Winter Terrain Park Best Practices
Criterion II: Planning and Design

II. Planning and Design

II.A. Integration into overall resort plan

Criterion II.A: Best practice in winter terrain park planning includes the integration of the terrain park into the overall resort planning as regards to anticipated terrain park rider volume, distribution of rider capabilities, traffic flow and segregation based on rider level, appropriate terrain park area and slope, signage, snow resource, equipment, and staff allocations.
Rationale: Many safety issues can be mitigated with a well-thought out terrain park plan that is integrated into the resort's master plan.
Practical considerations: Clientele volume and profile, siting, resources, etc. are essential constraints that must be understood before the design and layout of specific features can be accomplished. The mountain area/slope, snowmaking and other resources available to the terrain park design/build team will constrain the scope of the park and its features.
Criterion status: Approved February 16, 2012

II.B. Traffic control

Criterion II.B: Based on the resort plan for anticipated terrain park usage and profile of users, best practice in terrain park planning includes a plan to manage the rider traffic to and through the terrain park.
Rationale: Careful traffic planning will enable segregation by ability, enhance progressive learning, avoid crowding and potentially dangerous collision situations.
Practical considerations: Existing lift capacity, feed points, locations, and other runs serviced will constrain traffic throughput.
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II.C. Site an feature layout plan

Criterion II.C.1: Best practice in winter terrain park management includes resorts creating a detailed site plan for the terrain park that is based on the terrain park component of the overall resort plan (Criterion II.A.) and considers the following characteristics:

a. specific area to be devoted to the terrain park (Criterion II.A.)
b. detailed understanding of the vertical slope profile of the allocated area (Criterion II.A.)
c. lift access, traffic flow, access modes and throughput (Criterion II.B.)
d. existing permanent features or obstacles
e. availability and quantity of snow-making (Criterion II.A.)
f. signage locations
g. identified level of difficulty and potential for segregation of weaker from stronger riders (progression park = beginner terrain, small/med park = beginner intermediate, expert = intermediate/expert terrain)
h. access to grooming equipment

Criterion II.C.2: Best practice in winter terrain park management includes resorts creating a feature layout plan for the terrain park that considers the following characteristics:

a. identifying which features (jumps, rails, boxes, jibs, etc.) will be included based on the terrain park plan (Criterion II.A.) and site plan considerations above.
b. patron flow - rate, congregation points
c. speed control (fixed start area from full stop, limited access point for jump line)
d. landing area and recovery space
e. interference between features - no overlapping landing/approaches
f. segregated by levels of difficulty - create natural opportunities for progressive learning
g. ability for safely monitoring and maintaining
h. visibility - how well takeoffs can be seen from drop-in zones, lifts, and spectator/lodge view points, etc.
i. alternative routes through park with out interfering with other users

Rationale: Many common hazards like collisions or feature interference can be avoided with proper site planning. Segregation of more difficult features reduces likelihood a beginner accidentally attempting a more advanced feature. Allowing recovery time between features reduces chances of a rider attempting a feature unprepared.

Practical considerations: Area and snowmaking constraints will limit the number and size of features as well as the ease of segregating traffic by ability.
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II.D. Feature design

Criterion II.D: Best practice in terrain park feature design includes creating a written design for each feature including scale drawings, line-of-sight visibility regions and blind spots, and planned patron flow scheme segregated according to level of difficulty as described in Criterion II.C. Each feature design must meet the respective specific feature criteria:

1. Jumps

a. start - each sequence of jumps must have an identified fixed start point from a full stop (limits speed and allows for flow control) with an area large enough to accommodate the planned flow rate. The resort must have a plan for monitoring and limiting controlling flow rate under high traffic circumstances.

b. approach - long enough to achieve maximum design speed without speed checks. Maximum design speeds must be less than 80% surface terminal speed[1] under nominal friction/drag conditions.

c. transition - clearly identified, curvature radius such that a rider traveling at 80% surface terminal speed under nominal friction/drag conditions will not experience more than 2.0 g radial acceleration. If salting is used, the salted surface should extend above the transition by an distance equal to the maximum design takeoff speed times 1 second to allow riders sufficient time to adjust to the altered surface prior to takeoff.

d. take off - to avoid an involuntary inversion the end of the takeoff must be straight for a minimum distance of the maximum design speed times 0.3 seconds; take-off point (lip) must be marked for identification from no less than 20 feet away.

e. landing - surface shaped such that the impact is no more than 1.5 m equivalent fall height for any jumper[2] , long enough to accommodate a jumper traveling at 80% surface terminal speed under nominal friction/drag, no wear holes or divots deeper than 6 inches. The width of the landing should be at least three times the width of the takeoff and skirt at least 15 degrees outward.

f. signage/markings:

i. lift access area servicing park having signage indicating the parks/features and level of difficulty that can be accessed by lift.

ii. clear signage legible from no less than 40 feet away identifying winter terrain park area, schematic of features and level of difficulty, procedures to be followed prior to initiating run.

g. feature snow/ice properties - snow/ice/salt/temperature such that structural integrity of take off is not compromised over time period between inspections. Minimum density of compacted jump surface for take-off is 500 kg/m^3 (for reference, ice is 1000 kg/m^3).

2. Other features (rails, etc.)

a. Rail slides must be skirted to block underpass. All edges and surfaces must be tapered and not have points, catches, or gaps.

b. Features must not present up-hill impaling or sharp impact hazards.

c. Features must be made of materials with sufficient strength and structural integrity to handle 400 lb rider.

d. Features must be spaced to avoid interference between patrons using adjacent features.

e. Halfpipe features should conform to FIS specifications: (http://wiki.fisski.com/index.php/Half-Pipe_Courses).

Rationale: Proper feature design can avoid or mitigate many of the safety issues associated with winter terrain parks.
Practical considerations: Special training and some technical assistance may be required to insure compliance with some of the feature criteria.
Criterion status: Approved February 16, 2012 except the item II.D.1.g (red) which was deferred pending further research.

Technical Notes:

(1) "Terminal speed": The maximum speed on a slope with fixed geometry and nominal parameters. Specifically, for a slope angle, θ, mass of rider, m, a drag coefficient of C_d, frontal area, A, density of air, ρ, and kinetic friction coefficient, μ, the terminal speed is given by

$$v_T = \sqrt{\frac{2mg(\sin\theta - \mu\cos\theta)}{\rho A C_d}}$$

For example, the terminal speed for a 15^o slope with typical values for the parameters (g=9.8, m=70 kg, C_d = 0.45, ρ = 1 kg/m^3, μ = .08, and A =0.6 m^2) is about 68 mph.

(2) "equivalent fall height": The vertical height of fall that would result in a speed at impact on a horizontal surface equal to the component of landing velocity normal to the landing surface. For a rider landing with speed, v_L, at an angle θ_L with respect to the horizontal on a slope with angle θ_s with respect to the horizontal, the fall height equivalent is:

$$EFH = \frac{v_L^2 \sin^2(\theta_L - \theta_s)}{2g}$$