

State of Vermont PDD/Structures Design Section

Agency of Transportation

TO:	Wayne Symonds, P.E., Structures and Hydraulics Program Manager		
FROM:	Jennifer Fitch, P.E., Structures Project Manager		
DATE:	10/19/16		
SUBJECT:	Recommended Alternative: Hinesburg BF 021-1(35)		

The intent of this memo is to seek concurrence on the recommended alternative for the above referenced project, Culvert 24, a culvert (cattle pass) located along VT Route 116 in Hinesburg.

Site Information:

Culvert 24 is a state owned bridge approximately 4.9 miles south of the intersection of VT Route 116 and VT Route 2A. The culvert, constructed in 1949, is a 68' long, 72" diameter, asphalt coated, corrugated galvanized metal pipe, buried under an average of 4' of fill, designed as a cattle-pass for the Bissonette farm.

Traffic volumes along this roadway segment are moderate for Vermont with an average annual daily traffic (AADT) of 3700, and a design hourly volume (DHV) of 390. This roadway segment is classified as a minor arterial.

The following is a list of deficiencies:

- Culvert 24 has degraded to a 'serious' condition, with random perforations smaller than 2" in diameter throughout the culvert.
- The culvert is beginning to lose structural integrity (to crush).

Site Constraints:

<u>Utilities:</u> Aerial utilities including electric and communication lines run along the southern shoulder of the road, also buried communication cables are on the southern side of the road. These utilities may need to be relocated depending on the alternative chosen.

Environmental: In terms of environmental impacts, the site is located near a small (< 1 acre) class III wetland, and archeologically sensitive areas. It is not anticipated that the project will impact said areas. While there is a riparian corridor just to the east of the project that could be good habitat for Indiana and Northern Long Ear bats, there is no suitable habitat in the proximity of the project site for those endangered species.

<u>*ROW:*</u> The state owned ROW is variable along this roadway segment. The existing ROW is plotted on the existing conditions sheet. It is anticipated that the project will not go outside of existing ROW. However, Right-of-Way Property Management has discovered that "This cattle-pass was part of the As-built plans and depicted in the option as part of the settlement agreement to a certain dollar amount and a cattle-pass." And that any alternative that removes the capability of the culvert to serve as a cattle-pass would need a "Quit Claim Deed" from the current owners.

It is important to note that the Bissonette farm has been put into trust with the Vermont Land Trust and no longer needs the culvert for cattle passage.

Alternatives Analysis:

As noted in the inspection report, the culvert is in 'serious' condition, beginning to crush, and is randomly perforated with corrosion holes. In accordance with Vermont State Standards (VSS), the travel and shoulder lanes meet current standards, although based on feedback from the MOB, they would like the roadway widened to accommodate winter maintenance activities and bicycle and pedestrian use.

In accordance with the preliminary hydraulics report, "Our calculations, field observations and measurements indicate that structure doesn't drain much of anything. There is a wet field on the north side of this pipe. The north side is lower than the south side, causing some ponding in the pipe." Associated replacement recommendations include the following:

- 1. The structure can be removed as it does not appear to currently convey water.
- 2. If it is determined that a pipe should still be here, a new 24" diameter pipe can be placed here. The pipe and a ditch should be constructed so they can drain freely to the stream to the south.
- 3. If drainage is wanted here without a structure crossing the road, then a new ditch can be built along the north side of the road to the next culvert to the west. This will require a pretty deep ditch to get 3' of cover for a new culvert under the driveway.

As such, the following alternatives were examined:

- 1. No Action.
- 2. Removal of existing culvert, and replacement with a new 24" pipe.
- 3. Slip lining the existing culvert with a 24" pipe.
- 4. Removal of existing culvert, and replacing with roadway material to the existing typical.
- 5. Existing culvert to be filled with concrete grout, and side slopes constructed.
- 6. Removal of existing culvert, and replacement with a new 72" pipe for cattle passage.

The first the options were ruled out as viable alternatives:

- 1. No Action,
- 2. Removal of existing culvert, and replacement with a new 24" pipe, and
- 3. Removal of existing culvert, and replacing with roadway material to the existing typical

The "no action" alternative was ruled out due to the advanced state of deterioration of the existing culvert, since work would be required in the next 10 years. The alternatives that would require removal of the existing culvert were ruled nonviable unless legally necessary, due to the need to completely close VT Route 116 for an amount of time, which would cause undue hardship on the travelling public.

The "Slip lining with a 24" pipe", and the "Existing culvert to be filled with concrete grout" alternatives have significantly less of an impact on both the travelling public (utilizing temporary lane closures) and the environment (minimal excavation).

Maintenance of Traffic:

For this analysis, three options for traffic control were evaluated. The AADT and DHV for this project are within the allowable levels for usage of a single lane temporary bridge or phasing.

The shortest end-to-end detour is 64 miles (89 minutes' travel time) which is prohibitively inconvenient for emergency services and buses, although there are local bypasses that can be utilized by locals.

While the cross section is of a sufficient width for phasing this project, this would require the driving of sheet piles to maintain the roadway. Unfortunately, there are multiple outcroppings of ledge close to the culvert on both sides of the roadway, indicating a shallow bedrock which would prohibit the driving of sheet piling to the needed depth. Therefore, phasing is not deemed feasible.

A single lane, temporary bridge would be viable on either side of the existing culvert. But, if a temporary bridge were deemed the MOT alternative, Right-of-Way acquisition would be necessary. In addition, a temporary bridge on either side of the road would impact the wetlands (south side) or archeological sensitive area (north side). The amount of time to both install and remove the temporary bridge, would be comparable to the actual time required for the replacement of the culvert. For these reason, a temporary bridge is deemed to be a poor option.

Hinesburg BF 021-1(35)	Do	Slip Lining	Culvert to be Filled w/	Culvert Removal w/ 72" Pipe
	Nothing	w/24 Pipe	Concrete Grout	Replacement
Total Construction Cost	\$0	\$56,000	\$62,000	\$200,000
Project Development Duration	N/A	2 years	2 years	3 years
Design Life	<10 years	60 years	100+ years	70 years

Alternatives Matrix:

Note: The 72" pipe replacement costs are for a short term road closure. A temporary bridge will increase the cost to approximately \$400,000.

Recommended Alternative:

Alternative 5 is recommended, filling the existing culvert with concrete grout and constructing side slopes while traffic is maintained along VT Route 116. It is important to note that this alternative is contingent on a "Quit Claim Deed" from the property current owners. Otherwise, the existing culvert will need to be replaced with another structure to facilitate cattle passage.

Appendices:

Site Photos



Looking East on VT Route 116 from culvert 24



Looking West on VT Route 116 from culvert 24



Northern opening of culvert 24



Ledge outcropping near northern opening of culvert 24



Looking through culvert 24.

Utilities near southern opening of culvert 24

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for HINESBURG	bridge no.: 0024 District: 5
Located on: VT116 over CATTLE PASS	approximately 4.9 MI S JCT VT 2A Maintained By: STATE
CONDITION Deck Rating: N NOT APPLICABLE Superstructure Rating: N NOT APPLICABLE Substructure Rating: N NOT APPLICABLE Channel Rating: N NOT APPLICABLE Culvert Rating: 3 SERIOUS Federal Str. Number: 300211002404071 AGE and SERVICE	STRUCTURE TYPE and MATERIALS Bridge Type: ACCGMP Number of Main Spans: 1 Kind of Material and/or Design: 3 STEEL Deck Structure Type: N NOT APPLICABLE Type of Wearing Surface: N NOT APPLICABLE Type of Membrane: N NOT APPLICABLE Deck Protection: N NOT APPLICABLE
Year Built: 1949 Year Reconstructed: Type of Service On: 1 HIGHWAY Type of Service Under: 9 HIGHWAY-WATERWAY-RAI Lanes On the Structure: 02 Lanes Under the Structure: 00 Bypass, Detour Length (miles): 25 ADT: 4100 Year of ADT: 1996 GEOMETRIC DATA Length of Maximum Span (ft): 6 Structure Length (ft): 6 Lt Curb/Sidewalk Width (ft): 0 Rt Curb/Sidewalk Width (ft): 0 Bridge Rdwy Width Curb-to-Curb (ft): 0 Deck Width Out-to-Out (ft): 0	CULVERT GEOMETRIC DATA and INDICATORS Culvert Barrel Length (ft): 68 Average Cover Over Culvert (ft): 04 Waterway Area Through Culvert (sq.ft.): Culvert Wing/Header Rating: N NOT APPLICABLE Steel Culvert Corrosion Indicator: 4 RANDOM PERFORATIONS < 2" THROUGHOUT Multi Plate Culvert Bolt Line Crack Indicator: N NOT A STEEL
	MULTI PLATE APPRAISAL Appr. Rdwy. Alignment: 8 EQUAL TO DESIRABLE CRITERIA INSPECTION Inspection Date: 092015 Inspection Frequency (months): 12
Appr. Roadway Width (ft): 29 Skew: 0 Bridge Median: 0 NO MEDIAN Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD Min Vertical Underclr (ft): 06 FT 00 IN	

INSPECTION SUMMARY and NEEDS

09/4/2015 Culvert is in poor condition. Culvert needs to be replaced or removed as no signs of use in past years. ~JAS/TJB

10/27/2014 Culvert is in poor condition. Culvert should be replaced soon due to the starting of the crushing. ~FRE/TJB

11/7/2013 Culvert is in poor condition. and should be replaced in the near future. ~FRE/MJK

10/26/2012 Culvert will need replacement in the near future. ~FRE/JAS

10/28/2010 Poor condition due to the heavy rust scaling and numerous holes along haunches. Pipe needs repairs. Pipe serves as a cattle pass and seems to haven't been used in years. State should consider removal if feasible. ~MK/RF

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION HYDRAULICS UNIT

TO:	Jennifer Fitch, Structures Project Manager		
FROM:	Leslie Russell, P.E., Hydraulics Project Manager		
DATE:	4 April 2016		
SUBJECT:	Hinesburg BF 021-1(35) – VT 116 Culv 24 – Cattle Pass Preliminary Hydraulics		

We have completed our hydraulic study for the above referenced site, and offer the following information for your use:

Existing Conditions

The existing structure is an asphalt coated corrugated metal pipe that is 6' in diameter. It was built in 1949 and has served as a cattle pass. It is 68' long and provides 28.3 sq. ft. The inspection report states that the pipe is in poor condition and either needs to be replaced or removed. The pipe is under about 4' of fill.

Our calculations, field observations and measurements indicate that structure doesn't drain much of anything. There is a wet field on the north side of this pipe. The north side is lower than the south side, causing some ponding in the pipe.

Repair Comments

1. If this pipe is to remain, a liner can be installed. It can be as small as 24". The pipe and a ditch should be constructed so they can drain freely to the stream to the south.

Replacement Recommendations

In sizing a new structure we attempt to select structures that meet both the current VTrans hydraulic standards, state environmental standards with regard to span length and opening height, and allow for roadway grade and other site constraints.

Based on the above considerations and the information available, we recommend any of the following structures as a replacement at this site:

- 1. The structure can be removed as it does not appear to currently convey water.
- 2. If it is determined that a pipe should still be here, a new 24" diameter pipe can be placed here. The pipe and a ditch should be constructed so they can drain freely to the stream to the south.
- 3. If drainage is wanted here without a structure crossing the road, then a new ditch can be built along the north side of the road to the next culvert to the west. This will require a pretty deep ditch to get 3' of cover for a new culvert under the driveway.

General Comments

It is always desirable for a new structure of this size to have flared wingwalls at the inlet and outlet, to smoothly transition flow through the structure, and to protect the structure and roadway approaches from erosion. The wingwalls should match into the channel banks. Any new structure should be properly aligned with the channel, and constructed on a grade that matches the channel. A new structure should span the natural channel width.

Stone Fill, Type I should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet, up to a height of at least one-foot above the top of the opening. The stone fill should not constrict the channel or structure opening.

Please contact us if you have any questions or if we may be of further assistance.

LGR

cc: Hydraulics Project File via NJW

AGENCY OF TRANSPORTATION

То:	Jennifer Fitch, P.E., Structures Project Manager	
From:	Geotechnical Engineer Via Callie Ewald, P.E., Senior Geotechnical Engineer	
Date:	November 24 th , 2015	
Subject:	Hinesburg BF 021-1(35) Preliminary Geotechnical Information	

1.0 INTRODUCTION

We have completed our preliminary geotechnical investigation for the replacement of Bridge #24 on VT Route 116 over a cattle pass in the town of Hinesburg, VT. It is located 4.9 miles south of the junction of VT Route 116 and VT Route 2A. The subject project consists of rehabilitating or replacing the existing asphalt coated corrugated galvanized metal pipe (ACCGMP). This review included the examination of as-built record plans, historical in-house bridge boring files, water well logs and hazardous site information on-file at the Agency of Natural Resources, USDA Natural Resources Conservation soil survey records, published surficial and bedrock geologic maps, and observations made during a site visit.

2.0 SUBSURFACE INFORMATION

2.1 Previous Projects

Record plans were found for the project, but boring data was not included.

The Geotechnical Engineering Section maintains a GIS based historical record of subsurface investigations, which contains electronic records for the majority of borings completed in the past 10 years. An exploration of this database revealed one nearby project, Hinesburg STP 0199(2) approximately 1.8 miles away. Information from this project (1 boring drilled on February 16th, 2011) indicated loose gravelly sand for the first 9 feet and loose to very loose silty clay and clay from 9 feet to depth of hole. The borehole stopped at 25 feet and no bedrock was encountered.

2.2 Water Well Logs

The Agency of Natural Resources (ANR) documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, the logs can be used to determine general characteristics of soil strata in the area. The soil description given on the logs is done in the field, by unknown personnel, and as such, should only be used as an approximation. Figure 1 contains the subject project as well as surrounding well locations found using the ANR Natural Resources Atlas. Four water wells within an approximate 900 foot radius of the project were used to get an estimate of the depth to bedrock likely to be encountered for Bridge #24 and are highlighted below by red boxes.

Figure 1. Culvert and Nearby Well Locations

Table 1 lists the well sites used in gathering the surrounding information, and includes the approximate distance from the bridge project, depth to bedrock, and overburden material encountered.

Well ID	Approx. Distance From Project (feet)	Approx. Depth To Bedrock (feet)	Overburden Material
6255	235	3	Topsoil
146	665	350	Clay
202	685	25	Clay & Gravel
159	770	222	Hardpan/Gravel/Sand

Table 1. Well Information from Wells Illustrated in Figure 1

2.3 Hazard Waste Sites and Underground Storage Tanks

The ANR Natural Resource Atlas also maps the location and information of known hazardous waste sites and underground storage tanks. The location of this project is not on the Hazardous Site List and no impact from other hazardous waste sites are anticipated. The closest location of an underground storage tank was a residential site at the Marrinson Residence, approximately 1.2 miles away.

2.4 USDA Soil Survey

The United States Department of Agriculture (USDA) maintains an online surficial geology map of the US. According to the Web Soil Survey, the stratum directly underlying the project site consists of very fine sandy loam at depths ranging from 0 to 60 inches below ground surface. These soils are classified by the USDA soil survey as moderately well drained with a depth to bedrock of greater than 80 inches and a depth to groundwater of 18 to 36 inches.

2.5 Geologic Maps of Vermont

Mapping conducted in 1970 for the Surficial Geologic map of Vermont shows that the project area is underlain by glaciofluvial kame gravel that is kame terrace.

According to the 2011 Bedrock Map of Vermont, the project site is underlain with wellbedded dolostone weathering beige, cream, and buff, with green, red, or gray phyllite, siliceous partings, and thin beds of blue-quartz-pebble conglomerate and quartzite.

3.0 BRIDGE INSPECTION

Based on the latest bridge inspection report from October 27, 2014, the culvert is in serious condition and will need to be replaced soon. From the inspection, it was indicated that the culvert has started to crush on the top of the culvert as shown in Figure 2. The red arrows are pointing to a separation at the culvert joint which is likely resulting from the pipe compressing.

Figure 2: View of Culvert Crushing (Bridge Inspection Photo on 10/27/14)

The inspection report also indicated that there were perforations less than 2 inches throughout the culvert, due to corrosion and the arrows are pointing to some of the perforations shown in Figure 3.

Figure 3: Corrosion throughout Culvert (Bridge Inspection Photo on 10/27/14)

4.0 FIELD OBSERVATIONS

A preliminary site visit was conducted on November 6th, 2015 to determine possible obstructions inhibiting boring operations and to make any other pertinent observations about the project area. Overhead power lines run along the south side of the existing culvert as shown in Figure 4. The culvert's approximate location is inside the red lines in Figure 4. Visible bedrock is located on the northeast side of the existing culvert as shown in Figure 5.

Figure 4: View at Culvert Location Looking East

Figure 5: Visible Bedrock Located Northeast of Culvert – Circled in Red

Information from this visit indicated that the culvert has been used as a cattle pass in previous years. It is unclear whether it is actively being used as a cattle pass. The culvert is nearby to a small stream that also crosses under VT Route 116.

5.0 **RECOMMENDATIONS**

Based on this information, possible foundation options for a culvert replacement include the following:

- Precast or steel arch bridge with spread footings founded on rock or soil
- Reinforced concrete box culvert with new headwalls and wingwalls

We recommend a minimum of two borings taken with one located on the north side of VT Route 116 and one located on the south side of VT Route 116 in order to more fully assess the subsurface conditions at the site including, but not limited to, the soil properties, groundwater conditions, and depth to bedrock (if applicable). More borings may be necessary here to get a profile of bedrock across the footprint of the culvert based on the observed visible bedrock seen on the north side of the culvert. Due to the overhead utilities on the south side and difficulty with access, we recommend initially drilling two borings on either side of the pipe in the roadway, and then performing additional borings if deemed necessary.

6.0 CONCLUSION

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-2561.

cc: Project File/CEE MRG

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The Structures Section has begun the scoping process for BF 021-1(35), VT Route 116, Culvert 24, A cattle pass. This is an A.C.C.G.M.P. constructed in 1949. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the culvert as 3 (Serious). We are interested in hearing your thoughts regarding the items listed below. Leave it blank if you don't wish to comment on a particular item.

- Your thoughts on the general condition of this bridge and the general maintenance effort required to keep it in service. Being a metal structure circa 1949, it has outlived the normal life of a metal structure and it is just a matter if time before we get a failure. Metal structures cannot be repaired
- 2. Any comments on the geometry of the bridge (curve, sag, banking, sight distance)? Location is fine and sight distance is adequate
- Do you feel the posted speed limit is appropriate?
 Speed limit is appropriate
- Is the width adequate for snow plowing?
 The roadway width should be increased for plowing and bicycle use.
- 5. Are the railings constantly in need of repair or replacement? What type of railing works best for your district? (We are recommending more and more box beam guardrail on our bridges because of crash-worthiness and compatibility with accelerated projects). Being a metal structure, there is no bridge rail, just steel beam guardrail. We have no issues with box beam guardrail or heavy duty steel beam guardrail.
- 6. Are you aware of any unpermitted driveways within the likely project limits? We frequently encounter driveways that prevent us from meeting railing standards and then discover them to be illegal. We are not aware of any illegal drives in the area.
- 7. Are you aware of abutting property owners that are likely to need special attention during the planning and construction phases? These could be people with disabilities, elderly, or simply

Page 1 of 3 12 October 2016 folks who feel they have been unfairly treated in the past. The only owner who may need special attention is the owner of the adjacent farm regarding the size of the replacement cattle pass.

- 8. Do you find that extra effort is required to keep the slopes and river banks around the bridge in a stable condition? Is there frequent flood damage that demands repair? N/A
- 9. Does this bridge seem to pick up an unusual amount of debris from the waterway? N/A
- 10. Do you think a closure with off-site detour and accelerated construction would be appropriate? What should we consider for a detour route, assuming that we use State route for State projects and any route for Town projects? There is no feasible state route detour for VT 116 in Hinesburg . To detour on State routes it would be VT 116 NB to US 2 in South Burlington to I 89 SB to I 189 to US 7 SB to VT 17 EB to VT 116 NB. This would take an hour plus to get from Hinesburgh Village to the south side of the project. There is a Town Highway detour option but it involves a narrow and windy gravel road which is not acceptable. This section of VT 116 carries many trucks that are going to and leaving Casey's gravel pit, the only operational gravel pit in Chittenden county.
- 11. Please describe any larger projects that you have completed that may not be reflected on the attached Appraisal sheet, such as deck patches, paving patches, railing replacement with new type, steel coating, etc. Nothing
- 12. If there is a sidewalk on this bridge, how effective are the Town's efforts to keep it snow and ice free? N/A
- 13. Are there any drainage issues that we should address on this project? Not we are aware of Page 2 of 3 12 October 2016

- 14. Are you aware of any complaints that the public has about issues that we can address on this project? Not that we are aware of.
- 15. Anything else? Nothing at this time.

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Trip to: 1652 N 116 Rd Bristol, VT 05443-5253 24.35 miles / 33 minutes		Thru Route	
Ą	1309 Williston Rd , South Burlir 572144.466908, -73.171462 (Address is approximate)	ngton, VT 05403-	Download Free App
•	1. Start out going south on Hinesburg Rd / V VT-116. <u>Map</u>	I-116 toward Ruth St . Continue to follow	24.4 Mi 24.4 Mi Total
	2. 1652 N 116 RD. <u>Map</u>		
P	1652 N 116 Rd , Bristol, VT 054 (Address is approximate)	43-525344.152215, -73.045833	

Total Travel Estimate: 24.35 miles - about 33 minutes

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_			Notes	
Trip to: 1652 N 116 Rd Bristol, VT 05443-5253 37.07 miles / 56 minutes		pquest	Detour Route	
		Rd 3-5253 minutes		
	Ą	1309 Williston Rd , South E 572144.466908, -73.171462 (Address is approximate)	Burlington, VT 05403- 2	Download Free App
٠	1. W	Start out going north on Hinesburg R . <u>Map</u>	d / VT-116 toward Williston Rd / US-2	0.01 Mi 0.01 Mi Total
4	WEST 2.	Take the 1st left onto Williston Rd / U	JS-2 W. Continue to follow US-2 W. Map	1.8 Mi 1.9 Mi Total
4	SOUTH 3.	Turn left onto S Willard St / US-7 S. №	<u>lap</u>	0.9 Mi 2.8 Mi Total
4	SOUTH 4.	Turn left onto Shelburne Rd / US-7 S	. Continue to follow US-7 S . <u>Map</u>	25.6 Mi 28.4 Mi Total
4	17 5.	Turn left onto Main St / VT-17. Contin	ue to follow VT-17. <u>Map</u>	8.7 Mi 37.1 Mi Total
	6.	1652 N 116 RD. <u>Map</u>		
	P	1652 N 116 Rd , Bristol, VT (Address is approximate)	05443-525344.152215, -73.0458	33

Total Travel Estimate: 37.07 miles - about 56 minutes

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Total Travel Estimate: 1.55 miles - about 3 minutes

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	PROJECT NAME: HINESBURG	
	PROJECT NUMBER: BF 021-1(35)	
ST ALONG € ST E ALONG €	FILE NAME: I5b094/sI5b094profile.dgn PROJECT LEADER: J.FITCH DESIGNED BY: PROFILE SHEET	PLOT DATE: 12-OCT-2016 DRAWN BY: D.D.BEARD CHECKED BY: SHEET 2 OF 7

DESIGNED BY: -----

CHANNEL CROSS SECTIONS I

CHECKED BY: -----

SHEET 5 OF 7

	project name: HINESBURG	
	project number: BF 021-1(35)	
	FILE NAME: I5b094/sI5b094xs.dgn	PLOT DATE: 12-0CT-2016
	PROJECT LEADER: J.FITCH	DRAWN BY: D.D.BEARD
	DESIGNED BY:	CHECKED BY:
5	CHANNEL CROSS SECTIONS 3	SHEET 7 OF 7