Gravity vs Vacuum

Investment costs and maintenance
In 20 minutes...

Vacuum – gravity: comparing investment costs
Case study: one project in the Middle East and one in Eastern Europe
Vacuum – gravity: comparing operations costs
Worldwide vacuum

Typical: 500-8000 PE

No of valves

Year

Systems built outside Germany by Roediger
Investment cost

Gravity vs vacuum – Zoltan Barcza | page 4

- heavy Machinery required
- complicated Excavation
- larger Pipe Diameters
- add. Pumping Stations required
- unstable or rocky Underground
- high Ground Water Table
- low Population Density
- Deeper Trenches

Conditions

Gravity SYSTEM

VACUUM SYSTEM
**Typical question**

I have a settlement of 2000 PE, what would be the price? Ok-ok…. Than What range?

Conclusion: every vacuum project is different, so we need a map of the area.
Sample project in Middle East

Home game:
Flat
Sandy
Coastal area
7500 PE
Sample project in Middle East
Sample project in Eastern Europe

High ground water table
Flat
Channels crossing
Road already built
8400 PE
Sample project in Eastern Europe

![Graph showing costs for different components of a project, with Sewer Lines, Collection chambers/Manholes, Vacuum Station/Pump stations, Other costs, and TOTAL costs. The graph is color-coded and shows the cost distribution for each component.]
## Case study

... how much does it cost?

<table>
<thead>
<tr>
<th>Vacuum:</th>
<th>Gravity with pump stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection chambers</td>
<td>Manholes</td>
</tr>
<tr>
<td>Network with small diameter pipes</td>
<td>Network with big diameter pipes</td>
</tr>
<tr>
<td>Shallow and narrow trenches</td>
<td>Deep and wide trenches</td>
</tr>
<tr>
<td>Only one vacuum station</td>
<td>Many pumping stations</td>
</tr>
<tr>
<td>Logistics, customs</td>
<td>Logistics, customs</td>
</tr>
</tbody>
</table>

**Alltogether: - 35% -40%**

depending always on the individual / typical project
The myth: no maintenance in gravity systems
The truth: there is a whole industry built on cleaning and repairing gravity systems

RoeVac® Vacuum systems

Labour
- Regular check of collection chambers
- Regular check of vacuum station

Replacement/repair
- Oil and filters to vacuum pumps
- Valve membrane (app. every 5 years) replacement

Gravity systems

Labour
- Regular check of manholes
- Pipeline inspection, CCTV inspections
- Cleaning accumulated sludge, slime and debris (jetting with high-pressure)
- Flushing

Replacement/repair
- Oil discharge pumps and lifting station pumps
- Manhole/Sewer rehabilitation
Operation and maintenance

**RoeVac® Vacuum systems**

**Electricity consumption**
- Electricity consumption of vacuum station (approx. 15-25 kWh/PE/year)

**Cleaning the system:**
- Vacuum sewer mains are self-cleansing due to high velocity

**Sewage treatment:**
- Handle only wastewater
- Handle fresh waste water, mixed with air
- Closed system – handle only wastewater of the community

**Gravity systems**

**Electricity consumption**
- Electricity consumption of lift- and pump stations

**Cleaning the system:**
- H₂S deodorization
- Flushing, spooling the system

**Water treatment:**
- Handle big amount of infiltrated ground water
- Handle aged and possibly septic wastewater
- Handle wastewater from unsure source
Operation and maintenance

**RoeVac® Vacuum systems**

**Operation Safety**
- No operational risks to operators
- All equipment can be accessed from above ground level
- No direct contact with wastewater
- No climbing into manholes or confined spaces required

**Gravity systems**

**Atmospheric hazards in confined spaces:**
- low oxygen
- hydrogen sulphide
- explosive concentrations of methane

**Physical hazards with confined space entry**
- Objects falling onto operators

**Biological hazards:**
- Germs and diseases
- Viruses
- Pathogenic organisms
- Insects, animals
- Bad smell
Thank you for the attention!

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Example A: Area with a high population density

2,000 PE

500 m

500 m

VS
Example A: Area with a higher population density

**Vacuum costs:**

- Pipes: \(2,000 \text{ m} \times 50 \text{ €/m} = 100,000 \text{ €}\)
- Collection chambers: \(100 \text{ CC} \times 2,000 \text{ €} = 200,000 \text{ €}\)
- Vacuum station: \(= 200,000 \text{ €}\)

**Total:** \(500,000 \text{ €}\)

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**Gravity costs:**

- Pipes: \(2,000 \text{ m} \times 100 \text{ €/m} = 200,000 \text{ €}\)
- Manholes: \(40 \times 300 \text{ €} = 15,000 \text{ €}\)
- Pump station: \(1 \times 50,000 \text{ €} = 50,000 \text{ €}\)

**Total:** \(275,000 \text{ €}\)
Example B: Area with a lower population density

2.000 PE

2.000 m

3.000 m

40 PE
Example B: Area with a low population density

**Vacuum costs:**

- Pipes: $10,000 \times 50 \text{ €/m} = 500,000 \text{ €}$
- Collection chambers: $130 \text{ CC} \times 2,000 \text{ €} = 260,000 \text{ €}$
- Vacuum station: $= 200,000 \text{ €}$

**Total:** $960,000 \text{ €}$

**Gravity costs:**

- Pipes: $10,000 \times 100 \text{ €/m} = 1,000,000 \text{ €}$
- Manholes: $200 \times 300 \text{ €} = 60,000 \text{ €}$
- Pump stations: $4 \times 50,000 \text{ €} = 200,000 \text{ €}$

**Total:** $1,260,000 \text{ €}$

- 30%
Gravity

Vacuum

Vacuum/Pressure

Vacuum