/A

Recommendation:

N/A

Action:

No formal action required. For Committee review and discussion purposes only.

Attachments

PWC Calendar Jan2020

Form Review

Inbox	Reviewed By	Date
Grant Riemer	Grant Riemer	01/16/2020 12:40 PM
Kurt Ulrich	Kurt Ulrich	01/16/2020 04:03 PM
Form Started By: Bruce Westby		Started On: 01/14/2020 08:03 AM
Final Approval Date: 01/16/2020		

Public Works Committee Future Topics Calendar *

Date	Topics for Discussion – Committee Action
February 2020	Sunfish Lake Sedimentation Basin Improvements (<i>Westby</i>)
March 2020	Gibbon Street Basement Flooding Funding Options (<i>Westby</i>)
Future/TBD	Sunwood Drive Roundabout Landscaping (<i>Riemer</i>)
Date	Topics for Discussion – Regulatory
Future/TBD	Sunfish Lake Boulevard Speed Zone Study Results (<i>Westby</i>)
Future/TBD	Bunker Lake Boulevard Speed Study Results (<i>Westby</i>)
Future/TBD	County Ditch Maintenance / Buffer Law (<i>Westby</i>)
Date	Topics for Discussion – Policy
Future/TBD	Landscaped Median Maintenance Policy (<i>Riemer</i>)
March 2020	Draft Trail Maintenance Policy (<i>Westby</i>)
March 2020	Draft Stormwater Pond Maintenance Policy (<i>Westby</i>)
Date	Topics for Discussion – Planning and Budget
April 2020	Municipal State Aid System (MSAS) Revisions (<i>Westby</i>)
May 2020	Review 1996 and 2007 (unadopted) TH 47 Corridor Studies (<i>Westby</i>)
Ongoing	Public Works Facility Review/Update (<i>Riemer</i>)
Date	Topics for Discussion – Staff Updates
Ongoing	Water Conservation Opportunities / Incentives (<i>Westby</i>)
Future/TBD	Asset Management Program (<i>Westby</i>)
Ongoing	NW Metro Area Regional Surface Water Supply Study
Ongoing	Centralized Water Treatment Facility - Preliminary Design Report

* Dates are subject to change based on the availability of information and required attendees, staff workload, and competing interests and objectives.