A new concept for dimensioning salt storage facilities in Germany

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0. CONTENT

This presentation is based on parts of the research project carried out at the request of the Federal Ministry for Transport, Building and Urban Development, represented by the Federal Highway Research Institute, under research project no. 04.0243/2011/LRB. The authors are solely responsible for the content.

1. Introduction

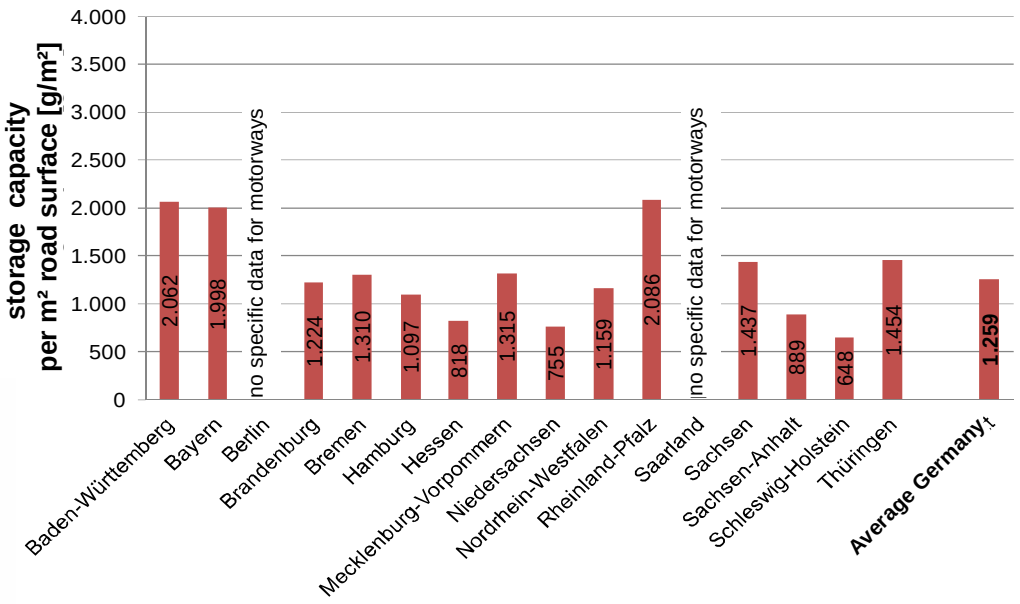
- Salt for winter service is stored in halls and silos
- Dimensioning of the storage facilities based on experience, available funds and benchmarks in the past
- In winter 2009/10 and December 2010 massive shortages in salt supply in many parts of Germany because of long-lasting winter weather periods
- Short-term reactions:

⇒additionally salt storage capacities in the road depots as well as centralized buffer storage spaces

⇒new rules for ordering and supply of salt

1. Introduction

- 2012 about 1.9 million t salt storage capacities for motorways, federal and state highways and district roads (partly)
- part of this are 600,000 t in central buffer storages
- great differences between states and regions based on different climatic conditions, length of road network, supply concept and other individual reasons
- for example, on the maintenance depots for the motorway network the average storage capacities per m² road surface vary between 650 and 2,100 g for the 16 German states



2. Method

- Same security of supply for all maintenance centres
- The necessary storage facility depends on
  - Length of road network
  - Intensity of winter weather conditions
  - Concept of additional supply during winter

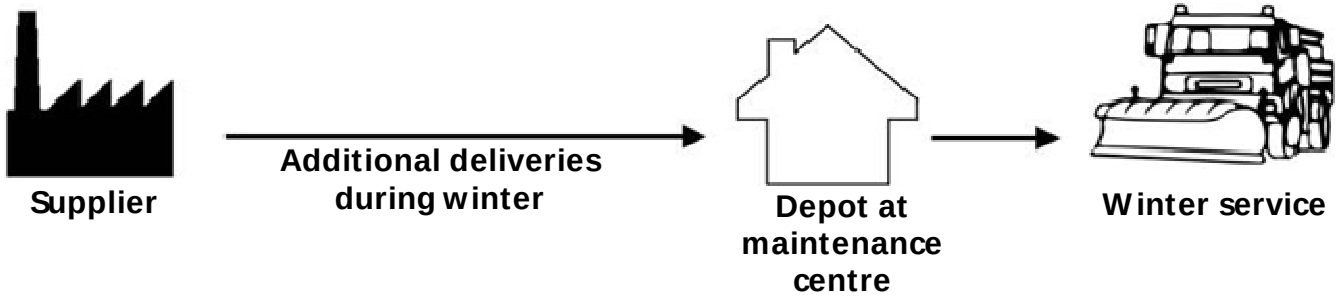
⇒Calculation of the amount of spreading material on every day for different spreading scenarios based on climatic data of the past (about 50 – 100 years)

⇒Calculation of maximum totals for time span of 30 days and the whole winter (values and probability of occurrence): $q_{30,max}$ $q_{30,0,2}$ $q_{180,max}$

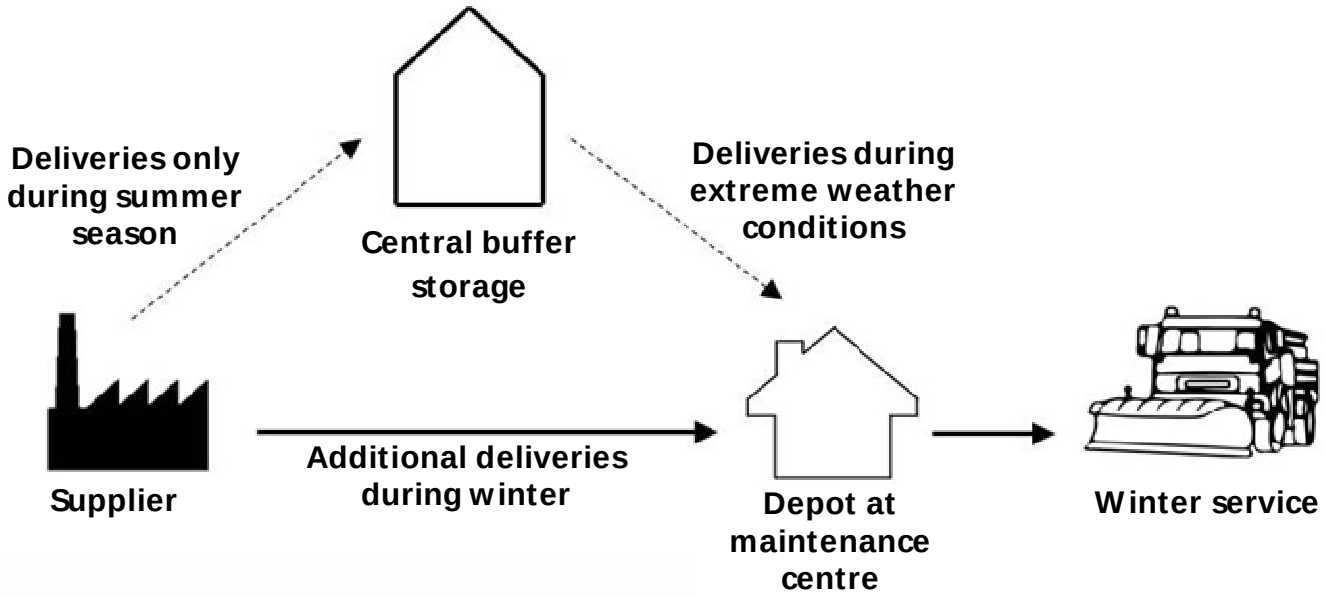
⇒Verification of the storage facility for different storage and logistic concepts

2. Method

Concept 1

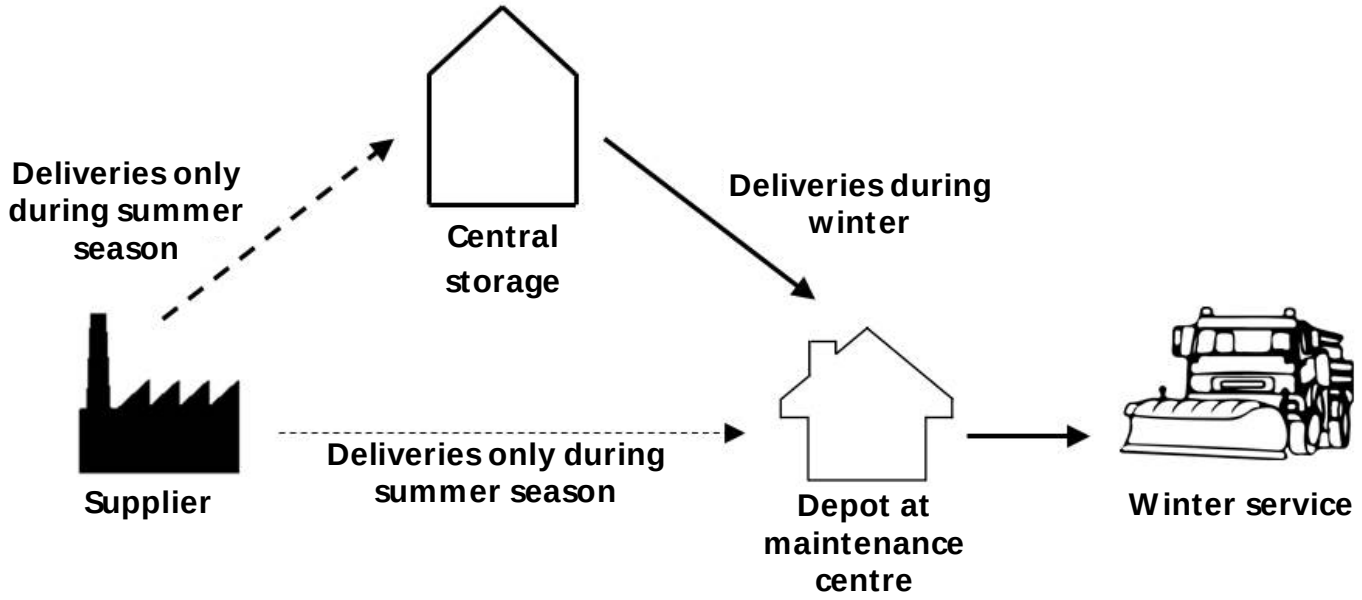


Concept 2



2. Method

Concept 3



Storage and logistics concept	Storage capacity maintenance centre	Storage capacity central / buffer storage space	Overall storage capacity
Concept 1	$q_{30;max}$	-	$q_{30;max}$
Concept 2	$q_{30;0.2}$	$q_{30;max} - q_{30;0.2}$	$q_{30;max}$
Concept 3	Current capacity	$q_{180;max}$ – current capacity	$q_{180;max}$

3. Results

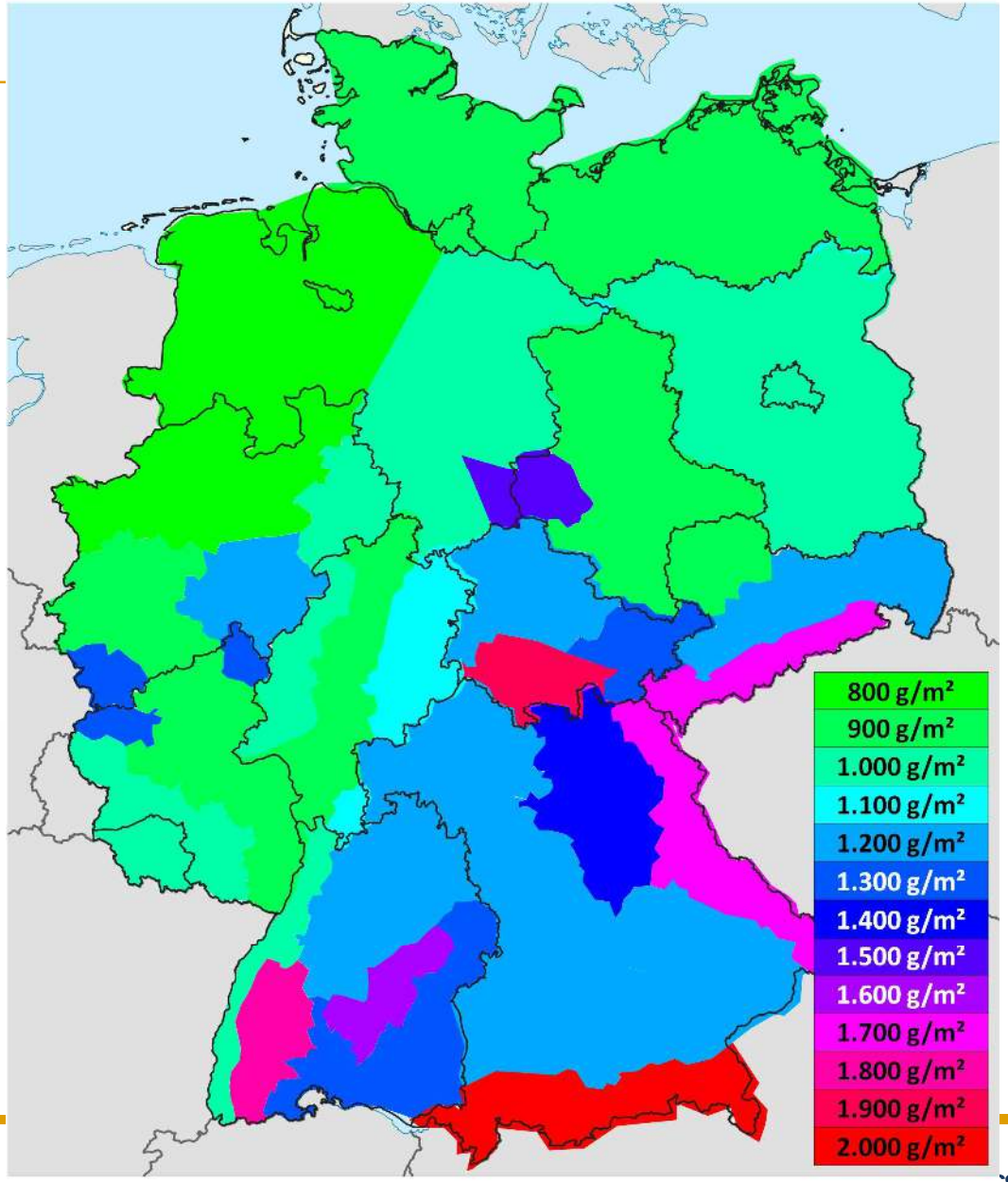
Climatic regions for ascertaining storage capacities for spreading material and assessment values $q_{30;max}$

- Data from 149 climate stations
- Climate areas of RWIS
- Altitude & topography

⇒39 climatic regions

⇒13 assessment values

⇒Individual dimensioning for each maintenance centre (about 700)



Storage capacities (nationwide)

- **Existing storage capacities:**
  - Maintenance Centres: 1.24 mio t
  - Central storage facilities (leased):0.62 mio t
- **Concept 1 (only depots at maintenance centres):**
  - Necessary storage facility : 1.09 mio t
  - Overcapacity (some centres):0.30 mio t
  - Necessary extension of capacities: 0.15 mio t
  - Capacities after extension: 1.39 mio t

Storage capacities (nationwide)

- **Concept 2 (depots at maintenance centres and central buffer storages):**
  - Necessary extension of capacities at maintenance centres: 0.04 mio t
  - Necessary central buffer storages: 0.11 mio t
  - Capacities after extension: 1.39 mio t
- **Concept 3 (depots at maintenance centres and central storages, without deliveries by the supplier during winter):**
  - Necessary total capacity: 2.63 mio t
  - Existing effective capacity at maintenance centres: 1.22 mio t
  - Necessary central storages: 1.41 mio t

Cost and profitability analysis (nationwide)

- **Only decision relevant costs (no cost of spreading material overall)**
  - Investment, maintenance or leasing for storage capacities
  - Costs of transport
  - Other (costs of storage, capital costs)
- **Concept 1:**
  - Annual costs: 98 mio EUR
  - Investment: 114 mio EUR
- **Concept 2:**
  - Annual costs : 92 mio EUR
  - Investment: 29 mio EUR (+ 17 mio EUR optional*)
- **Concept 3:**
  - Annual costs : 109 mio EUR
  - Investment: 0 mio EUR (+ 208 mio EUR optional*)

* optional costs for the investment of central storages instead of leasing

4. Conclusions for Practice

- **Standardized nationwide concept for dimensioning salt storage facilities**
  - Very high security of supply for all maintenance centres
  - Considering specific wintry conditions, road network etc.
  - Necessary Storage facilities depend on storage and logistic concept
- **Concept 2 with additional central buffer storages most advantageous concept for many federal states**
- **First nationwide investigation regardless of**
  - Specific requirements for spreading on individual road sections
  - Structural condition of existing storage facilities
  - Availability of central storage facilities and regional leasing payments
  - Contract conditions for salt delivering and regional competition
  - …

⇒ **State specific implementation concepts are necessary**

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Thank you for your attention!

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