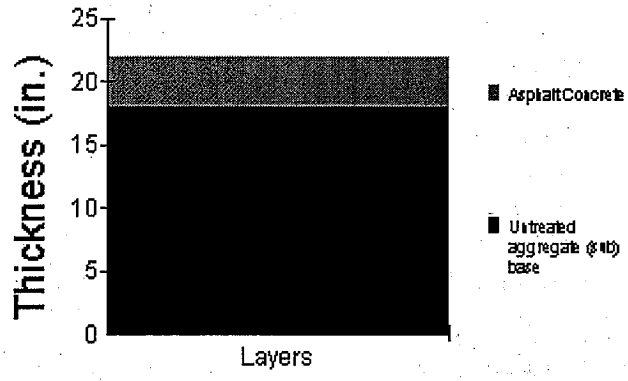
Asphalt Institute

Pavement Design Detail Report

SW-1 Thickness Design Software version 1.0



User:	sdoherty	Date:	1/3/2013	Time:	10:06
Project Information					
Project Name:	Green Hill Rd. Existing				
Description:	Green Hill Rd. ESALs under current conditions.				
Pavement Use:	General Roadway				
Problem Type:	New Pavement Design				
Design Input Summary					
Climate:	45° F				
Design Traffic (ESAL):	126,627				
Subgrade M_r (psi):	38,500				
Design Traffic Details					
Design Life (years):	20				
Design Lane Factor:	0.8				
Initial Average Annual Daily Traffic (AADT):	1800				
Truck Volume, as a percentage of AADT:	5				
Annual Compound Growth Rate (%):	2				
Type of usage:	Rural				
Truck Classification	% Trucks	Truck Factor			
TRUCK(2-AXLE,4-TIRE)	70	0.01			
TRUCK(2-AXLE,6-TIRE)	15	0.30			
TRUCK(3-AXLE or MORE)	10	0.90			

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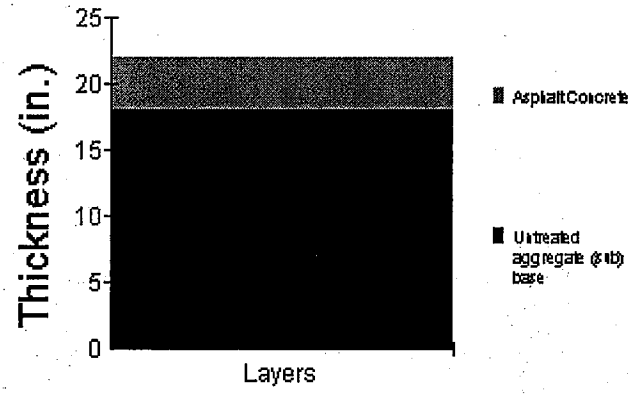
MULT.TRUCK(<=4-AXLE)	2	0.64
MULT.TRUCK(5-AXLE)	2	1.36
MULT.TRUCK(>=6-AXLE)	1	1.63
TOTAL:	100	N/A
Calculated Equivalent Single Axle Loads (ESAL)		
Initial Year Traffic (ESAL):	5,211	
Design Life (ESAL):	126,627	
Subgrade Information		
Type of Measurement:	Resilient Modulus (M_r)	
Correlation Equation:	N/A	
Recommended Design Strength Percentile	75.0	
Design Strength Percentile:	N/A	
Individual M_r Values	M_r	
	38,500	
Average:	38,500	38,500
Std Dev:	0	0
Design M_r	38,500	
Design Results		
HMA Thickness (in)	4.0	
Aggregate Base Thickness (in)	18.0	

Asphalt Institute

Pavement Design Detail Report

SW-1 Thickness Design Software version 1.0



User:	sdoherty	Date:	1/3/2013	Time:	10:51
Project Information					
Project Name:	Green Hill Rd. Proposed				
Description:	Green Hill Rd. ESALs under proposed conditions.				
Pavement Use:	General Roadway				
Problem Type:	New Pavement Design				
Design Input Summary					
Climate:	45° F				
Design Traffic (ESAL):	411,885				
Subgrade M_r (psi):	38,500				
Design Traffic Details					
Design Life (years):	20				
Design Lane Factor:	0.8				
Initial Average Annual Daily Traffic (AADT):	1830				
Truck Volume, as a percentage of AADT:	6.6				
Annual Compound Growth Rate (%):	2				
Type of usage:	Rural				
Truck Classification	% Trucks	Truck Factor			
TRUCK(2-AXLE,4-TIRE)	53	0.01			
TRUCK(2-AXLE,6-TIRE)	12	0.30			

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TRUCK(3-AXLE or MORE)	7	0.90
MULT.TRUCK(<=4-AXLE)	1	0.64
MULT.TRUCK(5-AXLE)	26	1.36
MULT.TRUCK(>=6-AXLE)	1	1.63
TOTAL:	100	N/A
Calculated Equivalent Single Axle Loads (ESAL)		
Initial Year Traffic (ESAL):	16,950	
Design Life (ESAL):	411,885	
Subgrade Information		
Type of Measurement:	Resilient Modulus (M_r)	
Correlation Equation:	N/A	
Recommended Design Strength Percentile	75.0	
Design Strength Percentile:	N/A	
Individual M_r Values	M_r	
	38,500	
Average:	38,500	38,500
Std Dev:	0	0
Design M_r	38,500	
Design Results		
HMA Thickness (in)	4.0	
Aggregate Base Thickness (in)	18.0	

MnPAVE Design Summary

MnPAVE 6.210 Simulation Input File: Greenhill East Existing

Confidence and Reliability do not necessarily agree. All layer values are reduced based on Confidence. Monte Carlo Reliability randomly selects values for each layer. Use Reliability for final design.

Preliminary Life Estimate		20-Year Reliability	
Fatigue	Rutting	Fatigue	Rutting
>50 years	46 years	100%	99.8%

Project Information

District	County	City
6	Houston	Barrington

Project Number	Route	Reference Post
4895A	Green Hill Rd	from to

Letting Date	Construction Type
12/27/12	

Designer	Soils Engineer
Sean Doherty	Roger Keilig

Climate Information

Season Mode	Location
Days	43° 44' Latitude, 91° 25' Longitude

Structural Information (Design Level: Intermediate)

Layer	Type	Subtype	Height (in.)
1	Hot-Mix Asphalt	PG52-34	3.00
2	Aggregate Base	FDR / Class 7	12.00
3	Engineered Soil	Silt	6.00
4	Engineered Soil	Silt Loam (plastic)	12.00
5	Engineered Soil	Silty Clay	

Traffic Information

Load Type	Total Repetitions
ESALs	127,000

Notes

Reliability Statistics for Green Hill Road east of the proposed gravel pit under current conditions.

20 Year Reliability of > 85% recommended for ESALs <1,000,000
Houston County MN selected for climate similarities with Barrington NH

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MnPAVE Design Summary

MnPAVE 6.210 Simulation Input File: Greenhill East Max

Confidence and Reliability do not necessarily agree. All layer values are reduced based on Confidence. Monte Carlo Reliability randomly selects values for each layer. Use Reliability for final design.

Preliminary Life Estimate		20-Year Reliability	
Fatigue	Rutting	Fatigue	Rutting
37 years	20 years	98.5%	86.7%

Project Information

District	County	City
6	Houston	Barrington

Project Number	Route	Reference Post
4895A	Greenhill Rd	from to

Letting Date	Construction Type
12/27/12	

Designer	Soils Engineer
Sean Doherty	Roger Keilig

Climate Information

Season Mode	Location
Days	43° 44' Latitude, 91° 25' Longitude

Structural Information (Design Level: Intermediate)

Layer	Type	Subtype	Height (in.)
1	Hot-Mix Asphalt	PG52-34	3.00
2	Aggregate Base	FDR / Class 7	12.00
3	Engineered Soil	Silt	6.00
4	Engineered Soil	Silt Loam (plastic)	12.00
5	Engineered Soil	Silty Clay	

Traffic Information

Load Type	Total Repetitions
ESALs	340,000

Notes

Maximum load Reliability Statistics for Green Hill Road east of the proposed gravel pit.

20 Year Reliability of > 85% recommended for ESALs <1,000,000
Houston County MN selected for climate similarities with Barrington NH

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MnPAVE Design Summary

MnPAVE 6.210 Simulation Input File: Greenhill East Proposed

Confidence and Reliability do not necessarily agree. All layer values are reduced based on Confidence. Monte Carlo Reliability randomly selects values for each layer. Use Reliability for final design.

Preliminary Life Estimate		20-Year Reliability	
Fatigue	Rutting	Fatigue	Rutting
31 years	17 years	95%	77.2%

Project Information

District	County	City
6	Houston	Barrington

Project Number	Route	Reference Post
4895A	Greenhill Rd	from to

Letting Date	Construction Type
12/27/12	

Designer	Soils Engineer
Sean Doherty	Roger Keilig

Climate Information

Season Mode	Location
Days	43° 44' Latitude, 91° 25' Longitude

Structural Information (Design Level: Intermediate)

Layer	Type	Subtype	Height (in.)
1	Hot-Mix Asphalt	PG52-34	3.00
2	Aggregate Base	FDR / Class 7	12.00
3	Engineered Soil	Silt	6.00
4	Engineered Soil	Silt Loam (plastic)	12.00
5	Engineered Soil	Silty Clay	

Traffic Information

Load Type	Total Repetitions
ESALs	412,000

Notes

Reliability Statistics for Green Hill Road east of the proposed gravel pit under propused conditions.

20 Year Reliability of > 85% recommended for ESALs <1,000,000
Houston County MN selected for climate similarities with Barrington NH

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MnPAVE Design Summary

MnPAVE 6.210 Simulation Input File: Greenhill West Existing

Confidence and Reliability do not necessarily agree. All layer values are reduced based on Confidence. Monte Carlo Reliability randomly selects values for each layer. Use Reliability for final design.

Preliminary Life Estimate		20-Year Reliability	
Fatigue	Rutting	Fatigue	Rutting
>50 years	>50 years	100%	100%

Project Information

District	County	City
6	Houston	Barrington

Project Number	Route	Reference Post
4895A	Greenhill Rd	from to

Letting Date	Construction Type
12/27/12	

Designer	Soils Engineer
Sean Doherty	Roger Keilig

Climate Information

Season Mode	Location
Days	43° 44' Latitude, 91° 25' Longitude

Structural Information (Design Level: Intermediate)

Layer	Type	Subtype	Height (in.)
1	Hot-Mix Asphalt	PG58-34	3.00
2	Aggregate Base	FDR / Class 7	6.00
3	Aggregate Base	MNDOT Class 6	12.00
4	Engineered Soil	Sand	

Traffic Information

Load Type	Total Repetitions
ESALs	127,000

Notes

Reliability Statistics for Green Hill Road west of the proposed gravel pit under current conditions.

20 Year Reliability of > 85% recommended for ESALs <1,000,000
Houston County MN selected for climate similarities with Barrington NH

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MnPAVE Design Summary

MnPAVE 6.210 Simulation Input File: Greenhill West Max

Confidence and Reliability do not necessarily agree. All layer values are reduced based on Confidence. Monte Carlo Reliability randomly selects values for each layer. Use Reliability for final design.

Preliminary Life Estimate		20-Year Reliability	
Fatigue	Rutting	Fatigue	Rutting
22 years	49 years	85.4%	99.9%

Project Information

District	County	City
6	Houston	Barrington

Project Number	Route	Reference Post
4895A	Greenhill Rd	from to

Letting Date	Construction Type
12/27/12	

Designer	Soils Engineer
Sean Doherty	Roger Keilig

Climate Information

Season Mode	Location
Days	43° 44' Latitude, 91° 25' Longitude

Structural Information (Design Level: Intermediate)

Layer	Type	Subtype	Height (in.)
1	Hot-Mix Asphalt	PG58-34	3.00
2	Aggregate Base	FDR / Class 7	6.00
3	Aggregate Base	MNDOT Class 6	12.00
4	Engineered Soil	Sand	

Traffic Information

Load Type	Total Repetitions
ESALs	880,000

Notes

Maximum Load Reliability Statistics for Green Hill Road west of the proposed gravel.

20 Year Reliability of > 85% recommended for ESALs <1,000,000
Houston County MN selected for climate similarities with Barrington NH

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MnPAVE Design Summary

MnPAVE 6.210 Simulation Input File: Greenhill West Proposed

Confidence and Reliability do not necessarily agree. All layer values are reduced based on Confidence. Monte Carlo Reliability randomly selects values for each layer. Use Reliability for final design.

Preliminary Life Estimate		20-Year Reliability	
Fatigue	Rutting	Fatigue	Rutting
41 years	>50 years	99.8%	100%

Project Information

District	County	City
6	Houston	Barrington

Project Number	Route	Reference Post
4895A	Greenhill Rd	from to

Letting Date	Construction Type
12/27/12	

Designer	Soils Engineer
Sean Doherty	Roger Keilig

Climate Information

Season Mode	Location
Days	43° 44' Latitude, 91° 25' Longitude

Structural Information (Design Level: Intermediate)

Layer	Type	Subtype	Height (in.)
1	Hot-Mix Asphalt	PG58-34	3.00
2	Aggregate Base	FDR / Class 7	6.00
3	Aggregate Base	MNDOT Class 6	12.00
4	Engineered Soil	Sand	

Traffic Information

Load Type	Total Repetitions
ESALs	412,000

Notes

Reliability Statistics for Green Hill Road west of the proposed gravel pit under proposed conditions.

20 Year Reliability of > 85% recommended for ESALs <1,000,000
Houston County MN selected for climate similarities with Barrington NH

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Civil Engineers
Structural Engineers
Traffic Engineers
Land Surveyors
Landscape Architects
Planners

January 4, 2013
TFM No. 47052.00
Trinity Conservation LLC
Barrington NH

Table 1: Green Hill Road Estimated Improvements Cost and Proposed Contributions Allocation

Total Road Length of Need	5300	LF
Average Road width	22	LF

Task 1: Pavement Overlay		
Condition 1: Existing Roadway Traffic		
1" Wearing coarse Overlay	4050	LF
(Excludes eastern 1250 feet)	545	TON
	$70	Cost per ton
	$38,150	Cost
Engineering & Contingencies 1.15	$43,872.50	Total Cost
Town's Contribution	$43,872.50	
Condition 2: With Proposed Borrow Pit		
1.5" Wearing coarse Overlay	3850	LF
	776	TON
	$70	Cost per ton
	$54,320	Cost
Engineering & Contingencies 1.15	$62,468.00	Total Cost
TC's Contribution	$18,595.50	
2" Wearing coarse overlay	200	LF
(within 100 feet of driveway)	54	TON
	$70	Cost per ton
	$3,780	Cost
Engineering & Contingencies 1.15	$4,347.00	Total Cost
TC's Contribution for Total Overlay	$22,942.50	

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48 Constitution Drive
Bedford, NH 03110
Phone (603) 472-4488
Fax (603) 472-9747
www.tfmoran.com

4 January 2013

Re: Green Hill Road Estimated Improvements Cost and Proposed Contributions Allocation

Task 2: Full Box Reconstruction 22' wide (Eastern 1250 feet)	1250	LF
3" HBP/6" Crushed Gravel/12" BR Gravel	$100.00	$/ LF
	$125,000.00	Total Cost
Town Contribution	$83,333	
TC's Contribution	$41,667	

Overall Project	TC's Contribution
Task 1	$22,943
Task 2	$41,667
Net	$64,609

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