

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use HIKER-PEDESTRIAN		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*
Design Tread Width	Wilderness	0" – 12"	6" – 18"	12" – 24" Exceptions: May be 36-48" at switchbacks, turnpikes, fords and steep side slopes.	24" Exceptions: May be 36-48" at switchbacks, turnpikes, fords and steep side slopes.	Not applicable
	Non-Wilderness	0" – 12"	6" – 18"	18" – 48"	32" – 96"	36" – 120"
Design Surface	Type	Native, un-graded. Intermittent, rough.	Native with limited grading. Continuous, rough.	Native with some on-site borrow or imported materials.	Imported materials or hardening is common.	Uniform, firm, and stable.
	Obstacles	Roots, rocks, logs, steps to 24".	Roots, rocks and log protrusions to 6"; steps to 14".	Generally clear. Protrusions to 3"; steps to 10".	Smooth, few obstacles. Protrusions 2-3"; steps to 8".	Smooth, no obstacles. Protrusions <2".
Design Grade**	Target Range (>90% of Trail)	< 25%	< 18%	< 12%	< 10%	< 5%
	Short Pitch Max (Up to 200' lengths)	40%	35%	25%	15%	10%
	Max Pitch Density***	< 10% of trail	< 5% of trail	< 5% of trail	< 3% of trail	< 3% of trail
Design Cross-Slope	Target Range	Not applicable	5 – 20%	5 – 10%	3 – 7%	2 – 3% (or crowned)
	Maximum	Up to natural side-slope.	Up to natural side-slope	15%	10%	3%
Design Clearing	Width	Sufficient to define trail corridor.	24" – 36", with some encroachment into clearing area.	12" – 18" outside of tread edge.	12" – 18" outside of tread edge	12" – 24" outside of tread edge.
	Height	6'	6' – 7'	8'	8'	> 8'
Design Turns	Radius	No minimum.	2' – 3'	3' – 6'	4' – 8'	6' – 12'

* Trail Classes 3, 4 and 5 may potentially provide accessible passage. If assessing or designing trails for accessibility, refer to current Agency trail accessibility guidance.

** Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential.

*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (1/31/2005)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use PACK AND SADDLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	Wilderness	Not Applicable: Not designed for equestrians as primary user, although equestrians may be present.	12" – 18" Exceptions: May be to 48" at switchbacks, turn-pikes, fords and steep side slopes.	12" – 24" Exceptions: May be to 48" at switchbacks, turn-pikes, fords and steep side slopes. Up to 60" along precipices.	24" Exceptions: May be to 48" at switchbacks, turn-pikes, fords and steep side slopes. Up to 60" along precipices.	Not Applicable: Not designed for equestrians as primary user. Equestrians generally not present.
	Non-Wilderness		12" – 24" (With above exceptions)	18" – 48" (With above exceptions)	36" – 96"	
Design Surface	Type		Native, w/ limited grading.	Native with some on-site borrow or imported materials.	Native with some imported materials or stabilization.	
	Obstacles		Roots, rocks, logs to 12"	Generally clear. Occasional protrusions to 6".	Smooth, few obstacles. Occasional protrusions 2-3".	
Design Grade*	Target Range (>90% of Trail)		< 20%	< 12%	< 10%	
	Short Pitch Max (Up to 200' lengths)		30%	20%	15%	
	Max Pitch Density***		< 5% of trail	< 5% of trail	< 3% of trail	
Design Cross-Slope	Target Range		5 – 10%	5%	5%	
	Maximum		Natural side-slope	10%	10%	
Design Clearing	Width		36" – 48"	60" – 78"	72" – 96"	
	Height	8' – 10"	10'	10' - 12'		
Design Turns	Radius	4' – 5'	5' – 6'	6' – 10'		

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use BICYCLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	One Lane	6" – 12"	12" – 24"	18" – 30"	24" – 48"	36" – 60"
	Two Lane	Not applicable.	Not applicable.	48" – 60" Accommodate two-lane travel with passing lanes.	60" – 84"	72" – 120"
Design Surface	Type	Native. Rough, unstable or soft tread.	Native, with limited grading. Unstable or soft sections likely.	Native with some on-site borrow or imported materials. Some soft areas.	Likely imported or stabilized tread. Few, if any, loose or soft surfaces.	Firm, hardened surface.
	Obstacles	Rocks, logs and roots up to 6–12" common. Forced portages likely.	Embedded rock, protrusions to 6". Some portages may be needed.	Generally smooth with few protrusions exceeding 3".	Smooth, few obstacles. 1 – 2" protrusions.	No obstacles to wheeled transport.
Design Grade*	Target Range (>90% of Trail)	15% – 18%	< 12%	< 10%	< 8%	< 5%
	Short Pitch Max (Up to 200' lengths)	30% 50% on downhill-only travel.	25% 35% on downhill-only travel.	15%	10%	8%
	Max Pitch Density***	< 10% of trail	< 5% of trail	< 5% of trail	< 3% of trail	< 3% of trail
Design Cross-Slope	Target Range	5% – 10%	5% – 10%	5%	3% – 5%	3% – 5%
	Maximum					
Design Clearing	Width	24" – 36" Some vegetation may encroach into clearing area.	36" – 48" Some light vegetation may encroach into clearing area.	12" – 18" outside of tread edge.	12" – 18" outside of tread edge.	18" – 24" outside of tread edge.
	Height	6' – 7"	7' – 8"	8'	8' - 9'	8' - 9'
Design Turns	Radius	3' - 4'	4' – 6'	6' – 8'	8' – 10'	8' - 12'

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, reconstruction and maintenance of trails, based on the Trail Class and Designed Use identified for the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use ALL TERRAIN VEHICLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width [If sideslopes are >50%, increase widths by 6"-18"]	One Lane	NA – Not designed for ATV as primary user.	30" – 48" At switchbacks, > 48"	42"-60" At switchbacks, >60"	54"-72" At switchbacks, >60"	NA – Not designed for ATV as primary user.
	Two Lane		Typically not designed for two-lane travel. Passing areas (uncommon) - 60"	60" and/or accommodate with passing areas 60"-78".	72"-96"	
Design Surface	Type		Native, w/ limited or no grading. Commonly soft and unstable.	Native w/ some onsite barrow or imported materials. Some loose or soft sections.	Relatively firm and stable. Gravel, pavers or other imported materials possible.	
	Obstacles		Embedded rock, steps, waterbars, holes and protrusions to 6".	Generally smooth, with few protrusions exceeding 4". Drain dips and low waterbars.	Smooth, few obstacles. 1-3" protrusion. Drain dips or waterbars with low-angle approach.	
Design Grade*	Target Range (>90% of Trail)		<25%	<15%	<10%	
	Short Pitch Max (Up to 200' lengths)		35%	25%	15%	
	Max Pitch Density**		<10% of trail	<5% of trail	<5% of trail	
Design Cross-Slope	Target Range		5% – 10%	3% – 5%	3% – 5%	
	Maximum		15%	10%	8%	
Design Clearing	Width [On steep side hills, increase clearing on uphill side by 6 – 12"]		36"- 48" Some vegetation may encroach into clearing area.	8"-12" outside of tread edge.	>12" outside of tread edge	
	Height	5' – 6'	6' – 7'	8'		
Design Turns	Radius [Use Climbing Turns vs. Switchbacks for ATVs whenever possible]	6' – 8'	8' – 10'	>10'		

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches must be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, repair and maintenance of trails, based on the Trail Class and Designed Use of the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use MOTORCYCLE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width [Note: If side-slope >50%, increase widths by 6" – 18"]	One Lane	Not Applicable: Not designed for equestrians as primary user, though equestrians may be present.	8" – 24" At switchbacks, 36 – 48"	18" – 36" At switchbacks, > 48".	30" – 48" At switchbacks, > 48".	Not Applicable: Not designed for equestrians as primary user, though equestrians may be present.
	Two Lane		Typically not designed for two-lane travel. Passing areas (uncommon) up to 60".	48" – 60" Occasional passing lanes to 72".	60" – 72"	
Design Surface	Type		Native, with limited or no grading. Commonly unstable and soft.	Native with some on-site borrow, pavers, or imported materials. Some loose or soft areas.	Gravel, pavers or other imported materials possible. Relatively firm, stable surface.	
	Obstacles		Soft sand and embedded rock, steps and protrusions up to 12".	Generally smooth with few protrusions exceeding 6".	Smooth, few obstacles. Few 2" – 4" protrusions.	
Design Grade*	Target Range (>90% of Trail)		< 25%	< 15%	< 10%	
	Short Pitch Max (Up to 200' lengths)		40% Rarely to 50% on downhill-only travel.	25%	15%	
	Max Pitch Density***		< 10% of trail	< 10% of trail	< 5% of trail	
Design Cross-Slope	Target Range		5% – 10%	5%	3% – 5%	
	Maximum		15%	10%	10%	
Design Clearing	Width [Note: On steep side-hills, increase clearing on uphill side by 6-12"]		36" – 48" Some vegetation may encroach into clearing area.	12" – 18" outside of tread edge.	> 18" outside of tread edge.	
	Height	7' – 8"	8'	8' - 9'		
Design Turns	Radius	4' – 5'	5' – 6'	6' – 8'		

* Grade variances should be based upon soils, hydrological conditions, use levels, and other factors contributing to surface stability and erosion potential. Due to effects of use on tread and erosion, steeper pitches should be carefully evaluated based on potential effects of these various factors.

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, reconstruction and maintenance of trails, based on the Trail Class and Designed Use identified for the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use CROSS-COUNTRY SKI		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*
Design Groomed Width*	One Lane	N/A – Not designed or managed for skiers as primary user.	3'-4'. If groomed, width of grooming equipment.	6'-8' (or minimum width of grooming equipment).	8'-10", but typically managed to accommodate two-way passage.	N/A – Not designed or managed for skiers as primary user.
	Two Lane		Typically not designed for two-lane travel. Employ 6'-8' passing areas in steeper sections.	>8' (or min width of grooming equipment) and/or accommodate with passing areas 8'-12' wide.	12'-14'.	
Design Grooming & Surface	Type		Coarse compaction. Occasional or no grooming (may be ski-packed). Snowmobile packing sufficient. Tracklayer optional.	Groomed or compacted using implements and/or tracklayer when packed surface is snow-covered, drifted, melted or skied out.	Well-groomed with tiller and/or other implements. Groomed frequently, and when groomed surface becomes degraded or buried.	
	Obstacles [Caused by use, lack of grooming, melt, or surface/subsurface protrusions]		Dips, bumps, or ruts to 12" common and may be tightly spaced. Surface obstacles may occasionally require off-trail bypass.	Generally smooth. Dips, bumps, or ruts to 8" uncommon and widely spaced. Surface obstructions not present.	Consistently smooth. Small, rolling bumps, dips and rises. Surface obstructions not present.	
Design Grade**	Target Range (>90% of Trail)		<15%	<10%	<8%	
	Short Pitch Max (Up to 200' lengths)		25%	20%	12%	
	Max Pitch Density***		<10% of trail	<5% of trail	<5% of trail	
Design Cross-Slope	Target Range		<10%	<5%	<5%	
	Maximum [For up to 50']	20%	15%	10%		

Designed Use CROSS-COUNTRY SKI		Trail Class 1	Trail Class 2	Trail Class 3*	Trail Class 4*	Trail Class 5*
Design Clearing	Width		4'-6' (or minimum width of grooming equipment, if larger). Light vegetation may encroach into clearing area	>1' outside of groomed edge. Light vegetation may encroach slightly into clearing area.	>2' outside of tread edge. Widen clearing at turns or if increased sight distance needed.	
	Height [Above normal max. snow level]		6'-8' or height of grooming machinery, if used.	>8' or height of grooming machinery.	10'	
Design Turns	Radius [Use Climbing Turns versus Switchbacks for Ski trails whenever possible]		8'-10' if not snowcat-groomed. OR: Minimum based on turning limits of grooming machine.	15'-20' (Provide sufficient radius for grooming equipment).	>25'	

* Trail Classes 3, 4 and 5 may potentially provide accessible passage. If assessing or designing trails for accessibility, refer to current Agency trail accessibility guidance.

** Grade variances should be based upon factors such as common snow type, use levels, tightness of turns, and other factors contributing to surface stability and erosion potential.

*** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.

USFS Trail Design Parameters (6/18/2002)

Trail Design Parameters provide guidance for the assessment, survey and design, construction, reconstruction and maintenance of trails, based on the Trail Class and Designed Use identified for the trail. Exceptions and variances to these parameters can occur, however, when site-specific circumstances demand such exceptions.

Designed Use SNOWMOBILE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Tread Width	One Lane	N/A – Not designed for Snowmobile as primary user.	Typically not groomed, but commonly signed. If groomed, 4'-6' (or minimum width of grooming equipment.)	6'-8' (or minimum width of grooming equipment). On tight-radius turns, increase groomed width to >10'.	8'-10'. On tight-radius turns, increase groomed width to >12'.	N/A – Not designed for Snowmobile as primary user.
	Two Lane		Typically not groomed, but commonly signed. If groomed, >8' groomed width.	>11' and/or accommodate with passing areas 12'-14' wide.	12'-16'. On tight-radius turns, increase groomed width to >14'.	
Design Surface	Type		Occasional or no grooming or user-packed. Coarse compaction with cat or snowmobile. Use of implements optional.	Groomed or compacted after significant snow accumulations or when moguled/rutted. Use of implements likely.	Well-groomed with tiller and/or other implements. Groomed frequently, soon after significant snow accumulations and before surface is degraded.	
	Obstacles [Caused by use, lack of grooming, or surface and subsurface protrusions]		Dips/bumps/ruts to 24" common and may be tightly spaced. Obstacles may occasionally require off-trail bypass.	Generally smooth. Dips, bumps, ruts to 12" infrequent and widely spaced. Surface obstacles not present.	Consistently smooth. Small, rolling bumps, dips and rises. Surface obstacles not present.	
Design Grade*	Target Range [>90% of Trail]		<20%	<15%	<10%	
	Short Pitch Max [Up to 200' lengths]		35%	25%	20%	
	Max Pitch Density**		<10% of trail	<5% of trail	<5% of trail	
Design Cross-Slope	Target Range		<15%	<10%	<5%	
	Maximum	25%	15%	10%		

Designed Use SNOWMOBILE		Trail Class 1	Trail Class 2	Trail Class 3	Trail Class 4	Trail Class 5
Design Clearing	Width		4'-6' (or minimum width of grooming equipment if used). Some vegetation may encroach into clearing area	>1' outside of groomed trail edge. Light vegetation may encroach into clearing area.	>2' outside of groomed trail edge. Widen clearing at turns or if increased sight distance needed.	
	Height [Above normal maximum snow level]		>6' (Provide sufficient clearance for grooming equipment if used).	>7' (Provide sufficient clearance for grooming equipment).	10' (Provide sufficient clearance for grooming equipment).	
Design Turns	Radius [Use Climbing Turns vs. Switchbacks for Snowmobiles whenever possible]		8'-10' if not groomed. (Provide sufficient radius for grooming equipment if used – typically 15-20')	15'-20' (Provide sufficient radius for grooming equipment).	>25'	

* Grade variances should be based upon factors such as common snow type, use levels, tightness of turns and others

** Maximum pitch density refers to the percentage of the trail that is within 5% (+/-) of the Short Pitch Maximum Grade.