Stand stability

- On critical sites, extraction racks are established at least one year before harvesting.
- In unstable (not optimally thinned) stands with high h/d values and short crowns it might be appropriate to establish the extraction racks one to more years before selective harvesting takes place.
Planning of ER: general remark

• Extraction racks must be planned in the context of terrain and harvesting systems (which are covered separately).

• All - even fully mechanised - harvesting systems allow a certain flexibility with respect to distance between ER – but greater distances might cause higher harvesting costs.
Dimension and alignment of ER 1

- Width: 4 m
- Distance: at least 20 m
- Gradient: up to 20 %
- Straightness: exact
- Crossing with forest roads: rectangular
- Role between harvesting operations: closed
- Erosion control: if necessary
- Extraction roads lean to the mountain side!
Dimension and alignment of ER 2

• Width: 4 m as standard due to width of vehicles

• Distance:
  – In flat terrain: min. 20 m, in older stands 40 or 60 m (preferrably multiples of 20 m)
  – In steep terrain: extraction racks 20 to 30 m; extraction roads up to 80 m and more
Dimension and alignment of ER 3

• Direction in flat terrain:
  – Straight: no curve around valuable trees!
  – Rectangular to the road system: widening at road crossing if required
• Direction in steep terrain:
  – Extraction racks perpendicular to contour lines
  – Extraction roads adjusted to the terrain and road system
Extraction racks: details

Source: Skogsarbeten

Prof. Dr. H. H. Höfle, CCF and Extraction Racks, 12./13.05.2010
Guidelines for extraction racks (State Forest Service of Baden-Württemberg)

Here: Examples for the alignment of extraction racks
Example for the alignment of extraction roads in steep terrain

Source: Forest Service of Thuringia
Example for a system of extraction roads (in the Black Forest)

Source: Dietz et. al.
Cross section of an extraction road

Source: Forest Service of Thuringia
What to do with old ER?

• If possible, they should be integrated into the new system
• Analysis in various steps (three in Baden-Württemberg):
  – Technical standard (grade, width, status)
  – Optimal type of rack with respect to terrain and to soil structure
  – Alignment: adjustment to the terrain, distance

• Rather to accept an inoptimal system than to make new tracks!?
The result of unmarked extraction racks

Source: WSL

Prof. Dr. H. H. Höfle, CCF and Extraction Racks, 12./13.05.2010
Existing ER (documented with GPS)

Final – and optimal - system using the old ER

Source: Hildebrandt

Prof. Dr. H. H. Höfle, CCF and Extraction Racks, 12./13.05.2010
Planning of extraction racks 1

• Unit to be planned for:
  – Not stand, rather
  – Compartment
  – Area for ER (“Feinerschließungseinheit”)

• Time:
  – Before the first harvesting operation.
  – Due to the timing (sequence) of operations, every stand is dealt within about five years.
Planning of extraction racks 2

- Person: forester – worker – contractor
- Criteria:
  - Terrain
  - Stand (age, dimension, density/visibility …)
  - Harvesting system
- Where:
  - on the map
  - in the terrain
Planning of extraction racks 3

In flat terrain:

• Map to start with:
  – Systematic arrangement
  – Avoid sensitive areas
  – Define bearing

• Transfer to the stand:
  – Two-men operation with compass and ranging rods
  – One-man operation with compass
  – One-man operation with compass: „thread method“
SUUNTO compass
Thread measuring device (WALKTAX by HAGLÖF)
Marking of extraction racks 1

- Criteria:
  - Visibility
  - Durability
  - Costs
  - Amenity (reaction of the public)
Marking of extraction racks 2

- At trees at the boundary of ER with ribbons or paint: high enough! – problem that marking has to be repeated (or through pruning of boundary trees)
- Through differentiation of the area of the ER (through not planting or planting with different species - in [re]fforestations -, mulching or “hardening” at the beginning of the rack)
- At the entrance of an ER (even with numbers)
- (Through poles of wood or metal)
Marking of extraction racks 3

- There is no one and optimal way of marking extraction racks in the stand (e.g. what colour? what type of paint? ...).
- Most of the methods must be repeated (ideally just before the next harvesting operation).
- Marking of extraction racks must be seen as an integral part of sustainable forest management.
When to open extraction racks?

- Depends on the silvicultural concept (see model for ash and sycamore)
- Already before the first precommercial thinning?
- Together with the first precommercial thinning?
- Simultaneously with the first (commercial) thinning
- One or several years before the first thinning
Source: Forest Service of Thuringia
Documentation of ER

• In the classical way through distance and bearing -> map
• Using GPS during marking
• Using GPS afterwards
• Using GPS during harvesting operations (receiver on the machines)
• Via remote sensing (areal photographs)
Source: Forest Service of Thuringia