

APPENDIX C

Graphical Representation of Answers to Selected Questions by Respondents to the Questionnaire Survey (see Appendix A)

RIOH-ALF				
WesTrack				
RRT-Rom				
NCAT				
MnROAD	TRACKER	RIOH-ALF		
LCPC-Fr	RRT-Romania	TRL-PTF		
ISETH	PRF-La	PRF-La	TRACKER	
In-APLF	MnROAD	NCAT	TRL-PTF	
HVS-SA	LINTRACK	LINTRACK	MnROAD	
HVS-Nordic	K-ATL	K-ATL	LCPC-Fr	
FHWA-PTF	ATLaS	ATLaS	ATLaS	
NAPTF	ISETH	ISETH	ISETH	
DRTM	HVS-SA	In-APLF	HVS-SA	
HVS-CRREL	DRTM	FDOT-HVS	NAPTF	HVS-A
CEDEX	HVS-CRREL	HVS-CRREL	DRTM	TxMLS
CAPTIF-NZ	CAPTIF-NZ	CAL/APT	CAL/APT	ISETH
ARRB-ALF	CAL/APT	ARRB-ALF	ARRB-ALF	HVS-SA
Oh-APLF	Oh-APLF	Oh-APLF	Oh-APLF	CAL/APT
National research program	Academic research program	State research program	Partnership with others in private sector	Service rendered for others; e.g., state DOTs, military, etc.

FIGURE C1 Nature of your APT program. (Source: Significant findings from full-scale/APT testing, Question 1.1).

RIOH-ALF					
HVS-A		RIOH-ALF			
TxMLS		WesTrack			
TRL-PTF		HVS-A			
RRT-Rom		TRACKER	RIOH-ALF		
PRF-La		TxMLS	WesTrack		
NCAT		TRL-PTF	HVS-A		
MnROAD	HVS-A	RRT-Rom	TxMLS		
LINTRACK	TxMLS	PRF-La	PRF-La		HVS-A
LCPC-Fr	TRL-PTF	NCAT	NCAT		TxMLS
K-ATL	MnROAD	MnROAD	MnROAD		MnROAD
ATLaS	LINTRACK	LINTRACK	LINTRACK		LINTRACK
ISETH	LCPC-Fr	LCPC-Fr	LCPC-Fr	HVS-A	LCPC-Fr
In-APLF	ATLaS	K-ATL	ATLaS	TRL-PTF	K-ATL
HVS-SA	ISETH	ATLaS	ISETH	PRF-La	ATLaS
HVS-Nordic	In-APLF	ISETH	INDOT	MnROAD	ISETH
FHWA-PTF	HVS-SA	In-APLF	HVS-SA	LCPC-Fr	In-APLF
FDOT-HVS	FHWA-PTF	HVS-SA	FHWA-PTF	K-ATL	HVS-SA
NAPTF	NAPTF	FHWA-PTF	NAPTF	ATLaS	HVS-Nordic
DRTM	DRTM	FDOT-HVS	DRTM	In-APLF	FHWA-PTF
HVS-CRREL	HVS-CRREL	HVS-CRREL	HVS-CRREL	HVS-SA	FDOT-HVS
CEDEX	CEDEX	CEDEX	CEDEX	FDOT-HVS	NAPTF
CAPTIF-NZ	CAPTIF-NZ	CAPTIF-NZ	CAPTIF-NZ	HVS-CRREL	HVS-CRREL
CAL/APT	CAL/APT	CAL/APT	CAL/APT	CEDEX	CEDEX
ARRB-ALF	ARRB-ALF	ARRB-ALF	ARRB-ALF	CAL/APT	CAL/APT
Oh-APLF	Oh-APLF	Oh-APLF	Oh-APLF	ARRB-ALF	ARRB-ALF
Pavement structural composition	Loading environment (traffic/climate)	Materials and tests	Performance models	Construction techniques	Rehabilitation strategies

FIGURE C2 Implementation of your APT is geared towards. (Source: Significant findings from full-scale/APT, Question 1.2).

				HVS-A
	TxMLS		RIOH-ALF	MnROAD
	LINTRACK		WesTrack	LCPC-Fr
TRACKER	K-ATL		TRL-PTF	In-APLF
ISETH	HVS-Nordic	RRT-Rom	NCAT	HVS-SA
FDOT-HVS	NAPTF	PRF-La	CEDEX	FHWA-PTF
HVS-CRREL	Oh-APLF	CAPTIF-NZ	CAL/APT	ARRB-ALF
1-5	6-10	11-20	21-50	>50*

FIGURE C5 Number of pavement sections tested. (Source: Significant findings from full-scale/APT, Question 1.5).

*Upper limit not defined in questionnaire.

TRACKER	RIOH-ALF			
TRL-PTF	TxMLS			
LCPC-Fr	LINTRACK			
K-ATL	LCPC-Fr	HVS-A		
In-APLF	FHWA-PTF	NAPTF		
HVS-SA	FDOT-HVS	DRTM		
HVS-Nordic	HVS-CRREL	CEDEX	RRT-Rom	WesTrack
CAL/APT	CAL/APT	CAPTIF-NZ	PRF-La	MnROAD
Oh-APLF	ARRB-ALF	CAL/APT	NCAT	ISETH
1-3	4-6	7-11	12-24	>24*

FIGURE C6 Typical duration of an APT test per test section in months. (Source: Significant findings from full-scale/APT, Question 1.6).

*Upper limit not defined in questionnaire.

	RIOH-ALF			
	TRL-PTF			
	ATLaS	PRF-La	WesTrack	
RRT-Rom	HVS-SA	FHWA-PTF	MnROAD	
LINTRACK	CAPTIF-NZ	FDOT-HVS	LCPC-Fr	
K-ATL	ARRB-ALF	CEDEX	NAPTF	
In-Oh-APLF	Oh-APLF	CAL/APT	HVS-CRREL	
<\$1 M	\$1-2 M	\$2-5 M	>\$5 M*	

FIGURE C7 Estimated capital cost of APT facility equipment. (Source: Significant findings from full-scale/APT, Question 1.7).

*Upper limit not defined in questionnaire.

	RIOH-ALF				
	TRL-PTF				
	RRT-Rom			WesTrack	
	ISETH	LINTRACK		FDOT-HVS	
	CAPTIF-NZ	K-ATL	TxMLS	NAPTF	NCAT
In-APLF	ARRB-ALF	HVS-Nordic	PRF-La	HVS-CRREL	MnROAD
HVS-Nordic	Oh-APLF	FHWA-PTF	HVS-SA	CEDEX	CAL/APT
<\$0.1 M	\$0.1-0.2 M	\$0.2-0.4 M	\$0.4-0.8 M	\$0.8-1.6 M	>\$1.6 M*

FIGURE C8 Yearly APT budget without pavement construction cost. (Source: Significant findings from full-scale/APT, Question 1.8).
 *Upper limit not defined in questionnaire.

									WesTrack
									HVS-A
									TxMLS
									TRL-PTF
									PRF-La
									LINTRACK
			WesTrack	HVS-A	RIOH-ALF				K-ATL
			TxMLS	TRACKER	TRL-PTF				ATLaS
			TRL-PTF	NCAT	RRT-Rom				ISETH
			RRT-Rom	ATLaS	PRF-LA				In-APLF
	PRF-La		NCAT	HVS-SA	LINTRACK				FHWA-PTF
	ATLaS		K-ATL	FHWA-PTF	K-ATL				NAPTF
	In-APLF		ISETH	FDOT-HVS	ISETH				CAPTIF-NZ
	FHWA-PTF		CAPTIF-NZ	CAL/APT	INDOT				CAL/APT
TRACKER	FDOT-HVS		CAL/APT	ARRB-ALF	NAPTF			RRT-Rom	ARRB-ALF
LINTRACK	Oh-APLF	NAPTF	ARRB-ALF	Oh-APLF	CAPTIF-NZ	FDOT	NCAT	DRTM	Oh-APLF
<10%	10-20%	20-30%	>30%*	<10%	10-20%	<10%	10-20%	20-30%	>30%
Operational				Maintenance			Staff		

FIGURE C9 Breakdown of budget (N/A). (Source: Significant findings from full-scale/APT, Question 1.9).
 *Upper limit not defined in questionnaire.

RIOH-ALF			
WesTrack			
HVS-A			
TRACKER			
TRL-PTF			
RRT-Rom			
NCAT			
LINTRACK			
LCPC-Fr			
K-ATL			
ATLaS			
ISETH			
In-APLF			
HVS-SA			
HVS-Nordic			
FHWA-PTF			
DRTM			
HVS-CRREL			
CAPTIF-NZ	TxMLS		
ARRB-ALF	PRF-La		
Oh-APLF	FDOT-HVS	CEDEX	
<\$0.5 M	\$0.5-1 M	\$1-2 M	>\$2 M*

FIGURE C10 Average (typical) operational cost/test section. (Source: Significant findings from full-scale/APT, Question 1.10).

*Upper limit not defined in questionnaire.

RIOH-ALF					RIOH-ALF	
HVS-A					HVS-A	
TxMLS					TRACKER	
TRL-PTF					TxMLS	
RRT-Rom					TRL-PTF	
PRF-La		RIOH-ALF			RRT-Rom	
NCAT		HVS-A			PRF-La	
LINTRACK		TRACKER			NCAT	
K-ATL		TRL-PTF			LINTRACK	
ATLaS		RRT-Rom			K-ATL	
ISETH		PRF-La			ATLaS	
In-APLF		NCAT			In-APLF	
HVS-SA		LINTRACK			HVS-SA	
HVS-Nordic		K-ATL			HVS-Nordic	
FHWA-PTF		ATLaS			FHWA-PTF	
FDOT-HVS		In-APLF			FDOT-HVS	
NAPTF		FHWA-PTF			NAPTF	
HVS-CRREL		HVS-CRREL			HVS-CRREL	
CEDEX		CEDEX	HVS-SA		CEDEX	
CAPTIF-NZ	WesTrack	CAPTIF-NZ	HVS-Nordic	WesTrack	CAPTIF-NZ	
ARRB-ALF	MnROAD	ARRB-ALF	FDOT	MnROAD	ARRB-ALF	TxMLS
Oh-APLF	CAL/APT	Oh-APLF	NAPTF	CAL/APT	Oh-APLF	MnROAD
<5	>5*	<5	5-10	>10*	<5	>5*
Professional		Technical			Administrative	

FIGURE C11 Number of direct APT personnel. (Source: Significant findings from full-scale/APT, Question 1.11).

*Upper limit not defined in questionnaire.

					WesTrack
					HVS-A
					NCAT
					MnROAD
					NAPTF
					CAPTIF-NZ
					CAL/APT
					ARRB-ALF
			ISETH		
<\$100 k	\$100-200 k	\$200-500 k	\$0.5-1 M	\$1-2 M	>\$2 M*

FIGURE C12 Overall estimated savings/benefits in monetary terms for the respective programs. (Source: Significant findings from full-scale/APT, Question 1.12).

*Upper limit not defined in questionnaire.

RIOH-ALF	
WesTrack	
HVS-A	
TxMLS	
RRT-Rom	
PRF-La	
NCAT	
MnROAD	
LINTRACK	
LCPC-Fr	
ATLaS	WesTrack
ISETH	HVS-A
HVS-SA	TxMLS
HVS-Nordic	RRT-Rom
FHWA-PTF	NCAT
FDOT-HVS	MnROAD
NAPTF	LINTRACK
HVS-CRREL	LCPC-Fr
CAPTIF-NZ	ISETH
CAL/APT	In-APLF
ARRB-ALF	HVS-CRREL
Oh-APLF	ARRB-ALF
Structural performance	Functional performance

FIGURE C15 Purpose of the structural compositions used in APT programs. (Source: Significant findings from full-scale/APT, Question 2.1).

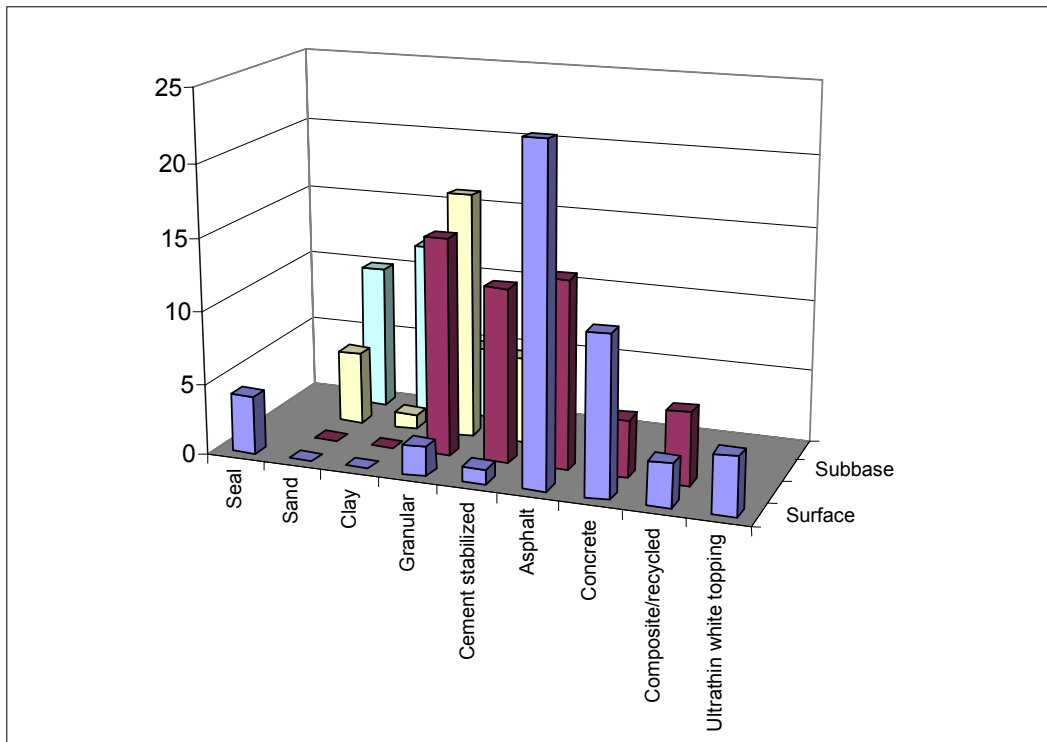


FIGURE C16 Pavement layers evaluated/validated in the structural performance tests. (Source: Significant findings from full-scale/APT, Question 2.2).

				PRFL-La
				WesTrack
				HVS-A
				TxMLS
				TRL-PTF
				NCAT
				LINTRACK
				K-ATL
				FHWA-PTF
				FDOT-HVS
			MnROAD	NAPTF
MnROAD	MnROAD	MnROAD	ISETH	DRTM
HVS-SA	HVS-SA	HVS-SA	HVS-SA	CAL/APT
ARRB-ALF	ARRB-ALF	CAPTIF-NZ	ARRB-ALF	Oh-APLF
Ravelling	Bleeding	Other	Aggregate loss	Not applicable

FIGURE C17 Distress criterion evaluated for seals. (Source: Significant findings from full-scale/APT, Question 2.3).

				RIOH-ALF	
				HVS-A	
				TxMLS	
				TRL-PTF	
				MnROAD	
				LINTRACK	
				K-ATL	
				ISETH	
				HVS-SA	
				HVS-Nordic	
				NAPTF	
				DRTM	
				HVS-CRREL	FHWA-PTF
				CEDEX	WesTrack
	HVS-A	MnROAD	CAPTIF-NZ	NCAT	
	HVS-SA	DRTM	CAL/APT	FDOT-HVS	MnROAD
ISETH	ARRB-ALF	HVS-CRREL	ARRB-ALF	Oh-APLF	NAPTF
Collapsing	Swelling	Freeze/thaw	Permanent deformation	Not applicable	Other

FIGURE C18 Distress criterion evaluated for pavements with clay/sand material. (Source: Significant findings from full-scale/APT, Question 2.4).

RIOH-ALF				
HVS-A				
TxMLS				
TRL-PTF				
PRF-La				
MnROAD				
LCPC-Fr				
K-ATL				
ISETH				
HVS-SA				
HVS-Nordic				
NAPTF		RIOH-ALF		
DRTM		HVS-A		
HVS-CRREL		MnROAD		
CEDEX		HVS-SA		WesTrack
CAPTIF-NZ	MnROAD	HVS-CRREL		NCAT
CAL/APT	DRTM	CAPTIF-NZ		FDOT-HVS
ARRB-ALF	HVS-CRREL	ARRB-ALF	K-ATL	Oh-APLF
Permanent deformation	Frost/thaw damage	Shear failure	Other	Not applicable

FIGURE C19 Distress criterion evaluated for pavements with granular materials. (Source: Significant findings from full-scale/APT, Question 2.5).

RIO-ALF				
HVS-A				
TxMLS				
TRL-PTF				
RRT-Rom				
PRF-La				
MnROAD				FHWA-PTF
LCPC-Fr				WesTrack
ISETH	RIOH-ALF			NCAT
HVS-SA	HVS-A			LINTRACK
NAPTF	TRL-PTF			FDOT-HVS
DRTM	ISETH		MnROAD	HVS-CRREL
CEDEX	HVS-SA	RRT-Rom	CAL/APT	CAPTIF-NZ
ARRB-ALF	ARRB-ALF	HVS-SA	ARRB-ALF	Oh-APLF
Cracking	Crushing	Carbonation	Other	Not applicable

FIGURE C20 Distress criterion for pavements with stabilized or cemented materials. (Source: Significant findings from full-scale/APT, Question 2.6).

RIOH-ALF						
WesTrack						
HVS-A						
TxMLS						
TRL-PTF	RIOH-ALF					
RRT-Rom	WesTrack					
PRF-La	TxMLS					
NCAT	TRL-PTF					
MnROAD	RRT-Rom					
LINTRACK	PRF-La					
LCPC-Fr	NCAT					
K-ATL	MnROAD					
ISETH	LINTRACK					
In-APLF	LCPC-Fr					
HVS-SA	K-ATL					
FHWA-PTF	ISETH					
FDOT-HVS	In-APLF		RIOH-ALF			
DRTM	HVS-SA		WesTrack			
HVS-CRREL	FHWA-PTF		TxMLS			
CEDEX	DRTM		NCAT	TxMLS		
CAPTIF-NZ	CEDEX	RIOH-ALF	MnROAD	RRT-Rom	WesTrack	
CAL/APT	CAPTIF-NZ	WesTrack	In-APLF	MnROAD	MnROAD	
ARRB-ALF	CAL/APT	MnROAD	HVS-SA	HVS-SA	K-ATL	
Oh-APLF	ARRB-ALF	HVS-CRREL	CAL/APT	FHWA-PTF	Oh-APLF	NAPTF
Rutting	Fatigue	Low temperature cracking	Moisture damage/ stripping	Aging	Other	Not applicable

FIGURE C21 Distress criterion evaluated for pavements with asphaltic materials. (Source: Significant findings from full-scale/APT, Question 2.7).

HVS-A												
TRL-PTF												
RRT-Rom												
MnROAD												
LCPC-Fr												
K-ATL												
ATLaS			HVS-A	HVS-A								
In-APLF			MnROAD	TRL-PTF								
HVS-SA	HVS-A		LCPC-Fr	MnROAD								
HVS-Nordic	MnROAD	TRL-PTF	ATLaS	LCPC-Fr	TRL-PTF					MnROAD		WesTrack
NAPTF	ATLaS	MnROAD	In-APLF	ATLaS	MnROAD	TRL-PTF				K-ATL		TxMLS
DRTM	HVS-SA	ISETH	HVS-SA	In-APLF	K-ATL	MnROAD				ATLaS		NCAT
CAL/APT	HVS-Nordic	HVS-SA	NAPTF	CAL/APT	ATLaS	K-ATL	TRL-PTF	TRL-PTF		HVS-SA		FDOT-HVS
ARRB-ALF	DRTM	CAL/APT	CAL/APT	ARRB-ALF	HVS-SA	HVS-SA	MnROAD	MnROAD		CAL/APT		HVS-CRREL
Oh-APLF	CAL/APT	ARRB-ALF	ARRB-ALF	Oh-APLF	CAL/APT	ARRB-ALF	ARRB-ALF	ATLaS	TRL-PTF	ARRB-ALF	RRT-Rom	CAPTIF-NZ
Cracking	Stress ratio	Joint failure	Fatigue	Curling and warping	Load transfer failure	Faulting	Spalling	Punchouts	Steel rupture	Erosion of subbase	Other	Not applicable

FIGURE C22 Distress criterion evaluated for pavements with concrete. (Source: Significant findings from full-scale/APT, Question 2.8).

	PRF-La					
	PRF-La					
	HVS-A					
	TxMLS					
HVS-A	TRL-PTF					
TxMLS	RRT-Rom			HVS-A		
TRL-PTF	NCAT		TxMLS	TxMLS		
RRT-Rom	MnROAD		TRL-PTF	TRL-PTF		
NCAT	K-ATL		NCAT	MnROAD		FDOT-HVS
ISETH	ISETH		ISETH	In-APLF		NAPTF
DRTM	In-APLF		In-APLF	FHWA-PTF	RRT-Rom	HVS-CRREL
CAL/APT	FHWA-PTF	NCAT	FHWA-PTF	DRTM	MnROAD	CAPTIF-NZ
ARRB-ALF	ARRB-ALF	DRTM	ARRB-ALF	ARRB-ALF	FHWA-PTF	Oh-APLF
Rutting	Cracking	Slippage	Fatigue	Debonding	Other	Not applicable

FIGURE C23 Distress criterion evaluated for pavements with composite materials. (Source: Significant findings from full-scale/APT, Question 2.9).

			WesTrack		
			PRF-La		
			HVS-A		
			TxMLS		
			RRT-Rom		
			NCAT		
			LCPC-FR		
			ISETH		TRL-PTF
			CEDEX		In-APLF
			CAPTIF-NZ		FDOT-HVS
		WesTrack	ARRB-ALF	K-ATL	NAPTF
		NCAT	ARRB-ALF	K-ATL	NAPTF
Safety	Environment	User cost	Roughness	Other	Not applicable

FIGURE C24 Which aspects of functional performance were addressed? (Source: Significant findings from full-scale/APT, Question 2.10).

RIOH-ALF							
WesTrack							
TxMLS							
TRL-PTF							
RRT-Rom							
PRF-La							
NCAT							
MnROAD							
LINTRACK		WesTrack					
LCPC-Fr		HVS-A					
ISETH	WesTrack	TxMLS					
HVS-SA	TxMLS	RRT-Rom					
FHWA-PTF	TRL-PTF	PRF-La					
FDOT-HVS	PRF-La	NCAT					
HVS-CRREL	NCAT	MnROAD					
CAPTIF-NZ	MnROAD	LCPC-Fr					K-ATL
CAL/APT	CEDEX	ISETH	RIOH-ALF				NAPTF
Oh-APLF	ARRB-ALF	ARRB-ALF	HVS-SA	HVS-SA	MnROAD	MnROAD	DRTM
Rutting	Skid resistance	Roughness	Punchouts	Delamination	Spalling	Other	Not applicable

FIGURE C25 Which safety aspects were addressed in your APT program? (Source: Significant findings from full-scale/APT, Question 2.11).

			WesTrack
			HVS-A
			TRL-PTF
			RRT-Rom
			PRF-La
			LINTRACK
			K-ATL
			ISETH
			FHWA-PTF
		NCAT	FDOT-HVS
		LINTRACK	NAPTF
TxMLS		HVS-CRREL	CAPTIF-NZ
HVS-SA	MnROAD	Oh-APLF	ARRB-ALF
Noise	Dust pollution	Other	Not applicable

FIGURE C26 Which environmental aspects were addressed in your APT program? (Source: Significant findings from full-scale/APT, Question 2.12).

	RIOH-ALF							
	WesTrack							
	HVS-A							
	TxMLS							
	TRL-PTF							
	RRT-Rom							
	PRF-La							
	NCAT							
RIOH-ALF	MnROAD							
WesTrack	LCPC-Fr							
TxMLS	K-ATL							
RRT-Rom	ISETH					HVS-A		
PRF-La	In-APLF					PRF-La		
NCAT	HVS-SA	RIOH-ALF				MnROAD		
MnROAD	HVS-Nordic	TxMLS				LCPC-Fr		
ISETH	FHWA-PTF	PRF-La				ISETH	HVS-A	
In-APLF	NAPTF	NCAT				HVS-SA	TxMLS	
HVS-SA	DRTM	MnROAD		WesTrack	HVS-Nordic	NCAT		
DRTM	HVS-CRREL	LCPC-Fr		PRF-La	DRTM	MnROAD		
HVS-CRREL	CEDEX	HVS-SA	PRF-La	MnROAD	HVS-CRREL	K-ATL		
CEDEX	ARRB-ALF	CEDEX	NCAT	HVS-SA	CEDEX	HVS-SA	TxMLS	MnROAD
ARRB-ALF	APLF	ARRB-ALF	MnROAD	FHWA-PTF	ARRB-ALF	ARRB-ALF	MnROAD	K-ATL
Air temperature	Pavement temperature	Rainfall	Relative humidity	Aging	Water table	Drainage	Depth to bedrock	Other

FIGURE C28 Environment/weather data that have been related to APT performance. (Source: Significant findings from full-scale/APT, Question 3.2).

	RIOH-ALF							
	HVS-A							
	TRL-PTF							
	RRT-Rom							
HVS-A	LINTRACK				RIOH-ALF			
RRT-Rom	LCPC-Fr				HVS-A			
LCPC-Fr	K-ATL				LCPC-Fr			
K-ATL	In-APLF				K-ATL			
In-APLF	HVS-SA				HVS-Nordic			
HVS-SA	HVS-Nordic				DRTM			
HVS-Nordic	FHWA-PTF				HVS-CRREL			
DRTM	DRTM				CEDEX			
HVS-CRREL	HVS-CRREL				CAPTIF-NZ		WesTrack	
Oh-APLF	ARRB-ALF	Oh-APLF	Oh-APLF	Oh-APLF	ARRB-ALF		K-ATL	
Air temperature	Pavement temperature	Relative humidity	Subgrade moisture	Aging		HVS-SA	NAPTF	
								Other

FIGURE C29 Environment/weather conditions that are controlled. (Source: Significant findings from full-scale/APT, Question 3.3).

	RIOH-ALF			
	WesTrack			
	HVS-A			
	TRACKER			
	TxMLS			
	TRL-PTF			
	RRT-Rom			
	PRF-La			
	NCAT			
	LINTRACK			
RIOH-ALF	LCPC-Fr			
WesTrack	K-ATL			
TxMLS	ISETH			
PRF-La	HVS-SA	WesTrack		
NCAT	HVS-Nordic	TxMLS		
LCPC-Fr	FHWA-PTF	NCAT		
K-ATL	FDOT-HVS	LINTRACK-NL		
In-APLF	NAPTF	LCPC-Fr		
HVS-SA	DRTM	HVS-SA	WesTrack	
FHWA-PTF	HVS-CRREL	HVS-CRREL	TxMLS	
FDOT-HVS	CEDEX	CEDEX	NCAT	
CEDEX	CAPTIF-NZ	CAPTIF-NZ	K-ATL	
ARRB-ALF	ARRB-ALF	ARRB-ALF	DRTM	
Oh-APLF	Oh-APLF	Oh-APLF	HVS-CRREL	
Hot (>40°C) (>104°F)	Moderate (>10°C <40°C) (>50°F <104°F)	Cold (<10°C) (<50°F)	Freezing (<5°C) (<41°F)	

FIGURE C30 APT test temperatures used. (Source: Significant findings from full-scale/APT, Question 3.4).

		TRACKER						
		TxMLS						
		TRL-PTF						
		RRT-Rom						
RIOH-ALF		PRF-La						
HVS-A		NCAT						
TxMLS		MnROAD						
TRL-PTF	RIOH-ALF	LINTRACK						
MnROAD	TxMLS	LCPC-Fr						
LCPC-Fr	TRL-PTF	K-ATL						
K-ATL	RRT-Rom	ISETH						
ISETH	PRF-La	In-APLF						
HVS-SA	MnROAD	HVS-SA				HVS-A		MnROAD
HVS-CRREL	LCPC-Fr	FHWA-PTF	MnROAD	TRL-PTF		TRL-PTF		K-ATL
CEDEX	ISETH	CEDEX	LCPC-Fr	RRT-Rom	TRL-PTF	MnROAD	TRL-PTF	HVS-SA
CAPTIF-NZ	HVS-SA	CAL/APT	K-ATL	MnROAD	MnROAD	HVS-CRREL	RRT-Rom	FDOT-HVS
CAL/APT	CEDEX	ARRB-ALF	ISETH	LCPC-Fr	In-APLF	CEDEX	ISETH	CAL/APT
ARRB-ALF	ARRB-ALF	Oh-APLF	HVS-SA	HVS-SA	FHWA-PTF	ARRB-ALF	CEDEX	ARRB-ALF
Granular materials	Stablized/cemented materials	Asphalt (Hot mix)	Asphalt (Cold mix)	Concrete	Whitetopping	Geofabrics	Reinforcements	Other

FIGURE C31 APT has led to the improved characterization of: (Source: Significant findings from full-scale/APT, Question 4.1).

							WesTrack				
				WesTrack	TRACKER		TxMLS				WesTrack
			WesTrack	PRF-La	TRL-PTF		PRF-La				TxMLS
		WesTrack	TxMLS	NCAT	NCAT		NCAT	TxMLS			PRF-La
		LCPC-Fr	NCAT	MnROAD	In-APLF		In-APLF	PRF-La			NCAT
	WesTrack	FHWA-PTF	K-ATL	FHWA-PTF	HVS-SA		FHWA-PTF	FHWA-PTF	TxMLS		FHWA-PTF
	TxMLS	ARRB-ALF	FHWA-PTF	FDOT-HVS	CEDEX		CAL/APT	ARRB-ALF	PRF-La	HVS-A	CAL/APT
PTF	MMLS3	French Rut Tester	Hamburg Tester	Asphalt Pavement Analyzer	Other wheel tracking	Volu-metric shear test	Repeated shear test at constant height	Simple shear test at constant height	Repeated shear test at constant stress	Uniaxial strain test	Shear frequency sweep test at constant height
Wheel Trafficking Tests		Wheel Tracking Tests				SST					

RIOH											
TxMLS											
TRL-PTF	WesTrack										
RRT-Rom	TxMLS										
PRF-La	TRL-PTF										
NCAT	PRF-La										
MnROAD	NCAT										
LINTRACK	MnRoad	WesTrack	WesTrack								
LCPC-Fr	LCPC-Fr	PRF-La	TRL-PTF								
K-ATL	K-ATL	NCAT	PRF-La								
HVS-SA	HVS-SA	MnROAD	NCAT								
TRL-PTF	FHWA-PTF	LCPC-Fr	MnROAD			TRL-PTF	WesTrack				
NAPTF	FDOT-HVS	K-ATL	HVS-SA	TRL-PTF	MnROAD	TRL-PTF					
DRTM	CEDEX	FHWA-PTF	FHWA-PTF	HVS-SA	ISETH	RRT-Rom					
CEDEX	CAL/APT	FDOT-HVS	FDOT-HVS	FDOT-HVS	In-APLF	MnROAD					
ARRB-ALF	ARRB-ALF	CEDEX	CEDEX	ARRB-ALF	HVS-SA	LINTRACK					
Penetration, Softening point, Ductility	Dynamic shear rheometer	Bending beam rheometer	Rotational viscometer	Sliding plate rheometer	Other asphalt binder tests	Other					
Asphalt Binder Tests											

FIGURE C34 Laboratory tests used in conjunction with APT of asphalt pavements. (Source: Significant findings from full-scale/APT, Question 4.4).

	RIOH-ALF								
	WesTrack								
	HVS-A					HVS-A			
	TxMLS					TRL-PTF			
	TRL-PTF					PRF-La			
	RRT-Rom					NCAT			
	PRF-La					MnROAD			
	NCAT	RIOH-ALF				LINTRACK			
	MnROAD	WesTrack				LCPC-Fr			
	LINTRACK	HVS-A				ISETH		RIOH-ALF	
TRACKER	LCPC-Fr	TRL-PTF				In-APLF		HVS-A	
TxMLS	K-ATL	NCAT				HVS-SA	HVS-A	PRF-La	
TRL-PTF	ISETH	MnROAD				FDOT-HVS	PRF-La	NCAT Auburn	
RRT-Rom	HVS-SA	LINTRACK				NAPTF	NCAT	MnROAD	
PRF-La	FDOT-HVS	HVS-SA				CEDEX	MnROAD	ISETH	
LCPC-Fr	CEDEX	FHWA-PTF				CAPTIF-NZ	HVS-SA	HVS-SA	
K-ATL	CAPTIF-NZ	CEDEX				CAL/APT	FDOT-HVS	CEDEX	
NAPTF	ARRB-ALF	CAL/APT	LCPC-Fr			ARRB-ALF	CEDEX	ARRB-ALF	HVS-SA
Oh-APLF	Oh-APLF	ARRB-ALF	ISETH	MnROAD	Oh-APLF	ARRB-ALF	Oh-APLF	CAL/APT	
Direct tensile tests	Indirect tensile tests	Bending beam fatigue	Cantilever fatigue tests	Semi-circular bending test	Triaxial testing	Dynamic creep	Static creep	Other performance related tests	
Other performance related tests									

RIOH-ALF										
WesTrack										
HVS-A		WesTrack						RIOH-ALF		
RRT-Rom		HVS-A						WesTrack		
PRF-La		TRACKER						TxMLS		
NCAT		PRF-La						RRT-Rom		
MnROAD		NCAT						NCAT		
K-ATL		MnROAD						MnROAD		
ISETH		LCPC-Fr		WesTrack	WesTrack		LCPC-Fr	RIOH-ALF	RIOH-ALF	
In-APLF		K-ATL		NCAT	RRT-Rom		K-ATL	MnROAD	TxMLS	
HVS-SA		In-APLF		In-APLF	MnROAD		ISETH	K-ATL	TRL-PTF	
NAPTF		HVS-SA	HVS-A	HVS-SA	LCPC-Fr		HVS-SA	ISETH	MnROAD	
DRTM		FDOT-HVS	LCPC-Fr	FHWA-PTF	HVS-SA		FHWA-PTF	HVS-SA	ISETH	
CEDEX		CAL/APT	HVS-SA	CEDEX	FHWA-PTF	MnROAD	DRTM	CEDEX	HVS-SA	
ARRB-ALF		ARRB-ALF	CAL/APT	CAPTIF-NZ	CEDEX	K-ATL	CEDEX	ARRB-ALF	CEDEX	TxMLS
Oh-APLF	HVS-SA	Oh-APLF	ARRB-ALF	CAL/APT	ARRB-ALF	FDOT-HVS	ARRB-ALF	Oh-APLF	ARRB-ALF	MnROAD
Marshall	Modified Marshall (Hugo)	Gyratory	Roller	Other compaction tests	Short or long term aging	Permeability	Basic aggregate tests	Unconfined compressive strength	California bearing ratio	Seismic measurements
Laboratory compaction										

FIGURE C34 (Continued).

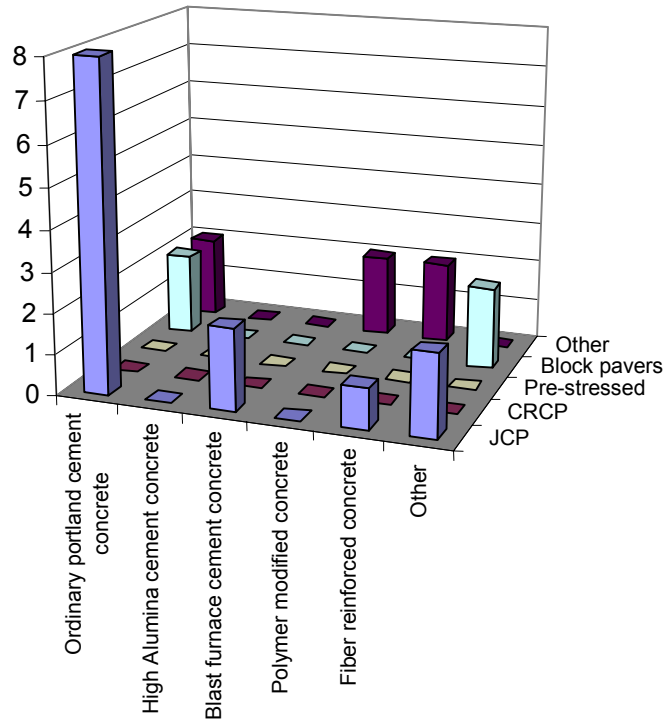


FIGURE C35 Concrete materials/structures tested with APT. (Source: Significant findings from full-scale/APT, Question 4.5).

	HVS-A		HVS-A	
	RRT-Rom		TRL-PTF	
	MnROAD	HVS-A	RRT-Rom	
	LCPC-Fr	MnROAD	MnROAD	
	K-ATL	K-ATL	LCPC-Fr	
HVS-A	FHWA-PTF	HVS-SA	K-ATL	
MnROAD	NAPTF	FHWA-PTF	FHWA-PTF	
LCPC-Fr	CAL/APT	CAL/APT	CAL/APT	MnROAD
K-ATL	ARRB-ALF	ARRB-ALF	Oh-APLF	Oh-APLF
Tensile strength	Flexural strength	Compressive strength	Stiffness modulus	Other

FIGURE C36 Properties that have been related to APT performance of concrete pavements. (Source: Significant findings from full-scale/APT, Question 4.6).

RIOH-ALF				RIOH-ALF				
WesTrack		RIOH-ALF		WesTrack				
HVS-A	RIOH-ALF	HVS-A		HVS-A				
TRACKER	HVS-A	TxMLS		TxMLS				
MnROAD	TxMLS	RRT-Rom		PRF-La				
LINTRACK	RRT-Rom	PRF-La		MnROAD				
LCPC-Fr	MnROAD	MnROAD	RIOH-ALF	LINTRACK				
In-APLF	LINTRACK	LINTRACK	WesTrack	LCPC-Fr				
HVS-SA	LCPC-Fr	LCPC-Fr	PRF-La	ISETH				
HVS-Nordic	ISETH	In-APLF	MnROAD	In-APLF	RIOH-ALF			
FHWA-PTF	HVS-SA	HVS-SA	LINTRACK	HVS-SA	TxMLS			
NAPTF	NAPTF	FHWA-PTF	LCPC-Fr	HVS-Nordic	RRT-Rom			
DRTM	DRTM	NAPTF	In-APLF	DRTM	PRF-La			
HVS-CRREL	HVS-CRREL	DRTM	HVS-SA	HVS-CRREL	MnROAD	HVS-A		
CEDEX	CEDEX	HVS-CRREL	FHWA-PTF	CEDEX	LINTRACK	TxMLS		
CAPTIF-NZ	CAPTIF-NZ	CEDEX	HVS-CRREL	CAPTIF-NZ	In-APLF	PRF-La		
CAL/APT	CAL/APT	CAPTIF-NZ	CEDEX	CAL/APT	HVS-SA	MnROAD		
ARRB-ALF	ARRB-ALF	CAL/APT	CAL/APT	ARRB-ALF	CAPTIF-NZ	ISETH	RIOH-ALF	
Oh-APLF	Oh-APLF	ARRB-ALF	ARRB-ALF	Oh-APLF	ARRB-ALF	ARRB-ALF	MnROAD	DRTM
Stress/strain modeling	Deflection modeling	Deformation modeling	Fatigue modeling	Back-calculation of modulus	Load equivalency	Pavement serviceability	Cracking	Other

FIGURE C39 Aspects of modeling studied using APT. (Source: Significant findings from full-scale/APT, Question 5.1).

RIOH-ALF					
WesTrack					
HVS-A					
TxMLS					
PRF-La					
MnROAD					
LINTRACK					
LCPC-Fr	RIOH-ALF				
K-ATL	HVS-A				
ISETH	TxMLS				
In-APLF	PRF-La				
HVS-SA	MnROAD				
HVS-Nordic	LCPC-Fr				
FHWA-PTF	K-ATL				
NAPTF	HVS-Nordic				
DRTM	NAPTF				
HVS-CRREL	DRTM	RIOH-ALF			
CEDEX	HVS-CRREL	HVS-A			
CAL/APT	CEDEX	TxMLS			
ARRB-ALF	CAPTIF-NZ	PRF-La			
Oh-APLF	ARRB-ALF	MnROAD			
Strain gauges	Pressure cells	Load cells	Displacement gauges	Subgrade moisture sensors	Other*
*Other instruments cited by respondents:					
Temperature sensors—Oh-APLF; CAL/APT			Temperature gauge—DRTM		
Emu & Bison strain coils—CAPTIF-NZ					
LVDT—FHWA-PTF					
Several attempts for measurement of asphalt sublayers: LINTRACK-NL					
MnROAD—see website (http://mnroad.dot.state.mn.us/research/Mnresearch.asp) and beyond the surface handout.					

FIGURE C40 Instrumentation used to gather modeling data. (Source: Significant findings from full-scale/APT, Question 5.2).

RIOH-ALF					
WesTrack					
HVS-A				RIOH-ALF	
TxMLS				WesTrack	
RRT-Rom				HVS-A	
PRF-La				TxMLS	
NCAT				PRF-La	
LINTRACK				MnROAD	
LCPC-Fr				LINTRACK	
K-ATL				LCPC-Fr	
ISETH				In-APLF	
HVS-SA				HVS-SA	
HVS-Nordic	WesTrack			FHWA	
NAPTF	TxMLS			NAPTF	
DRTM	PRF-La			DRTM	
HVS-CRREL	MnROAD			HVS-CRREL	
CEDEX	LINTRACK			CEDEX	
CAPTIF-NZ	LCPC-Fr	TxMLS		CAPTIF-NZ	PRF-La
CAL/APT	ISETH	MnROAD		CAL/APT	MnROAD
ARRB-ALF	FHWA-PTF	HVS-SA		ARRB-ALF	In-APLF
Oh-APLF	CEDEX	CAL/APT		Oh-APLF	DRTM
None	Elastic layer analysis	Visco-elastic analysis	Elasto-plastic analysis	Finite element analysis	Other

FIGURE C41 Models used with APT studies. (Source: Significant findings from full-scale/APT, Question 5.3).

HVS-A					RIOH-ALF				
TxMLS					WesTrack				
TRL-PTF					HVS-A				
RRT-Rom					NCAT				
MnROAD					MnROAD				
LCPC-Fr	MnROAD			RRT-Rom	In-APLF	HVS-A			
ISETH	K-ATL			MnROAD	HVS-SA	TRL-PTF		NCAT	
HVS-SA	ISETH			LCPC-Fr	HVS-CRREL	RRT-Rom	RIOH-ALF	MnROAD	
CEDEX	HVS-SA	TRL-PTF	ISETH	CAPTIF-NZ	LCPC-Fr	TxMLS	HVS-SA		
CAL/APT	ARRB-ALF	MnROAD	HVS-CRREL	CAL/APT	HVS-Nordic	MnROAD	CEDEX	MnROAD	
ARRB-ALF	Oh-APLF	ISETH	CEDEX	ARRB-ALF	HVS-CRREL	ARRB-ALF	ARRB-ALF	HVS-SA	
Unconventional materials	Joints	Buried pipes	Durability	Compaction	Reinforcement	Preventive maintenance	Surface texture	Surface drainage	

									PRF-La	
									NCAT	
				MnROAD		WesTrack	HVS-A		MnROAD	PRF-La
	PRF-La	MnROAD		HVS-SA	HVS-A	NCAT	NCAT		CAL/APT	MnROAD
Oh-APLF	CEDEX	CEDEX	ARRB-ALF	ARRB-ALF	LCPC-Fr	MnROAD	CEDEX	NCAT	ARRB-ALF	HVS-Nordic
Gradients	Slippage	Road marking	Traffic accommodation	Patching	Risk management	QA/QC	Surface tolerance	Layers	Subsurface drainage	Other

FIGURE C42 Aspects of pavement engineering that enhance construction and rehabilitation through APT. (Source: Significant findings from full-scale/APT, Question 6.1).

RIOH-ALF					
WesTrack					
TRL-PTF					
NCAT					
K-ATL					
ISETH					
HVS-SA		WesTrack			
CEDEX		HVS-A			
CAL/APT	WesTrack	NCAT			
ARRB-ALF	NCAT	CAL/APT	ARRB-ALF	Oh-APLF	MnROAD
Performance-related specifications	Warranties	Pay factors	Risk management	Not applicable	Other

FIGURE C43 APT aids in development of construction specifications and contracts with regards to: (Source: Significant findings from full-scale/APT, Question 6.2).