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Report on the Railroad dike in Vlaardingen

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Accidental use of earth bodies as flood defence

Sometimes earth structures are made for some other purpose as flood defence, but prove to be important for flood defence in a later stage. This also results in a multifunctional flood defence, although the intention was opposite.

An example of such a development can be found in the city of Vlaardingen (10 km west of Rotterdam) in the Netherlands. The city of Vlaardingen has been inhabited for several millennia. The original village was founded at the mouth of a tidal creek, the Vlaarding. Already in 175 BC a dam was constructed in the Vlaarding, including an (automatic) discharge sluice [DE RIDDER, 1999]. It was a culvert sluice with a valve made from logs. The location of the dam in the Vlaading is marked A in figure 1.

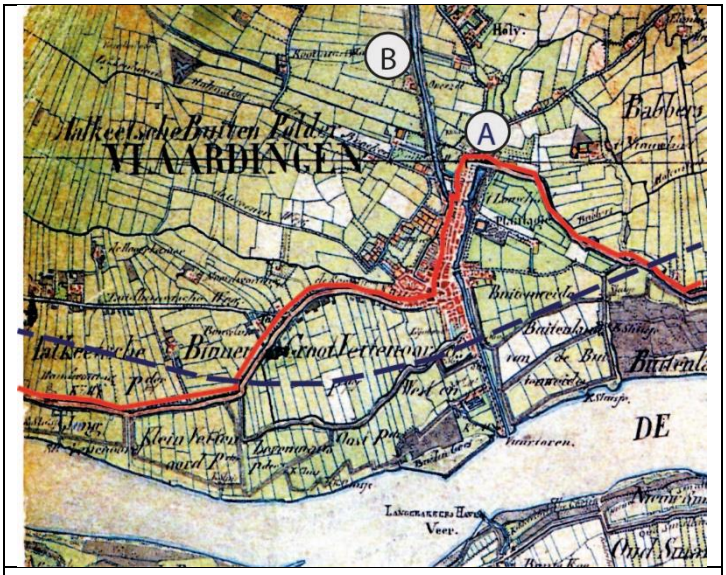


Figure 1: Vlaardingen in 1850; the red line is the sea dike of that moment, the dashed line the railroad constructed in 1890

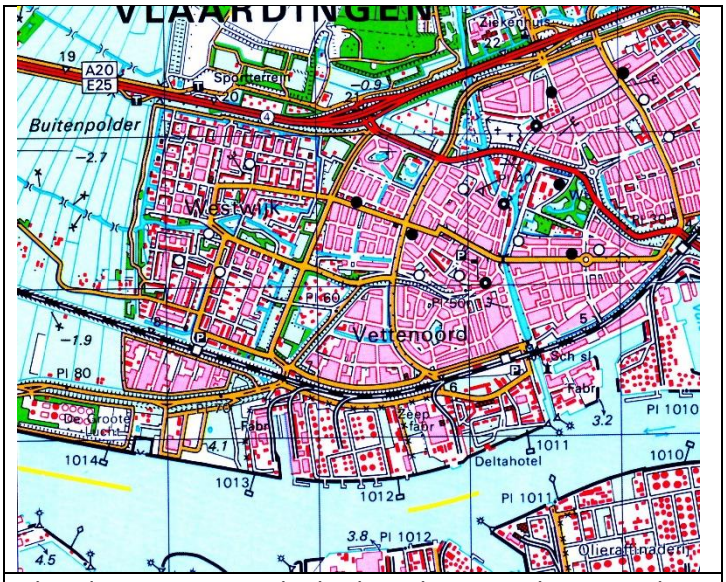
In mediaeval times the Vlaarding lost importance and a new discharge channel, the Vlaardinger Vaart (B) was constructed. At the place where this channel crossed the dike a new discharge sluice was constructed. The part of the channel between the dike and the tidal river was used as port; in those years Vlaardingen developed as an important fishery harbour.

Around 1880 is was decided to construct a railroad from Rotterdam to Hook of Holland. Construction works started in 1886. This railroad was constructed on an embankment, so it was elevated. The main reason for this elevation was that water crossings with bridges was more simple. Also an embankment was needed because of the soft soil at that location. At the crossing of the railroad and the harbour channel a (mobile) bridge and a safety lock was build. This lock was only to be closed during high storm surges in the tidal river to prevent flooding of the harbour area. In December 1884 during a storm surge the water level in Vlaardingen reached 3.20 m above MSL. Probably the area between the railroad dike and the old dike was flooded at that time, although the storm surge report [ANONYMUS, 1895] does not indicate serious damage for that area.

In 1895 a new port was dredged south of the railroad (Koningin Wilhelminahaven) and a new housing area was made between the old sea dike and the railroad near the Koninging Wilhelminahaven.

In 1916 a large flood occurred in the northern part of the Netherlands. As a reaction the local waterboard of Delfland decided that also the seadike in Vlaardingen had to be improved. This implied removal of several houses, warehouses and public buildings along the existing dike (Hoogstraat). Because this was not acceptable for the municipality of Vlaardingen they suggested to the waterboard to make the railroad embankment a real seadike and build a new (double) safety lock in the harbour channel (including a new railroad bridge). [ROTTERDAMS NIEUWSBLAD, 1916; ALGEMEEN HANDELSBLAD, 1916;]. This would also protect the new expansion of Vlaardingen south of the existing

dike. This resulted in a heightening of the railroad to 4.35 m above Mean Sea Level, a crest width of at least 6 m and a clay cover of 1 m thickness.



Vlaardingen in 1987; the harbour basin on the east side of the map is the Koningin Wilhelminahaven. The quarters "Vettenoord" and "Oostwijk"(the area with the number 5 near the railroad) have been constructed in the period 1900-1950.

Eventually this was done, dike improvement was paid by the waterboard and the municipality took charge of the sluice and new bridge [ALGEMEEN HANDELSBLAD, 1919].

In the period until 1950 the municipality expanded towards the railroad. Housing remained north of the railroad, while industry was created south of the railroad.

The housing area Vettenoord and Oostwijk has a height of approximately Mean Sea Level. The quay height of the Koningin Wilhelminahaven is 2.0 - 2.5 m above MSL. Other parts of the industrial area were raised somewhat more, some places are 3.5 m above MSL.

Although the waterboard required a clay cover of the railroad dike, it did not really became a good quality flood defence; the core consisted of sand and water could relatively easy flow under this dike. In 1953 the storm surge level in Vlaardingen reached a level of 3.71 m above MSL. This level was still below the crest level of the railroad dike, but because of the sandy core quite some seepage occurred at the inner side of the dike. Fortunately this seepage did not lead to piping and the railroad dike survived the storm surge.

The railroad dike in the sixties (photo Albert Sas)

Because no serious damage occurred in 1953, improvement of situation did not get a very high priority. In 1995 the situation was improved to meet the present day standards. At this moment the required height is 4.55 m above MSL. To improve the situation in fact a new dike adjacent to the railroad has been constructed with an actual height of 5.5. m above MSL.

A new cover layer was made. The actual height of the dike (south of the railroad line itself) is of 5.5 m above MSL.

Apart from seadefence and railroad track this dike also acts as a green separation between the living areas north of the dike and the industrial area south of the dike. The photographs in the figure below clearly illustrates this.

In summary, the main objective to build this piece of infrastructure was to create a railroad. Later it also got additional functions as sea defence and separator between various types of land use.

Cross sectional profile of the present dike. The thin line is the actual profile, with a maximum height of 5.5 m above MSL, the dash-dot line is the required height of 4.5 m. In this drawing and photos the riverside is on the right, the railroad tracks are on the horizontal part on the left side, with a height of approx. 4.5 m above MSL. The road on the river side (right) has a height of 2.90 above MSL, the road on the landside (left) has a height of 0.3 m aove MSL (drawing from the Ledger of the Delfland Waterboard, photos Google streetview)

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