Design&Build the *ultimate* pumptrack

PTBA Professional TrailBuilders ASSOCIATION

Waterloo, QC – BMXpert/Sentiers Boréals

Sentiers Boréals

Session content

- What is a pumptrack?
- Types of tracks
- Design
- Construction
- Maintenance
- Cost estimate
- Trends & inspiration

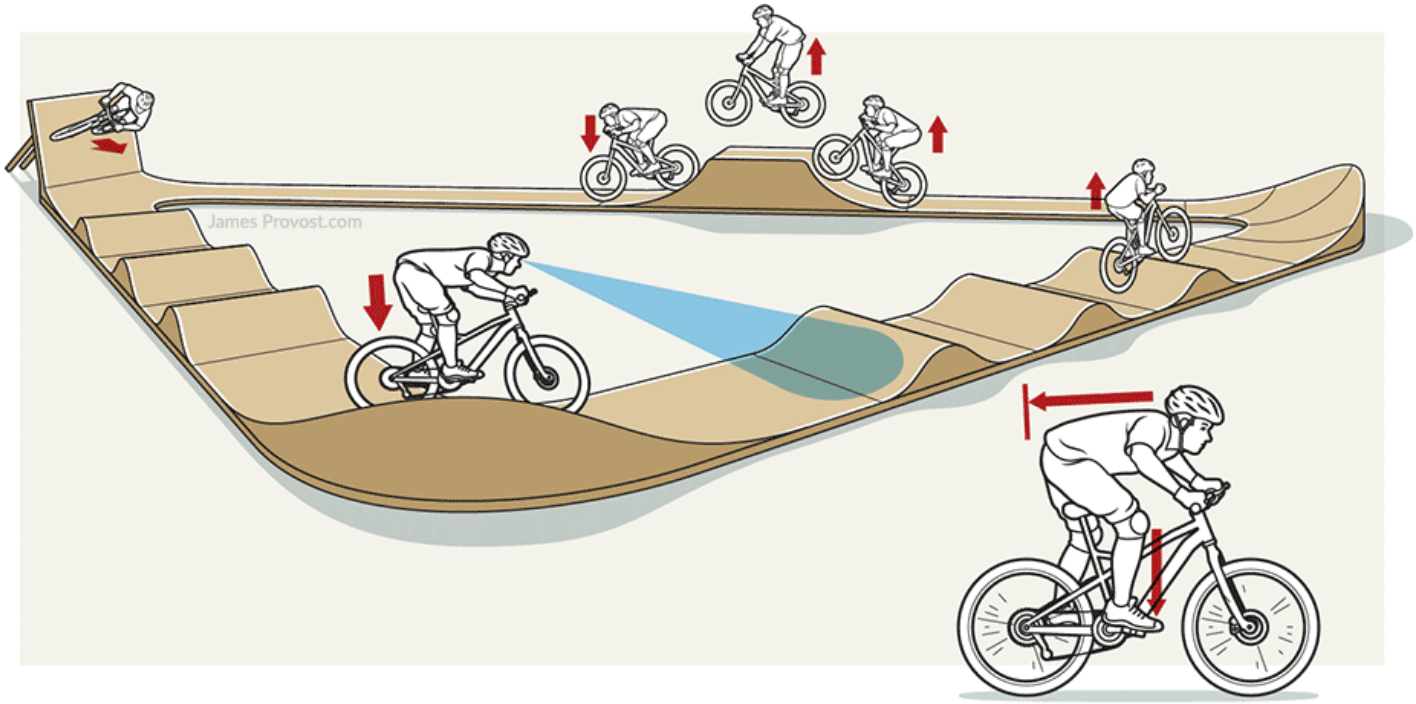
What is a pumptrack?

Pump Track – series of rollers, berms, and sometimes jumps, built and spaced in such a way as to al low a person to ride the course without pedaling, generating forward momentum through a technique called pumping.

Source: RideRedding.com

What is pumping?

Pumping – using your arms, legs, and body to move the bike down and up (unweighting / weighting) in a manner that propels the bike and rider across terrain without the need for pedaling.



Source: JamesProvost.com

Why it's important for mountain biking?

More intense skill building in 30 minutes than typical 4 hour ride

Builds the following skills:

- Anaerobic fitness
- Proprioception and bike control
- Vision
- Cornering
- Pressure Control
- Trail speed
- Trail finesse

Creates solid foundation for more advanced skills:

- Manuals
- Jumping

Type of bike

- Any bike will do!
  (or runbike, skateboard, roller blade, scooter, etc)
- BMX geometry recommended
- Lower your seat
- Add air to tires & suspension

Source: Norco Bikes

Bike park consideration

A pumptrack by itself have a limited appeal over time. It should always be viewed as an element of a more complete *bike park.*

Other features might includes:

- Skills area
- Dirt jumps
- Flow trails
- Gateway/kids trails
- XC trails
- Gravity oriented trails
- Slalom courses
- CX track

Source: Progressive Trail Design

Type of tracks

- Backyard
- Wood
- Composite
- Dirt
- Dirt w/ additive
- Surfaced dirt
- Asphalt track
- Pre-cast concrete
- In-place concrete

Source: BMXpert

Backyard track

Side note : Nice landscaping is key to good « wife acceptability »

Source: LeeLikesBikes.com

Wood

Source: Unknown

Wood (indoor park)

Source: The Lumberyard, Portland, OR

Fiberglass (wood frame)

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Dirt

Source: Elevated Trails Design

Dirt w/ soil additive

Source: Schneider Grading

Crushed stone surface

Source: Architrails, UK

Asphalt

Source: BMXpert

Pre-cast concrete

Source: Progressive Bike Ramps

In-place concrete

Source: ???

Pump park

Source: VeloSolutions

What is flow?

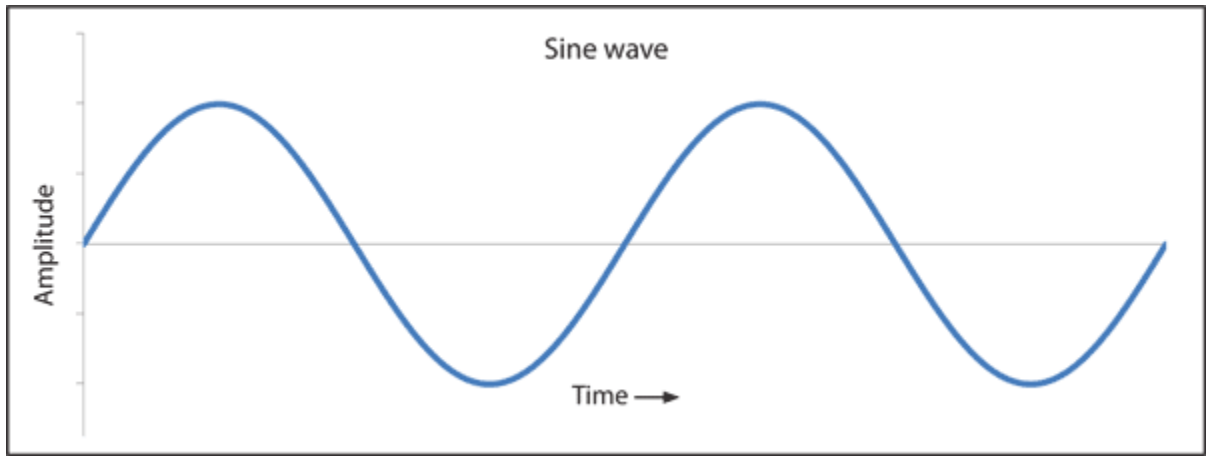
Flow is defined as a *predictable rythm*, based on a regular pattern.

Source: StockPhotos.com

What is flow?

Rythm (flow) is defined by *a smooth repetitive oscillation*

A sine wave is a mathematical curve that describe *a smooth repetitive oscillation*

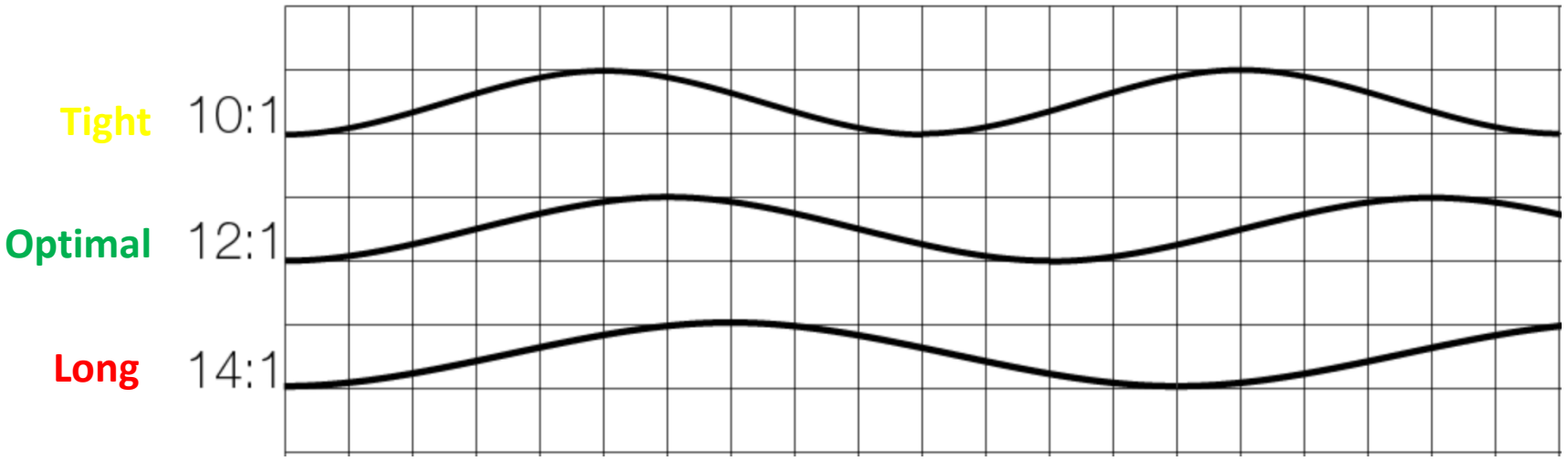


A pumptrack is a perfect sine wave.

** NO FLAT SPOTS.* ***NEVER****.*

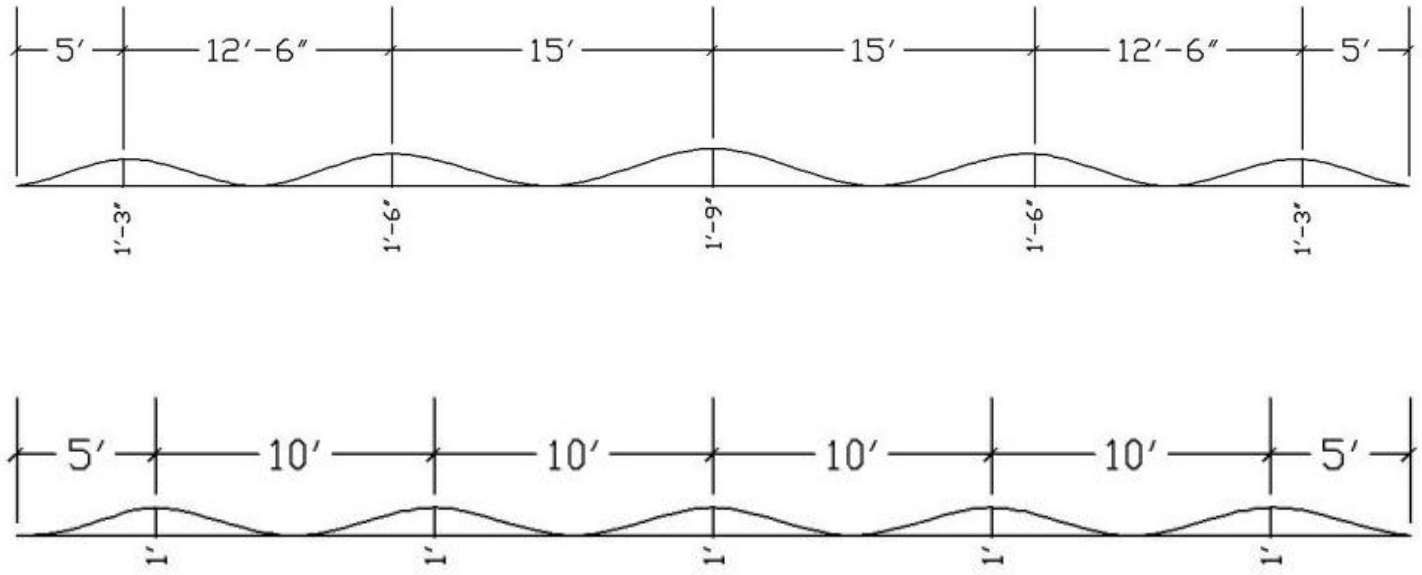
Source: Wiki

Golden Ratio



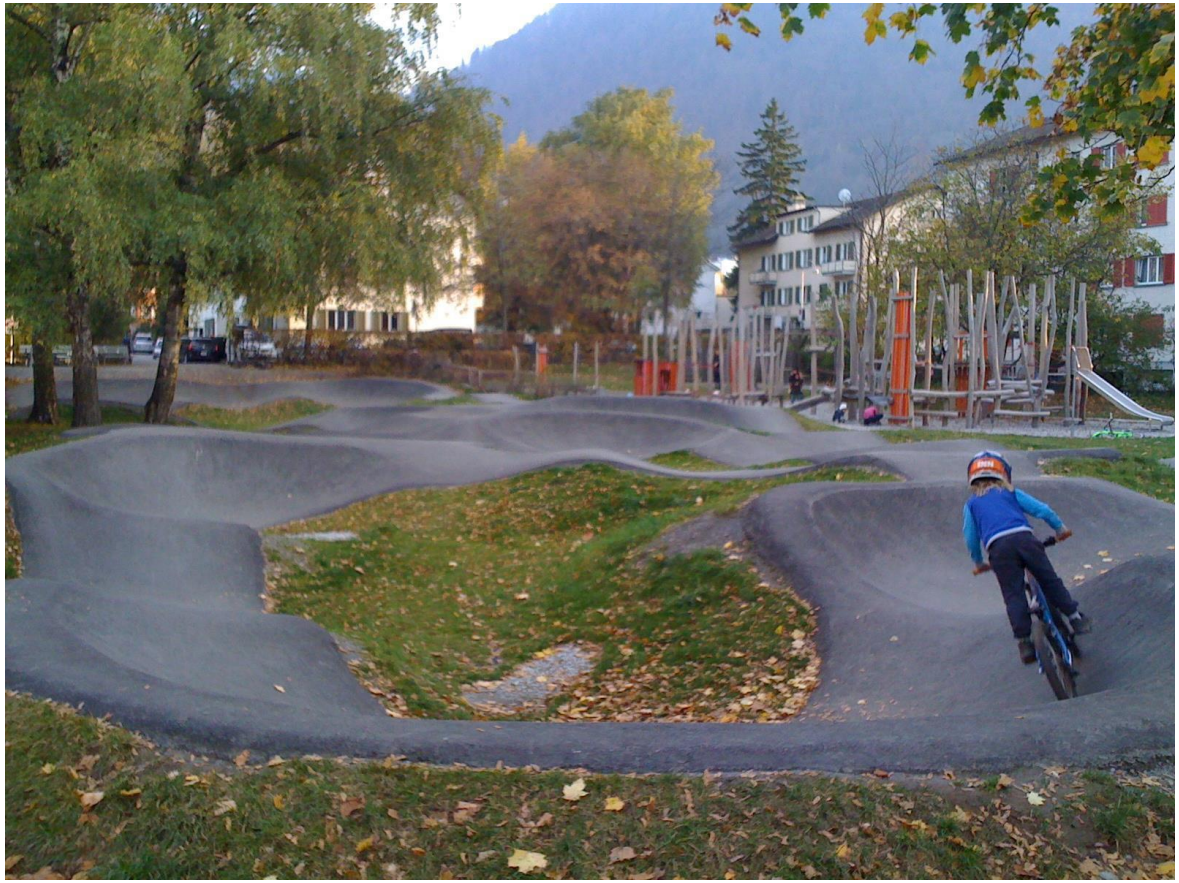
Source: Sentiers Boréals

Golden Ratio



Source: MTBR forum

Berm 101



Source: Chur, Switzerland (VeloSolutions)

Berm vs bank

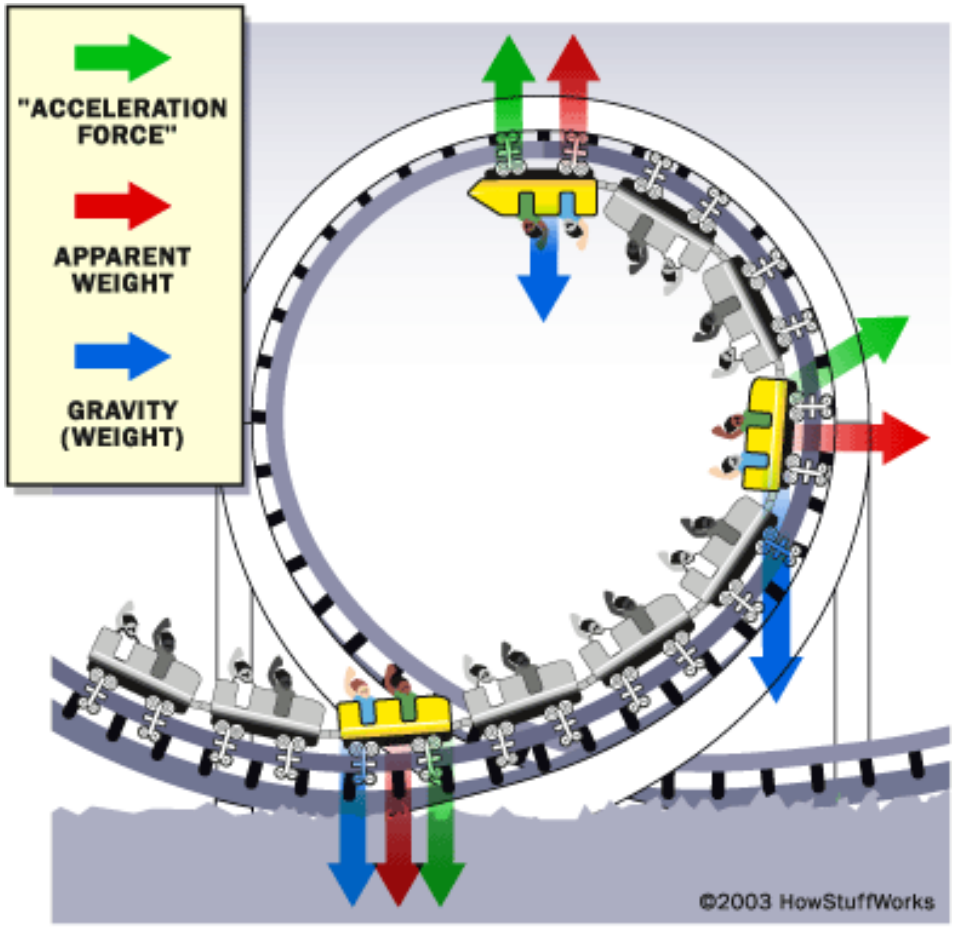
Inslope bank

Berm

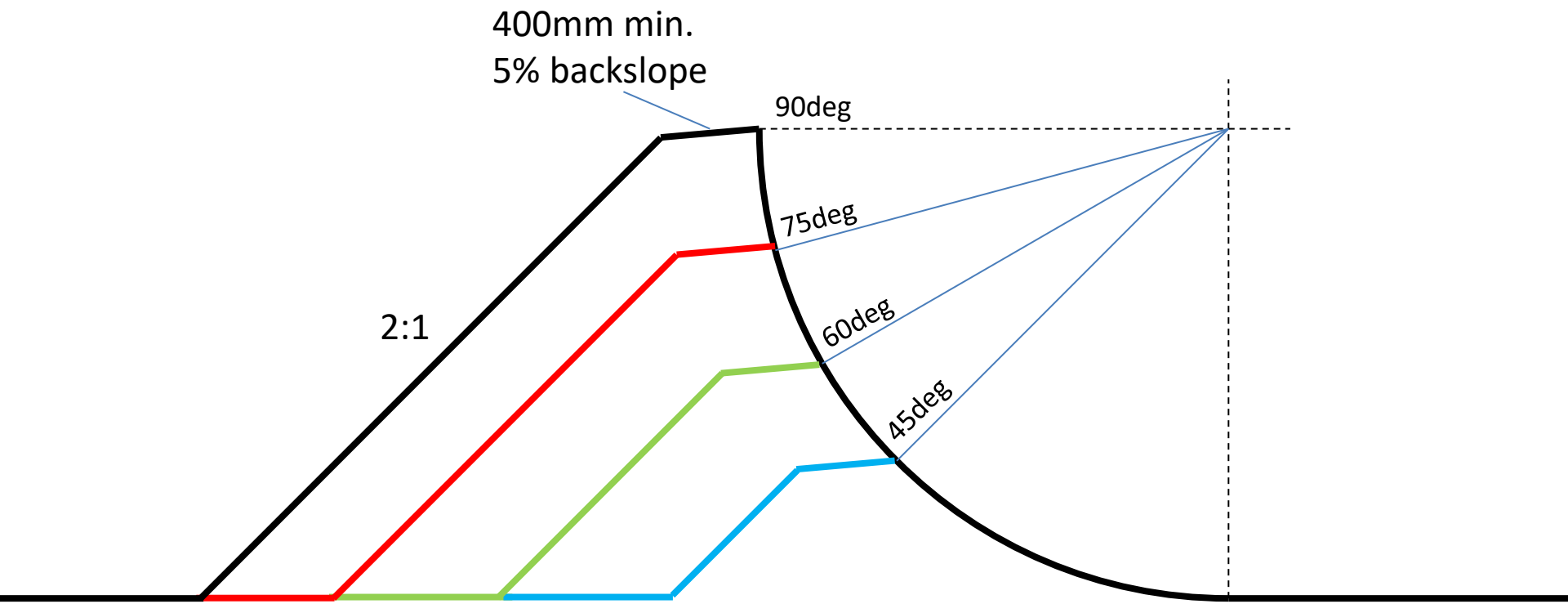
Remember: You *ride* a bank, you *rail* a berm

Source: Google Image | LeeLikesBikes.com

Berm science



Vertical profile of a berm



Source: Sentiers Boréals

Flat berm

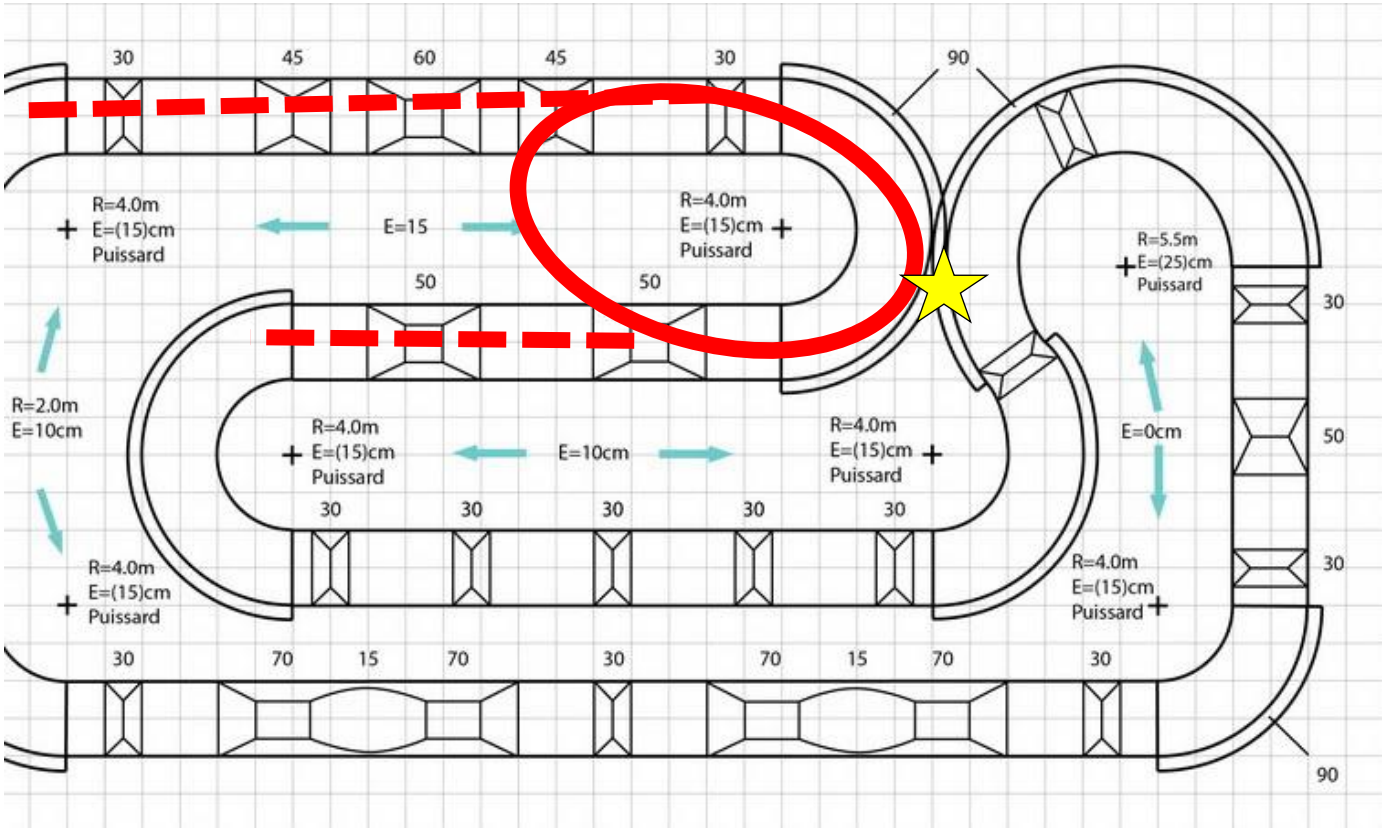
Flat berm
Top of berm is constant

Source: Sentiers Boréals

Rising berm

Source: BMXpert

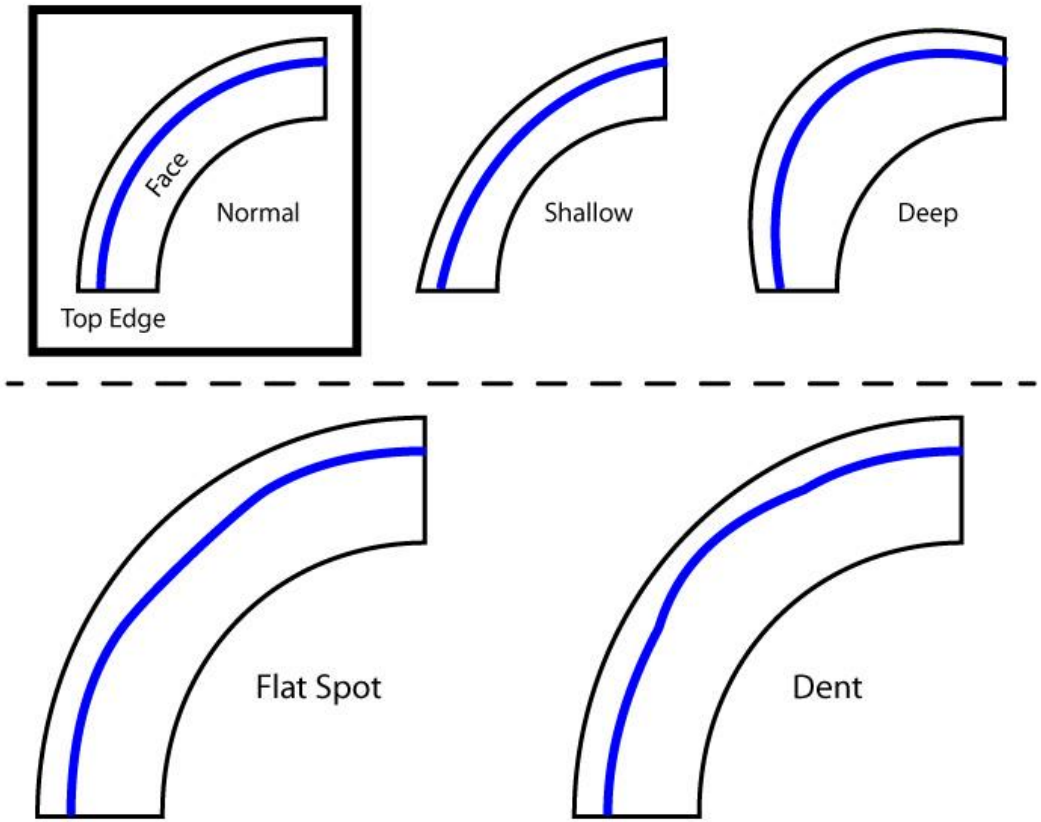
Off-center apex



Notice that the apex is off-center, based on an ellipsoid path

Source: Sentiers Boréals

Typical berm defect



Source: Elevated Trails Design

Typical berm defect

Source: Google Images

Retaining wall behind berm

Source: Sentiers Boréals

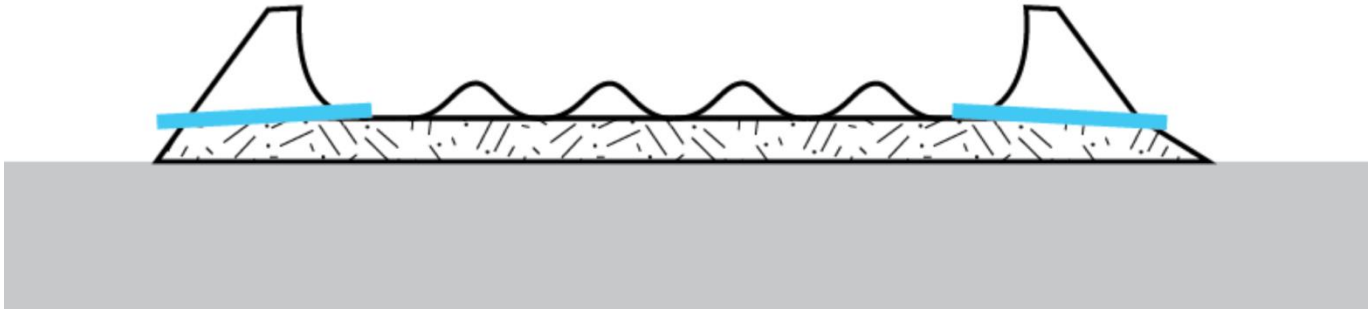
Drainage & erosion control

Source: Elevated Trails Design

Surface drainage

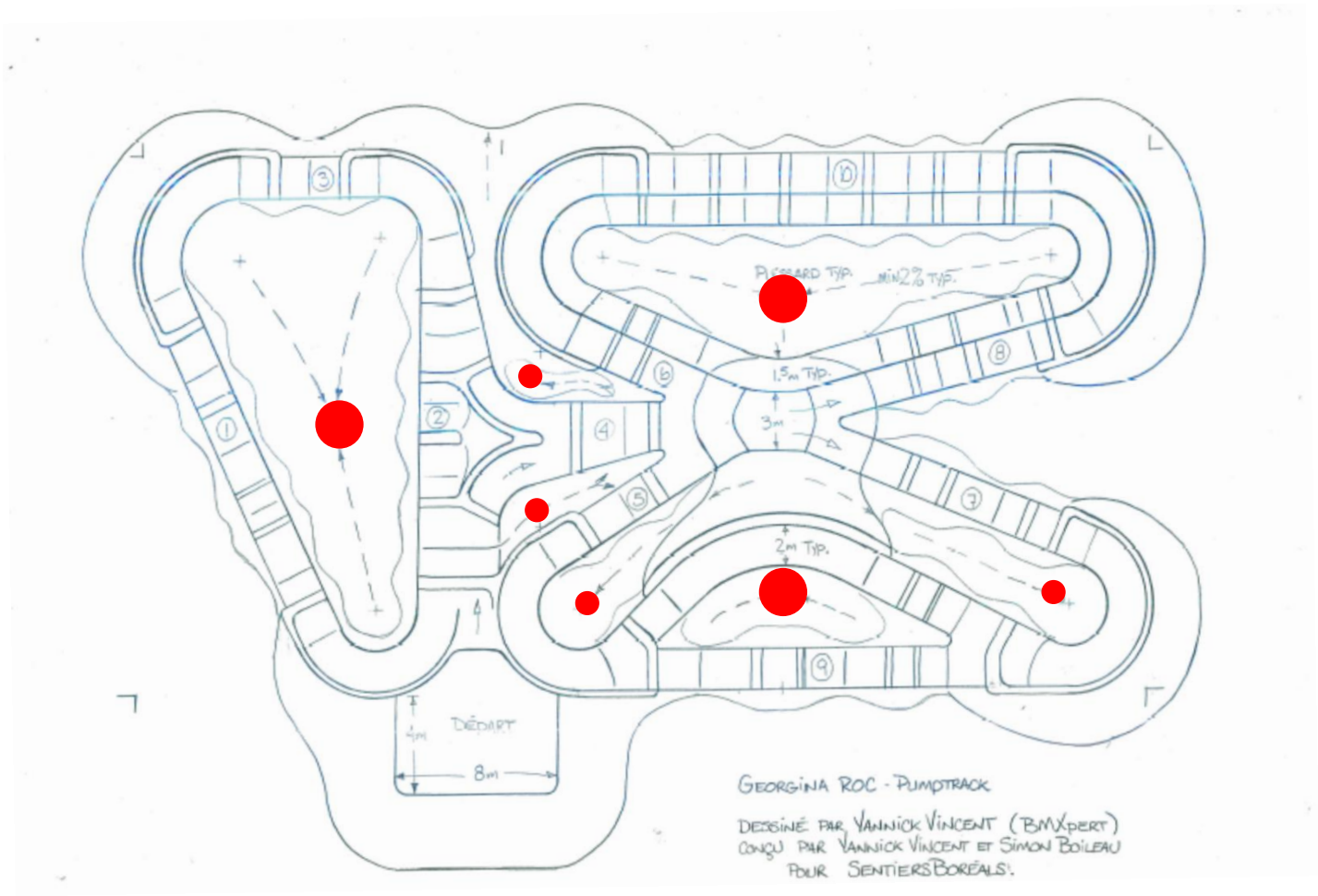
Source: Sentiers Boréals (2016 PTBA Workshop)

Surface drainage



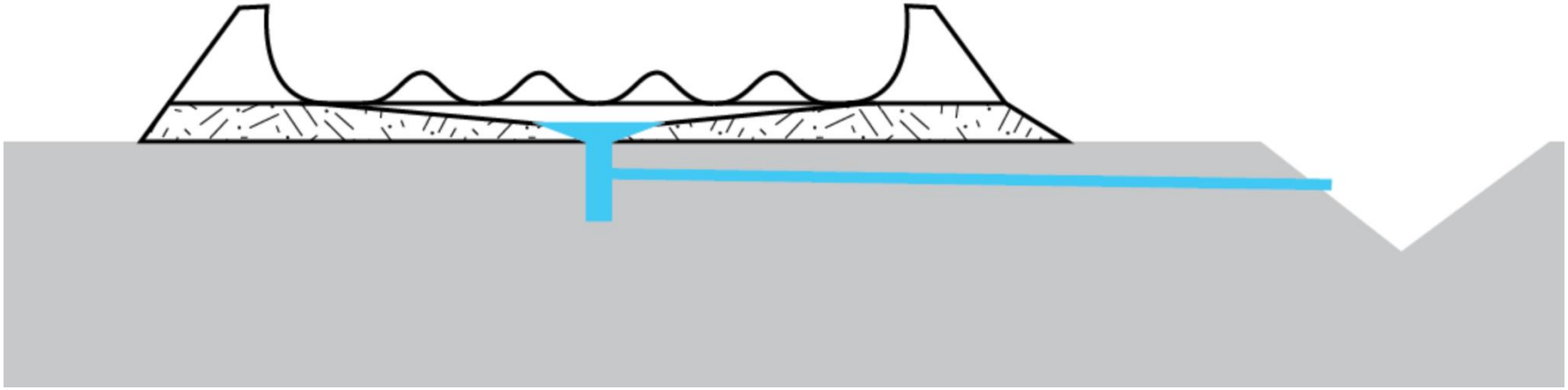
Source: Sentiers Boréals

Foundation drainage



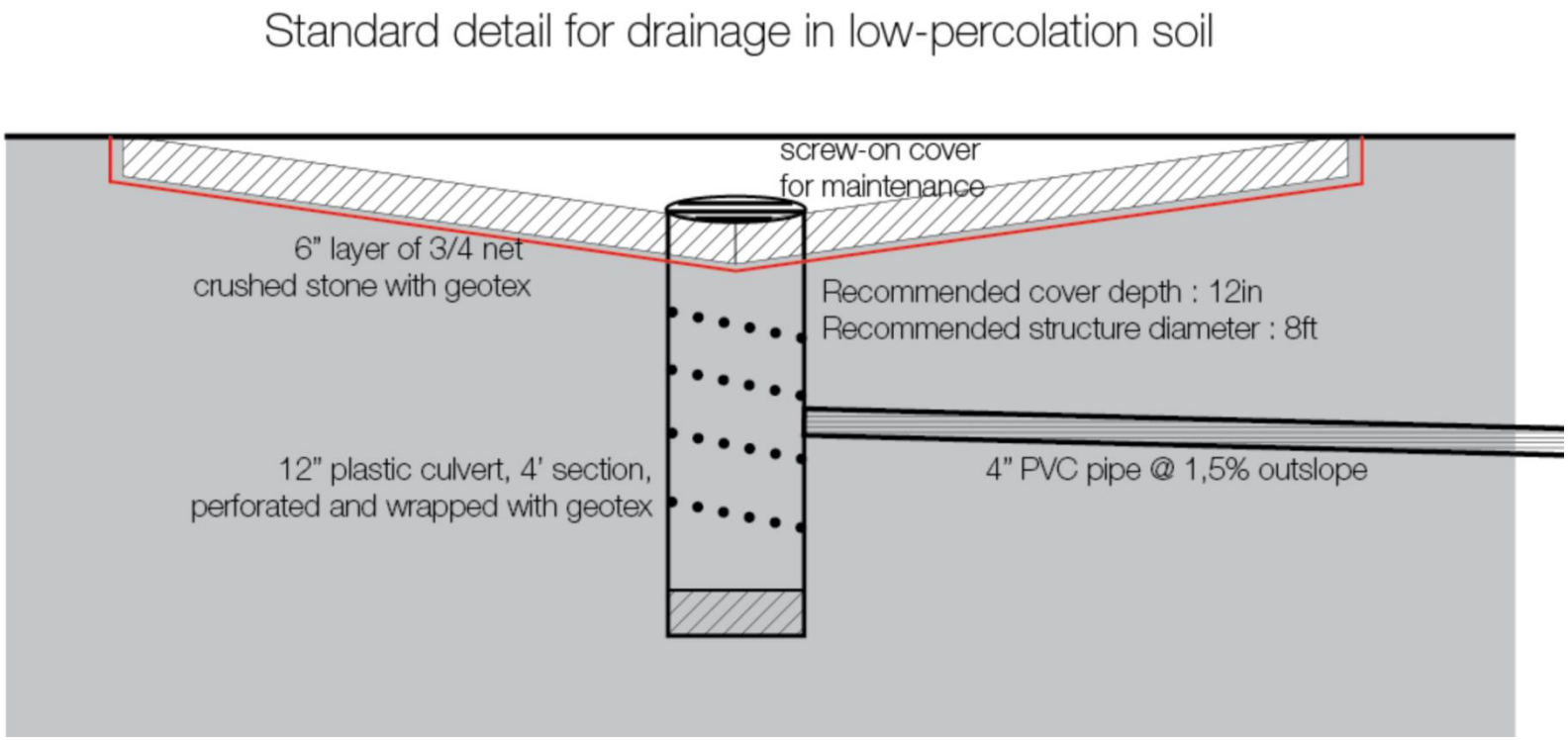
Source: Sentiers Boréals

Foundation drainage



Source: Sentiers Boréals

Foundation drainage



Source: Sentiers Boréals

Soil selection

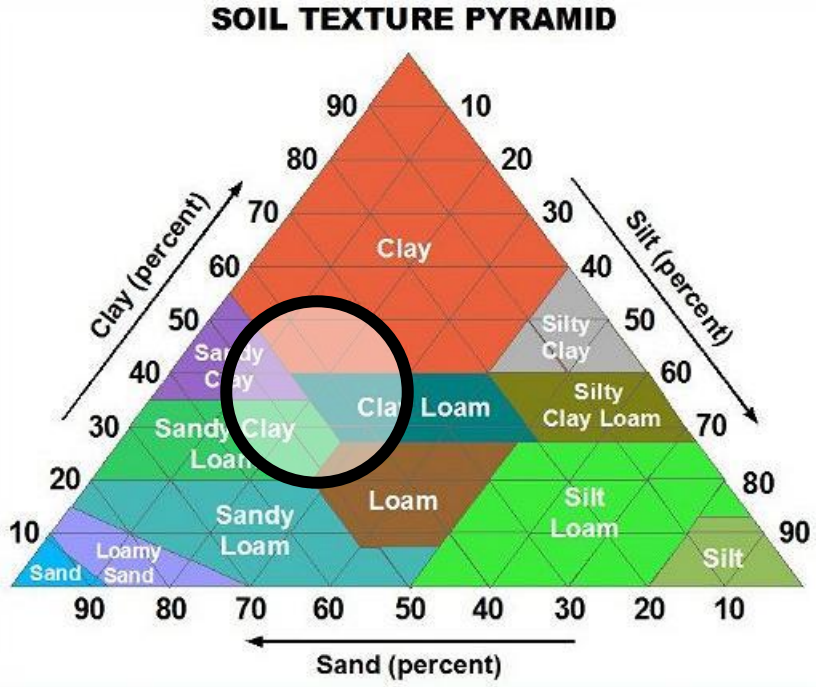
Source: Sentiers Boréals

Soil selection

DYI soil test

1) Fill 1/3 of jar with clean, loose dirt
2) Add 1 teaspoon of dish soap
3) Fill jar with water
4) Mix vigorously for 2min
5) Let rest for 24h
6) Calculate height of each layer (from bottom, sand-silt-clay)
7) Translate each layer in %

After 1 minute | After 1 day



Source: http://www.lawnlad.com/upload/fyi/FYI_SoilAnalysis.pdf

Soil compaction ratio

Table 10-1.—Soil Conversion Factors (Conversion Factors for Earth-Volume Change)

Soil Type	Soil Condition	Converted to		
		In-place	Loose	Compacted
Sand	In place	1.00	1.11	0.95
	Loose	.90	1.00	.86
	Compacted	1.05	1.17	1.00
Loam	In place	1.00	1.25	0.90
	Loose	.80	1.00	.72
	Compacted	1.11	1.39	1.00
Clay	In place	1.00	1.43	0.90
	Loose	.70	1.00	.63
	Compacted	1.11	1.59	1.00
Rock (blasted)	In place	1.00	1.50	1.30
	Loose	.67	1.00	.87
	Compacted	.77	1.15	1.00
Hard coral	In place	1.00	1.50	1.30
	Loose	.67	1.00	.87
	Compacted	.77	1.15	1.00

Surface hardness scale

Description of Material	E, Young's modulus (GPa)
Rubber	0.001-0.003
Clay	0.035
Sand	0.03-0.32
Sandstone	0.06
Crushed gravel	0.15-0.6
Asphalt 60°C	0.15-0.35
Asphalt 20°C	2-3.5
Concrete	14-21
Asphalt 0°C	13.5-35
Aluminum	70
Slate	95
Steel	200

Source: http://www.slowtwitch.com/Training/Running/Concrete_or_Asphalt__4793.html

Project planning

Zurich, Switzerland

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Project lifecycle

Planning

Construction

Maintenance (soft surface)

Maintenance (hard surface)

Site selection criterias

- **Easily accessible for the community**
- Land manager approval
- Sufficient area (2 tennis court min.)
- Flat or mellow grade
- Soil percolation & soil type
  - Contamined soil?
- Stormwater drainage requirements
- Public utility underneath?
- Shade and vegetation
- Water access (requirement)
- Equipment access
- Amenities
  - Parking
  - Restroom
  - Food & beverage
  - Bike station
  - Park lightning
  - Near a bike path

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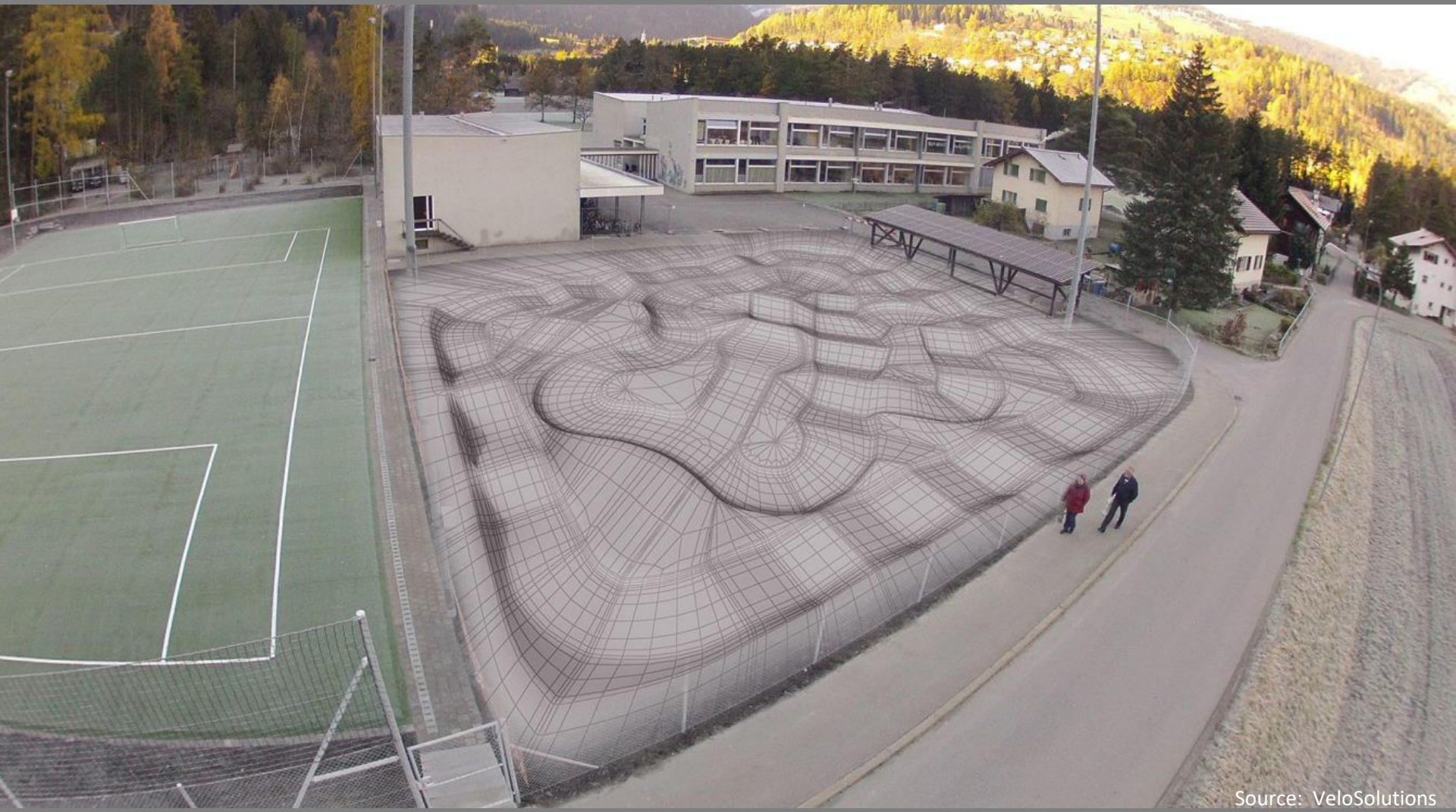
Project planning



Source: VeloSolutions

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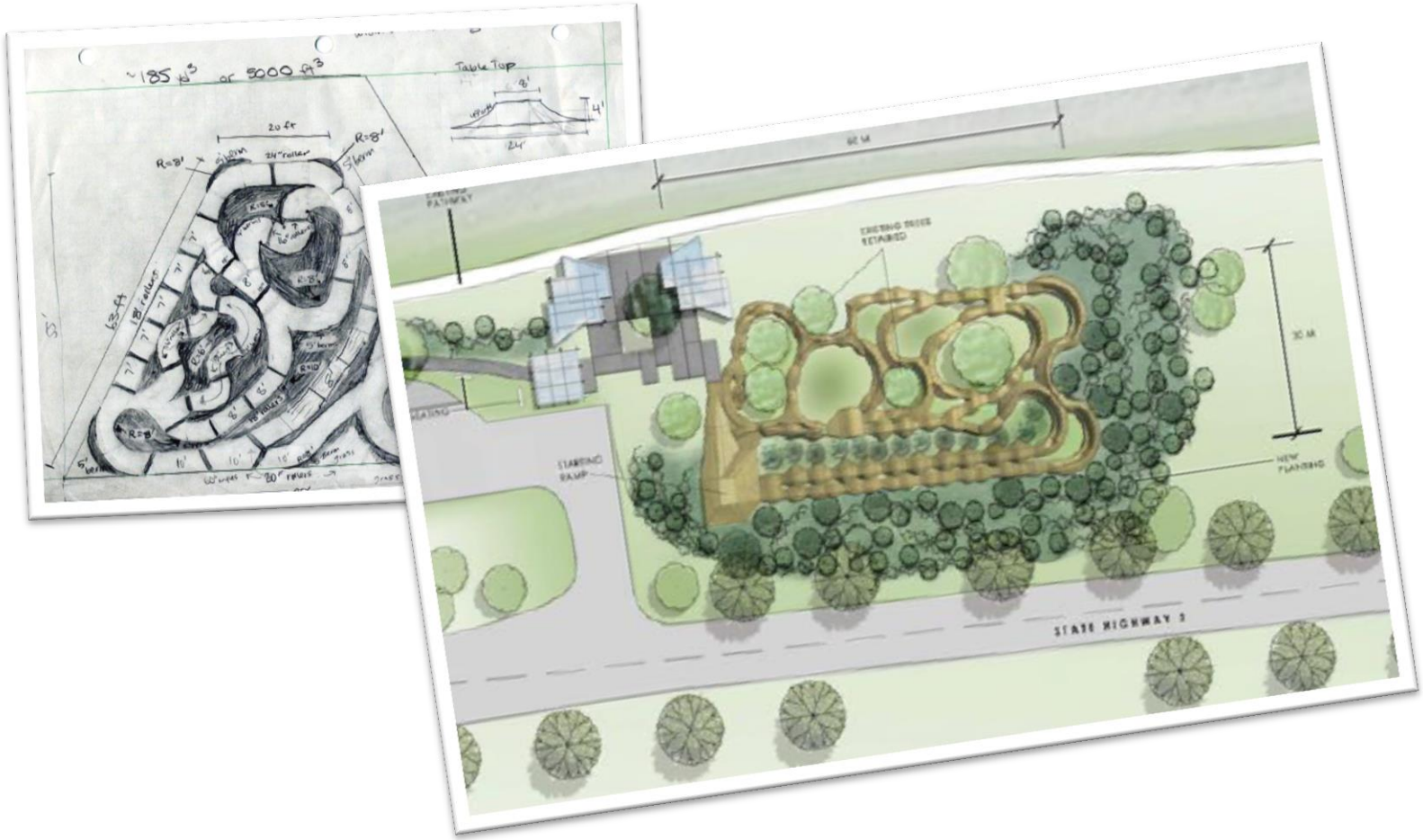
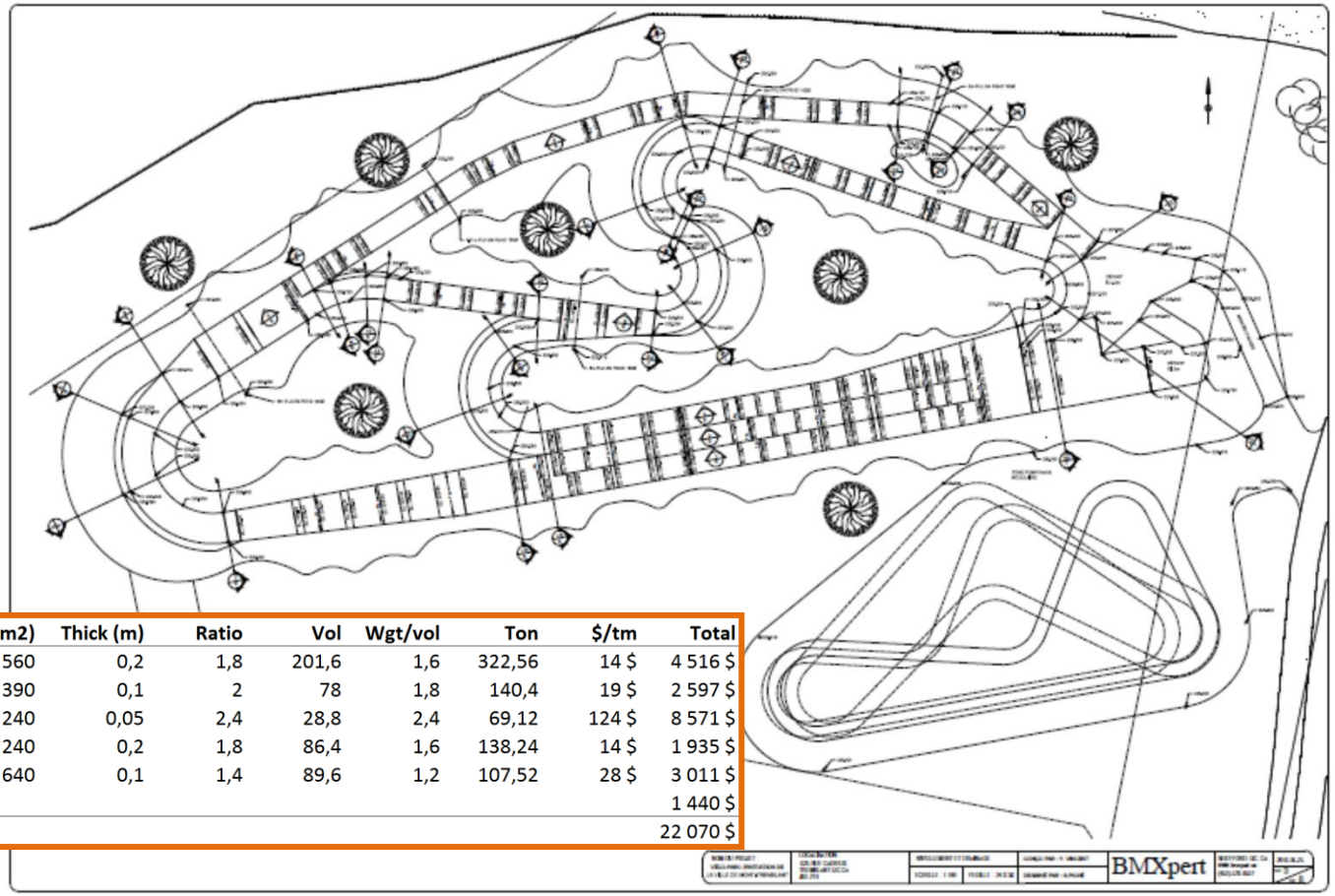
Design phase



Source: MTBR forum | unkown

Construction documents: CAD, specs and budget



Material	Area (m2)	Thick (m)	Ratio	Vol	Wgt/vol	Ton	$/tm	Total
Staging area (MG20 x 200mm)	560	0,2	1,8	201,6	1,6	322,56	14 $	4 516 $
Crushed granit 0-2mm	390	0,1	2	78	1,8	140,4	19 $	2 597 $
EB10S	240	0,05	2,4	28,8	2,4	69,12	124 $	8 571 $
w/ MG20 subsurface	240	0,2	1,8	86,4	1,6	138,24	14 $	1 935 $
Vegetal dirt	640	0,1	1,4	89,6	1,2	107,52	28 $	3 011 $
Hydroseeding								1 440 $
								22 070 $

Source: Sentiers Boréals | BMXpert

Cost estimate – volunteer vs. pro

Volunteer	Professional
• Dirt (<5000$)	• Dirt (20-40K+) • Modular (30-125K) • Asphalt (50-125K+) • Concrete (80-250K+)
• Free labor • Community involvment • Hard to hold accountable • Quality construction? • Good option for maintenance	• Expensive • Easy to hold accountable • Quality construction • Licensed & Insured • Meet homologation requirements (UCI) • In somes cases, licensed contractor is required for public infrastructure

Equipment & material

Volunteer

- Shovels (square and spade)
- Rake (gravel rake works best)
- Hand tamper
- Wheelbarrow
- Watering cans & buckets
- Hose w/ water source
- *Skid steer
- *Compactor plate
- Tarp (in case it rains)
- Beer, BBQ, water, sun cream…

Professional

- Tracked skid-steer
- Mini-excavator (3.5ton)
- Laser level (or Total Station)
- 2 measuring tape (100ft) and rope
- Wood stake (surveyor posts)
- Spray paint (a *LOT*)
- Vibratory drum roller
- Compactor plate for dirt
- Compactor plate for asphalt
- Water sprayer system
- Veg mat & seeds
- Erosion control material
- Geotextile + zip ties
- Drainage material
- Camera

Common problems

Rollers

- Too peaky (abrupt)
- Too mellow
- Too short or tall
- Too close together
- Too far apart
- Flat spots between

Berms

- Radius too tight
- Radius too mellow
- Height too short
- Inconsistent radius
- Bank instead of berm
- Improper profile (vertical angle)
- Top edge too weak
- Top edge weak

General

- Drainage failing
- Wrong material selection
- Lack of maintenance
- Incorrect maintenance
- Improper maintenance
- Not enough maintenance
- ***No progression!!***

Current trends

- Hard surfacing
- One track per skills level (kids, beginner, advanced)
- Key feature of a complete bike park
- Incorporating jumps and transfer in the design – maximize progression!
- Directionality of track

Source: Unknown

Thank you!

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Contributors

Some more inspiration…

End of day 2

Source: Sentiers Boréals

Some more inspiration…

Source: Elevated Trails Design

Some more inspiration…

Source: Sentiers Boréals

Some more inspiration…

Source: Stride Bike Park - Strasbourg, France (Bike Solutions)

Some more inspiration…

Source: Bike Solutions