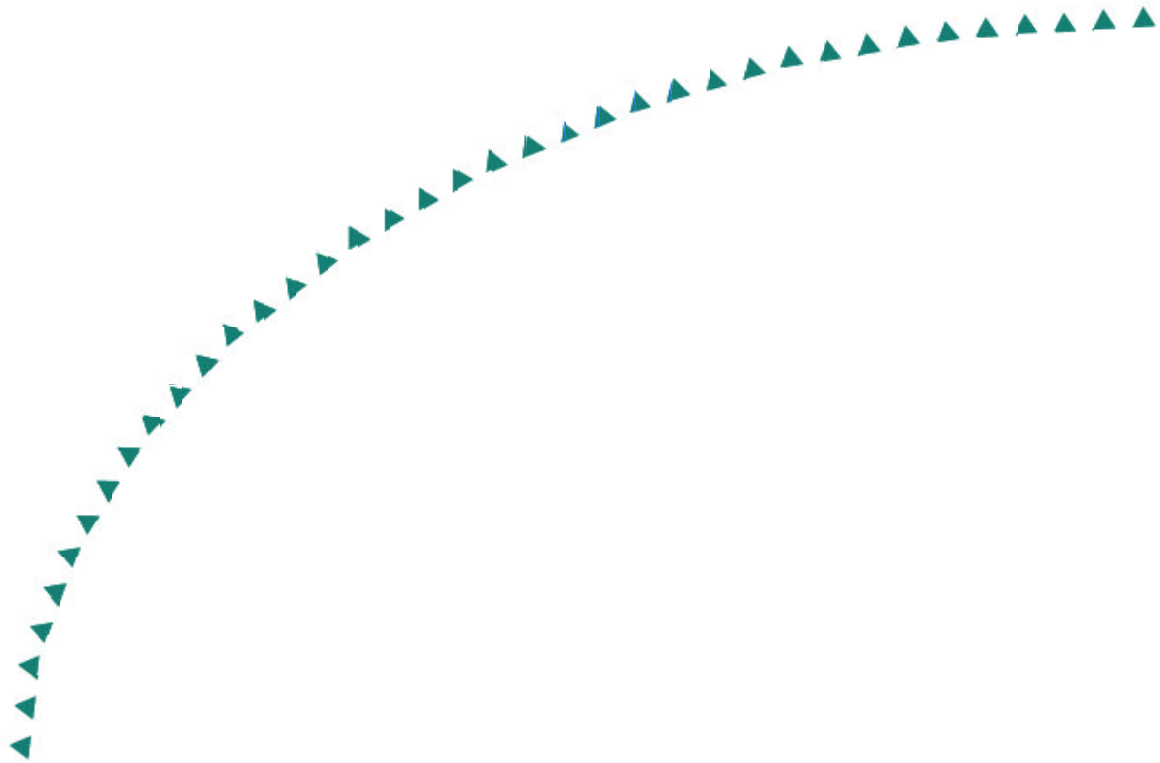
2003-11

Final Report

Saw and Seal Repair
Chisholm / Hibbing Airport Taxiway

Research



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The Chisholm-Hibbing Municipal Airport completed taxiway repairs of deteriorated sawed and sealed joints on August 6-8, 2001. This report documents the construction procedures, techniques, and materials used. A field review of the project was completed on January 24, 2002. This report also documents the initial performance of the repairs.

Transverse thermal cracking, followed by the deterioration of the hot mix asphalt at the crack, is a major problem in Minnesota. The pavement between the cracks is often in good condition. The area within one foot of the crack begins to strip and collapse inward/downward. It also can tent up in the winter due to freezing moisture in the crack area. Both situations require repair. Long-lasting, cost-effective repairs at the cracked areas are needed.

The hot pour, transverse patch material is a newer material that is fast, economical and durable. This material has the potential to be widely used for transverse crack repair on airports and roads in the state of Minnesota. This report focuses on the hot pour transverse patch material.

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SAW AND SEAL REPAIR
CHISHOLM-HIBBING
AIRPORT TAXIWAY

Construction Report
Leveling Cupped Joints
August 6-8, 2001

Field Review
January 24, 2002

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Office of Materials

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EXECUTIVE SUMMARY

The Chisholm-Hibbing Municipal Airport completed taxiway repairs, of deteriorated sawed and sealed joints on August 6-8, 2001. This report documents the construction procedures, techniques, and materials used. A field review was completed on January 24, 2002. This report also documents the initial performance of the repairs.

Transverse thermal cracking, followed by the deterioration of the hot mix asphalt at the crack is a major problem in Minnesota. The pavement between the cracks is often in good condition. The area within one foot of the crack begins to strip and collapse inward/downward. It also can tent up in the winter due to freezing moisture in the crack area. Both situations require repair. Long-lasting, cost-effective repairs at the cracked areas are needed.

The hot pour, transverse patch material is a newer material that is fast, economical and durable. This material has the potential to be widely used for transverse crack repair on airports and roads in the state of Minnesota. This report focuses on the hot pour transverse patch material.

INTRODUCTION

Chisholm-Hibbing Municipal Airport

The Chisholm-Hibbing Municipal Airport completed taxiway repairs of deteriorated sawed and sealed joints on August 6-8, 2001. This report documents the construction procedures, techniques, and materials used. A field review was completed on January 24, 2002. This report also documents the initial performance of the repairs.

Thermal Cracks

Transverse thermal cracking, followed by the deterioration of the hot mix asphalt at the crack is a major problem in Minnesota. The pavement between the cracks is often in good condition. The area within one foot of the crack begins to strip and collapse inward/downward. It also can tent up in the winter due to freezing moisture in the crack area. Both situations require repair. Cost-effective repairs at the cracked area do not exist.

Chisholm-Hibbing Municipal Airport Taxiway Construction

The Chisholm-Hibbing Municipal Airport constructed a taxiway parallel to runway 31 in 1992 (see Appendix B). The taxiway is 50-ft. wide with 20-ft. shoulders on each side. The taxiway is 8-in. of HMA, on 6-in. of aggregate base, on 12-in. of subase, on 30-in. of subgrade. Longitudinal drains were installed at the bottom of the subgrade, under the taxiway-shoulder joint. The shoulders are 4-in. of HMA. The pavement was sawed full depth, routed, and sealed at 50-ft. and 75-ft. intervals. Ten joints were sealed with silicone and a hot pour asphalt sealant was used in the remaining joints.

Chisholm-Hibbing Municipal Airport Taxiway Joint Deterioration and Repair

Secondary cracking parallel to the sawed joints appeared in 1995. At this time the joints appeared to be well sealed. The cracking was only on the thinner shoulder sections. Deterioration and cupping at the joints continued until the repairs were made.
Three techniques were used:

- Hot pour, transverse patch material (newer product)
  two mix sizes: regular and fine
  two mix products based on air temperature ranges, type 1 and 3
  Cost - $8.00 / ln. ft.
- Thermo-bond asphalt repair
  Cost - $10.00 / ln. ft.
- Clean and seal, leveling with a hot pour sealant
  Cost - $2.50 / ln. ft.

Research Potential

The hot pour, transverse patch material is a newer material that is fast, economical and durable. This material has the potential to be widely used for transverse crack repair on airports and roads in the state of Minnesota. This report focuses on the hot pour transverse patch material.

Taxiway Prior to Repairs

Photo 1. Taxiway section. The centerline of the taxiway is toward the bottom of the photo. The taxiway is 50-ft. wide.

Photo 2. Close up of joint. Severe cupping occurred across the entire joint. The coin is a quarter.

Photo 3. Shoulder section, 20-ft. wide. The shoulder sections were in worse condition than the taxiway.

The sealant often appeared to be performing well, yet deterioration was present. Traffic loading (ESAL's) would be very low for this pavement.

ROUTED JOINTS, TYPE 1 MATERIAL, 75-FT. SPACING

JOINTS TREATED	Joints 1-7 were repaired with Polypatch. *Note: joints 2-7 "leveled" with a joint sealant(see page 11), 2 or 3 days after placement of the PolyPatch.*
INSTALLATION TECHNIQUE	Routing was not over the crack, see the photos below. Joint 1 was routed ~ ¼"deep. *Joint 2 was not routed.* Joints 3-7 were routed ~ ¾ -1" deep. Routed joints were broomed, air blasted, heat lanced and filled. All joints were level filled.
PRODUCT	Crafco PolyPatch Type 1 (34281) designed for use in colder climates, tested for flexibility at -20° F.
DATE	Aug. 6, 2001
COMMENT	Repair work, author not present. Photos represent work completed. Type 1 has a lower adhesion property (15 psi vs. 25 psi) than type 3, but type 1 will resist cracking during cold weather better than type 3.

Photo 4. Typical routed joint. Fill from the shoulder toward the centerline. Recommended application temperature is 375-410° F.

Photo 5. Type 1 material used the larger size aggregate, (vs. the fine mix – type 3). The routed edge provides a better “edge” for the material to bond against.

ROUTED JOINTS, TYPE 3 MATERIAL, 75-FT. SPACING

JOINTS TREATED	Joints 8-23 were repaired with PolyPatch. *Note: joint 8 was "leveled" with the joint sealant, 2 or 3 days after placement of the PolyPatch.*
INSTALLATION TECHNIQUE	Joints 8-23 were routed ~ ¾ -1" deep. Routed joints were broomed, air blasted, heat lanced and filled. All joints were level filled.
PRODUCT	Crafco PolyPatch Fine Mix -Type 3 (34286) material designed for temperatures ranging from 120° F down to 20° F was being added to the existing Crafco PolyPatch Type 1 in the melter. The fine mix material is easier to feather out to the edge of the patch.
DATE	Aug. 7, 2001
COMMENT	Joint 8 was all Type 1 material. Joint 10 was about 2/3 Type 1 and 1/3 Type 3. As the material in the melter was used up, only the Fine Mix -Type 3 was used.

Photo 6. The material easily flowed into cracks and provides a smooth level surface across the joint.

Photo 7. This is the 12-in. wide rake. A 19-in. wide rake was also used.

Photo 8. Completed joint 8. A 12-in. wide patch. Due to the settling of material, joints 2-8 were skimmed leveled with the joint sealant.

Photo 9. This is joint 9. The 19-in. rake shows that the cupping at the joint was often greater than a foot wide. The router was run across the taxiway on each side of the joint. This provided a better "edge" for the patch material to adhere to.

Photo 10. Filling joint 9. This is type 1 material. It will perform better in colder weather than fine mix - type 3. Type 1 has a lower adhesion property than type 3 (15psi vs. 25psi). The routed edge should help the patch material bond to the taxiway. The type 1 also has a larger aggregate size than the fine mix - type 3. Therefore type 1 is better suited for the deeper patches.

Type 1 and type 3 material are both manufactured in a "regular" and fine fix product.
Buckets are not typically used to apply this material. The rubber boot type applicator shoot was lost during transport.

THERMO PATCH REPAIR

JOINTS TREATED	Joints 24-26. Only three joints used the thermo patch repair technique.
INSTALLATION TECHNIQUE	The pavement surface was heated to approximately 400° F. The surface was hand raked. New HMA was added (a Wisconsin mix: 5.5-6.0% AC and 3/8-in. aggregate, at about 250° F). The heated pavement and new HMA were mixed together and recompacted.
PRODUCT	Thermo patch with new fine mix HMA added.
DATE	Aug. 7, 2001
COMMENT	These joints were at 75-ft. spacing.

Photos 11 and 12. Raking the heated joint. Additional new fine HMA was added and mixed together with the existing material. The joint will reflect through the patch.

Photo 13. Joint 26, preparing the area for compaction.

Photos 14, 15, 16, and 17. Compact each edge first, than roll down the center of the patch.

Photo 18. The heating unit progressed across each joint. The sawed and sealed joint will reflect through this repair. The width of this repair is about 41-42 inches.

Due to the small quantities of repair types, it is difficult to estimate production rates for the different repair methods used on this project.

ROUTED OR SKIMMED JOINT, TYPE 3 MATERIAL, 50-FT. SPACING

JOINTS TREATED	Joints 27-32 Joint 26 to 27 is 75-ft. apart. Joint 27 to 28 is 50-ft. apart. Joints (27-45) are spaced 50-ft. apart.
INSTALLATION TECHNIQUE	These joints were *planned* to be routed (see page 12). Routed joints were broomed, air blasted, heat lanced and filled. All joints were level filled.
PRODUCT	Crafco PolyPatch Fine Mix - Type 3 (34281) designed for temperatures ranging from 120° F down to 20° F.
DATE	Aug. 7, 2001
COMMENT	Type 3 has the best adhesion properties, but may crack in the winter.

JOINTS TREATED	Joints 33-35
INSTALLATION TECHNIQUE	These three joints were not routed. All joints were level filled by skimming the material across the cupped joint.
PRODUCT	Crafco PolyPatch Fine Mix - Type 3 (34281) designed for temperatures ranging from 120° F down to 20° F.
DATE	Aug. 7, 2001
COMMENT	Type 3 has the best adhesion properties, but may crack in the winter. The fine mix is best for skimming the patches (without routed edges) and feathering to the edge of the patch.

Photo 19. Typical skim patch operation. Clean and dry.

Photo 20. The pavement surface temperatures during this repair work were up to 140° F by mid afternoon.

JOINT SEALANT ONLY, 50-FT. SPACING

JOINTS TREATED	Joints 36-45
INSTALLATION TECHNIQUE	These joints were skimmed leveled with crack filling material.
PRODUCT	Crafco Roadsaver 221 sealant.
DATE	Aug. 7, 2001
COMMENT	This sealant meets the specifications of ASTM 3405. The estimated amount of material was 2 lbs./ln.ft. No photos were taken during the initial construction.

Photo 21. Joint 42. Taken on 1/24/2002 during the field review. Three pennies are stacked under the ruler. The sealant was stretching and sagging, but did not break open.

FIELD REVIEW: JANUARY 24, 2002

General

Chris Cochran and Jerry Geib completed a field review on January 24, 2002. The reported air temperatures ranged from 5° F to 9° F.

Observations

Photo 22.
Joint 1 was cracked. This was the first joint repaired. This was the first time the contractor placed this material. The repair was not as smooth as other repairs. This joint was not covered with the crack sealant material.

Photo 23. Joint 8 did not appear to be cracked; however joints 2-8 were "skimmed leveled" with joint sealant, approximately two days after placement of the PolyPatch material. The joint sealant may have been masking a small crack in the patching material.

Joint 9 was 50% cracked. Joints 10-23 were 100% cracked. Joints 2-8, with the more flexible material, did not appear to be cracked. However, the joint sealant may have been masking the crack. All joints, at 75-ft. spacing, with the less flexible type 3 material were cracked.

Photo 24. Joint 24. The three joints repaired by the thermo patch method had cracked.

Photo 25. Joint 28.

Joints 28-32 (50-ft. spacing) were not cracked. All joints (10-23) with the same material at 75-ft. spacing were cracked.

Joint 27 was cracked. This joint has a 75-ft. spacing toward joint 26 and a 50-ft. spacing toward joint 28.

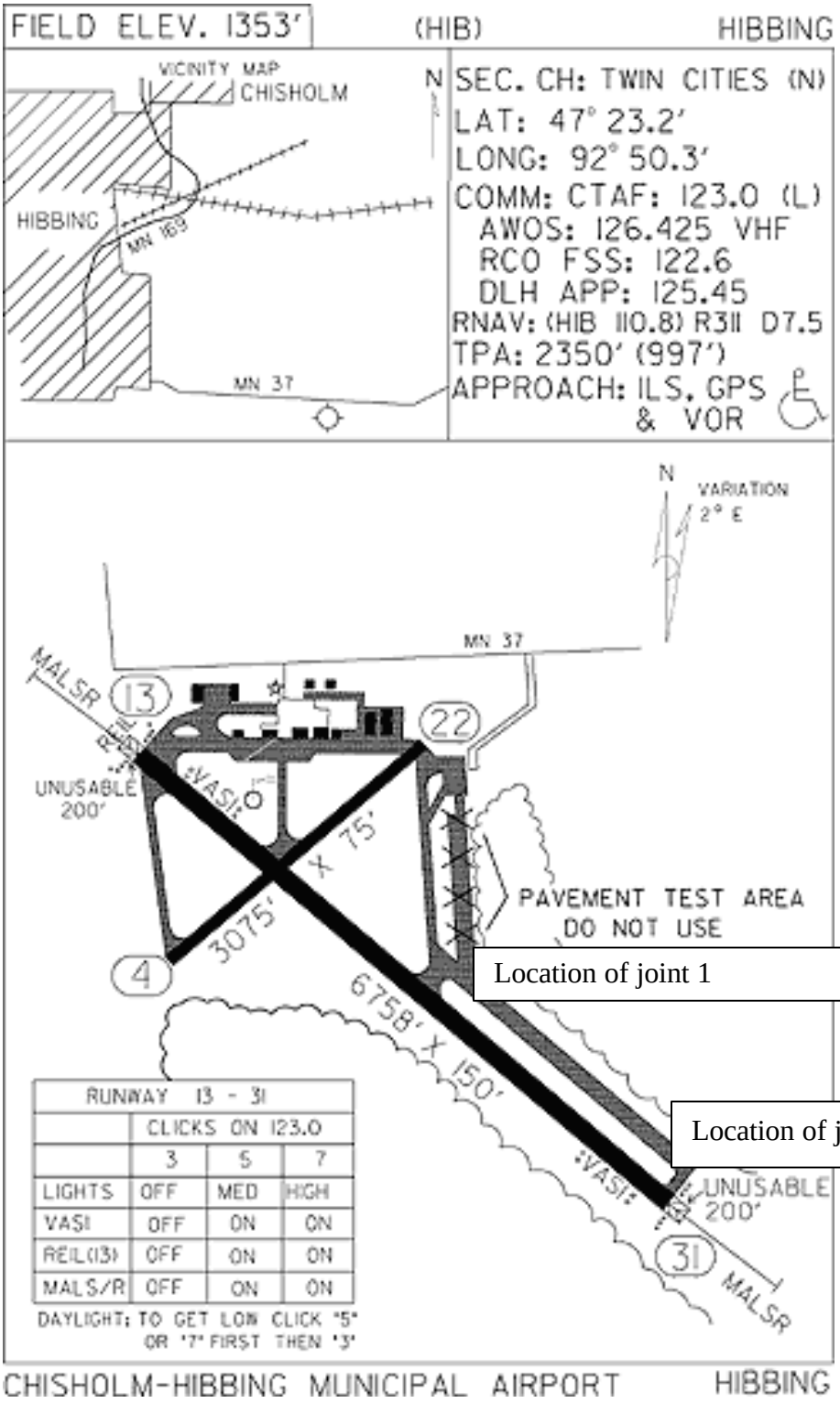
Also note that joints 33-35 were cracked, using the same material and the same joint spacing as joints 27-32. The only difference was that joints 27-32 were *planned* to be routed and joints 33-35 were just to be skimmed. Due to conflicting construction documents, it is not known for sure that joints 27-32 were routed.

Joint 42 is shown on page 10. All of the joints with the joint sealant were not cracked.

APPENDIX A

Joint number	Repair material	Joint spacing	Routed edges	Comments
1-7	Type 1	75-ft.	yes	Joint 1 is cracked, first repair. Joints 2-7 no cracks, covered with sealant.
8-23	Type 3	75-ft.	yes	Joint 8 no crack, covered with sealant. Joint 9 50% cracked, type 1 and 3 material. Joints 10-23 all cracked, type 3 material.
24-26	Thermo patch	75-ft.	n/a	All three joints, 100% cracked.
27-32	Type 3	50-ft.	maybe	Joint 27 cracked, 75-ft spacing on one side. Joints 28-32 no cracks.
33-35	Type 3	50-ft.	no	All cracked.
36-45	Sealant	50-ft.	no	No cracks.

APPENDIX B


FIELD ELEV. 1353'
(HIB)
HIBBING
VICINITY MAP
CHISHOLM
HIBBING
MN 169
MN 37
N
SEC. CH: TWIN CITIES (N)
LAT: 47° 23.2'
LONG: 92° 50.3'
COMM: CTAF: 123.0 (L)
AWOS: 126.425 VHF
RCO FSS: 122.6
DLH APP: 125.45
RNAV: (HIB 110.8) R311 D7.5
TPA: 2350' (997')
APPROACH: ILS, GPS & VOR
N
VARIATION 2° E
MN 37
MALSR
13
22
4
31
VASI
UNUSABLE 200'
3075' X 75'
6758' X 150'
PAVEMENT TEST AREA
DO NOT USE
Location of joint 1
Location of joint 45
RUNWAY 13 - 31
CLICKS ON 123.0
3
5
7
LIGHTS OFF MED HIGH
VASI OFF ON ON
REIL(13) OFF ON ON
MALS/R OFF ON ON
DAYLIGHT: TO GET LOW CLICK "5" OR "7" FIRST THEN "3"
CHISHOLM-HIBBING MUNICIPAL AIRPORT
HIBBING