Sveriges lantbruksuniversitet
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Continues Cover Forestry - Optimization of Off-road Transportation in (fairly) Steep Terrain

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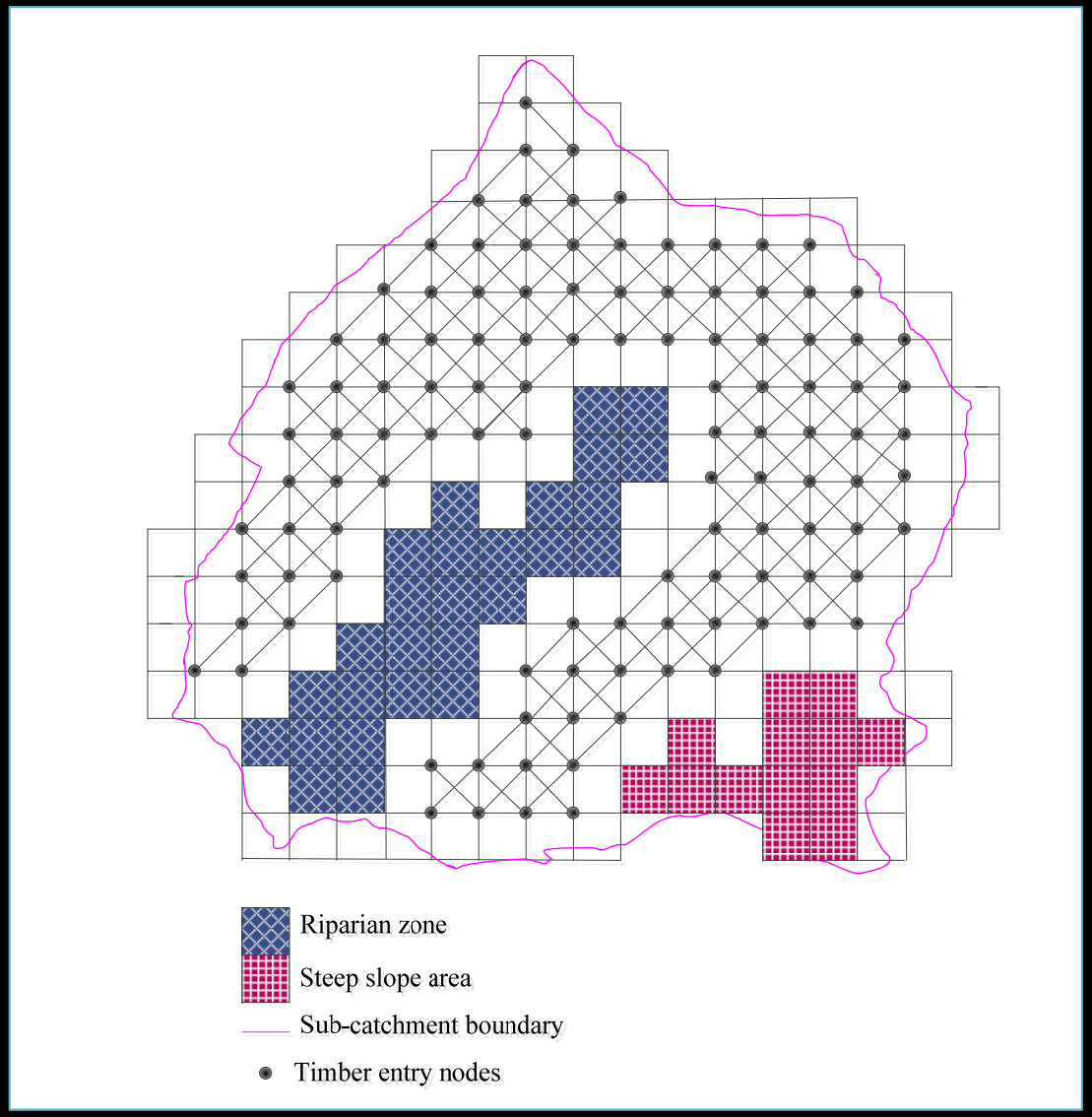
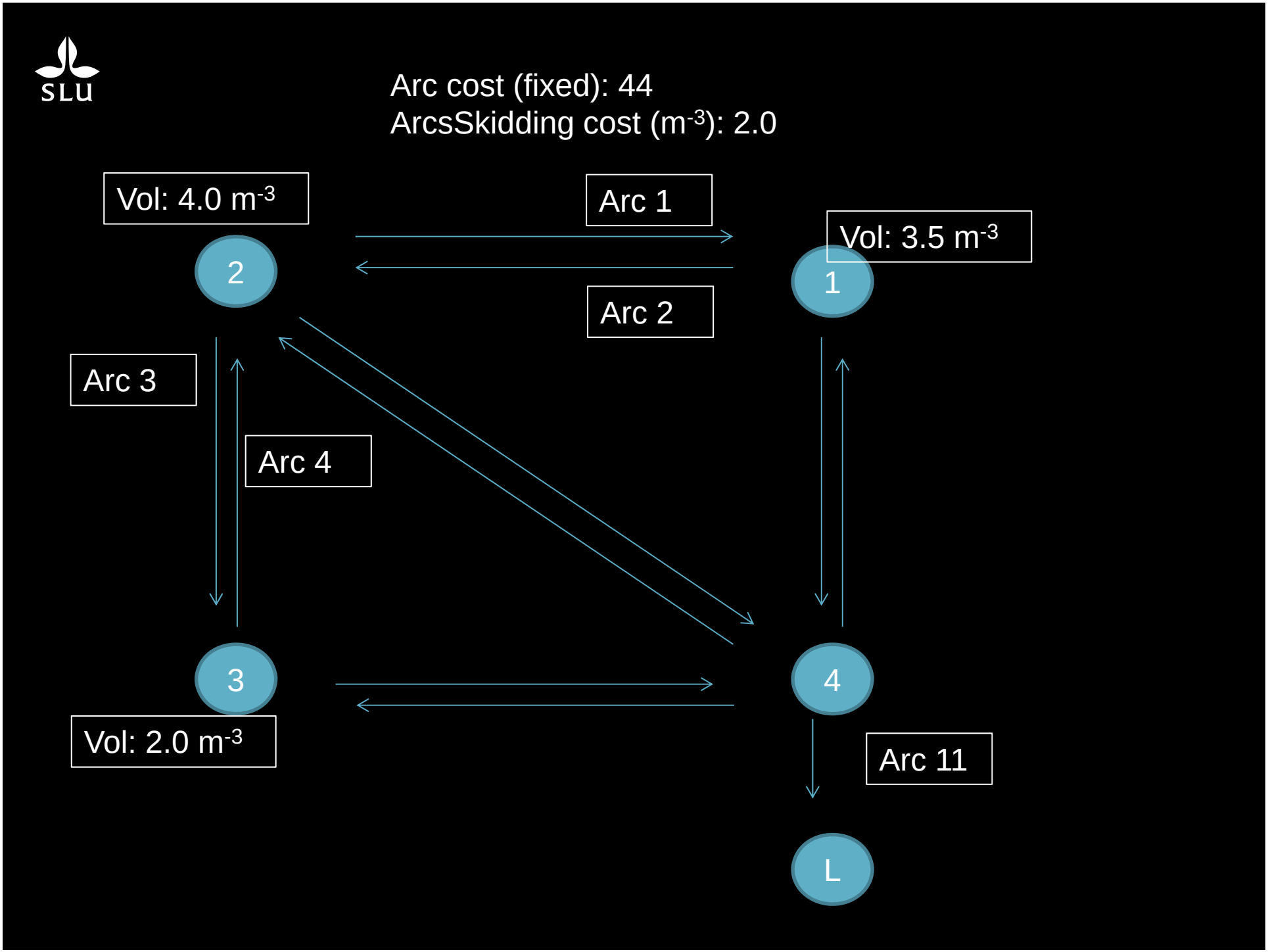
A schematic off-road transportation network with obstacles

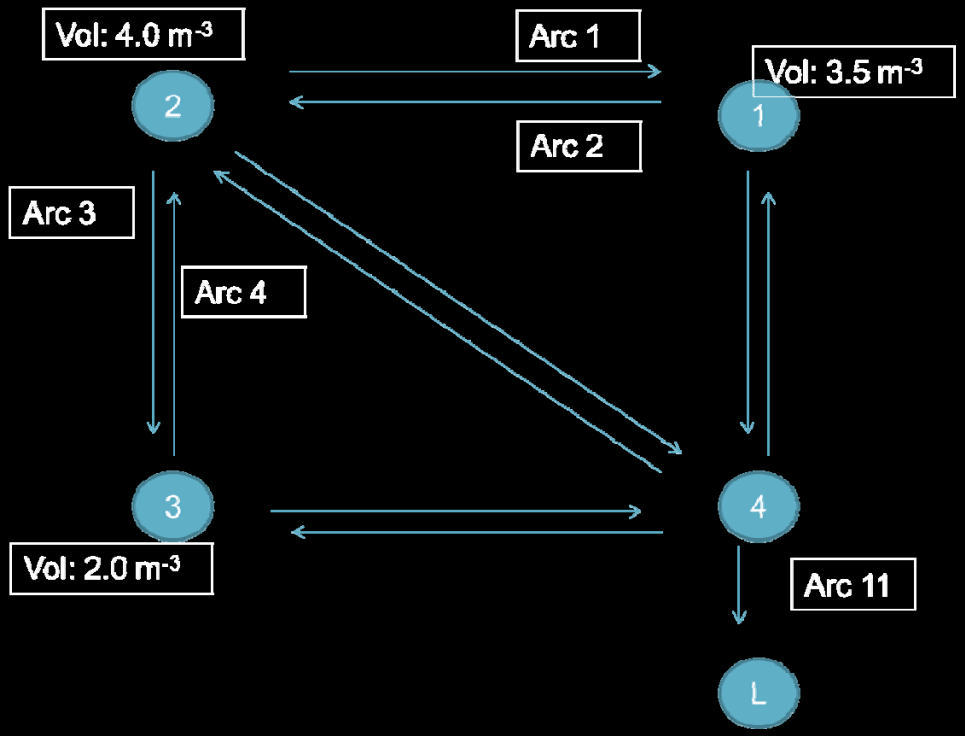



Arc cost (fixed): 44
ArcsSkidding cost (m-3): 2.0
Vol: 4.0 m-3
Arc 1
Vol: 3.5 m-3
2
1
Arc 2
Arc 3
Arc 4
3
4
Vol: 2.0 m-3
Arc 11
L

Two cases

- Transport to given landings
- Allocation of transport and landing

Transport to given landings (link model)

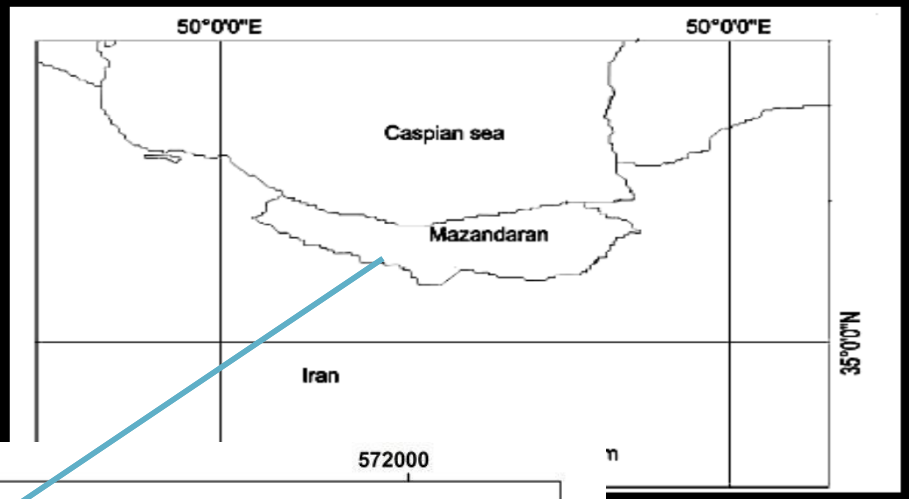


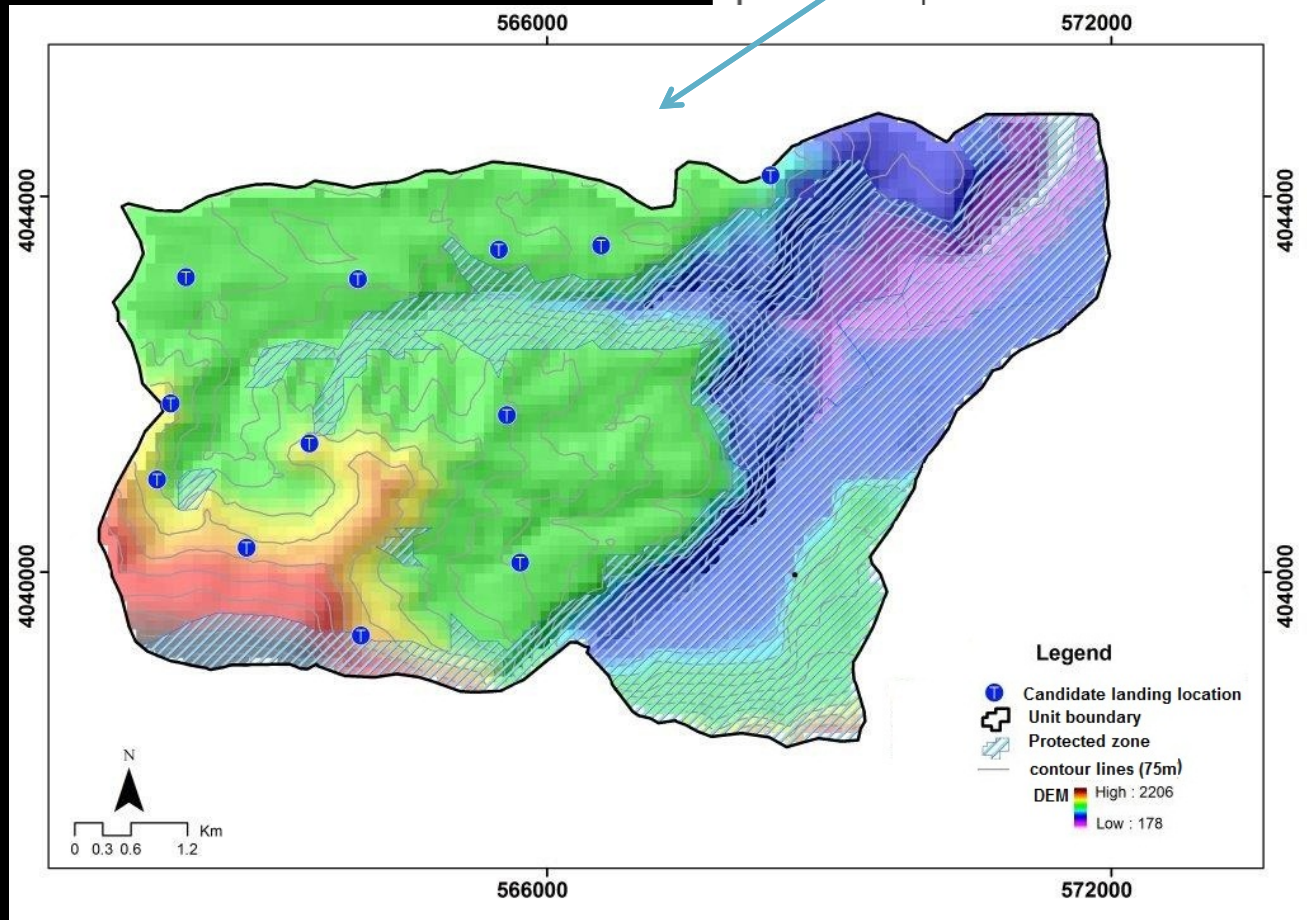
- Eq 1: sum of flow on arcs to node *i* + volume at node *i* = sum of flow out of node *i*
- Eq. 2: flow on arc between *i* and *j* <= M · open arc between *i* and *j* {0,1}

Solution strategies

- Straight on
- Route based model
- Reduce no. of arcs
- “Lifting”: Flow out from node only along one arc

Test area

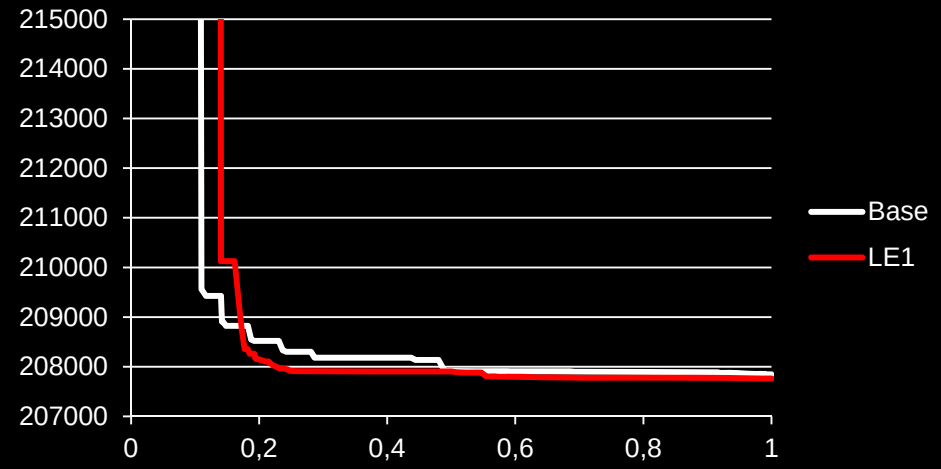




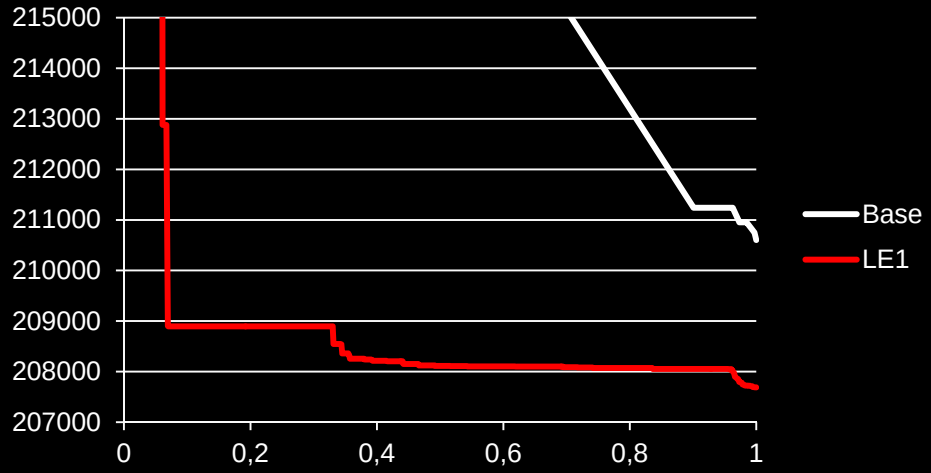
- ~2,600 nodes = ha
- 1-3 machines

Results
(3 hours run time)

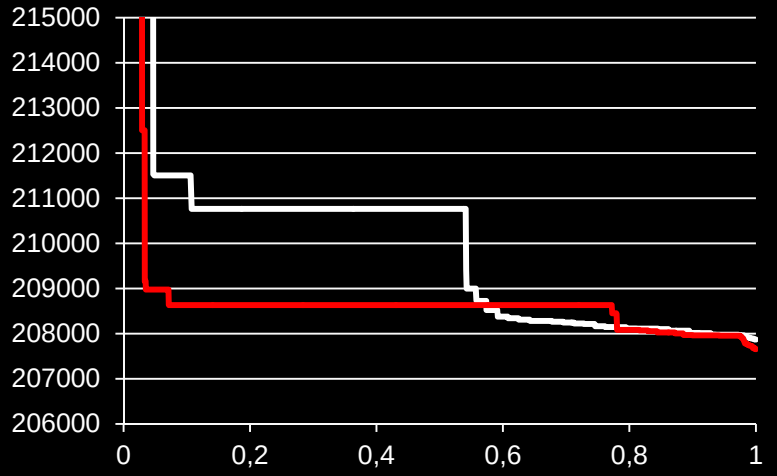
1 machine



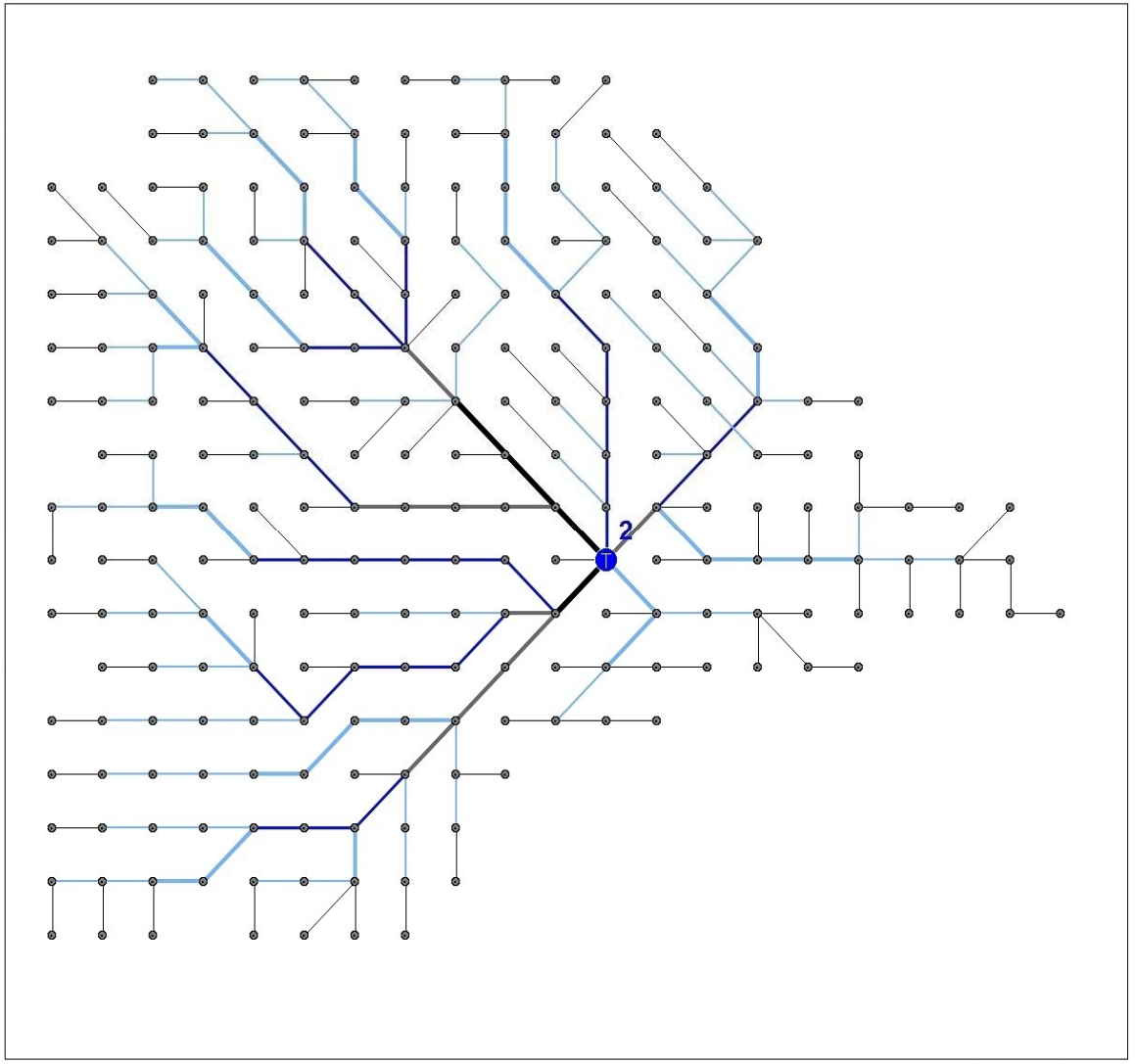
2 machines



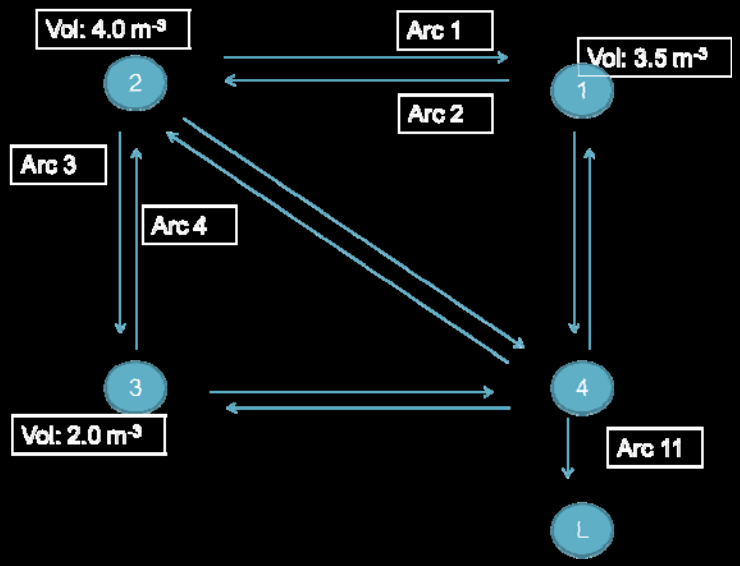
3 machines



Flow pattern



Allocation of transport AND landing (route model)



- Create **route** from node *i* to a landing *L* →
  1. Variable cost known
  2. Know what arcs to open → use *r* from *i* {0,1} <= open needed arc (m-n) {0,1}

Discussion points

- Manual solution OK?
- Flow of wood – but what about turns of skidder?
- CCF and larger scale planning?