Runway maintenance strategy: a summary

November 2023

To keep all runways and taxiways at Schiphol safe and in good condition, we regularly perform maintenance and other works on and around them. The runways are (often) unavailable for air traffic while the works are being carried out. Deploying other runways to handle flights means that there are consequences for runway use, air traffic and local residents.

We strive to carry out this maintenance as optimally and efficiently as possible. We therefore, in close cooperation with partners such as Air Traffic Control the Netherlands (LVNL), airlines and our local environment (by way of the former Schiphol Local Community Council), established a Runway Maintenance Strategy (RMS). This essentially means that we save up the works that need to be done within a period of a few years so that we can cluster them and carry the work out at the same time. When determining the RMS, we looked at factors including the scope (what needs to happen), the timing throughout the year and the planning of various works in order to find an optimal balance between technical feasibility, the wants and needs of the local community and interests from within the operation. The RMS therefore offers a transparent, predictable and stable maintenance strategy for the long term.

Reason and realisation

Until 2018, we carried out maintenance only when a runway or part thereof had reached the end of its lifecycle. Because we also carried out other types of works (constructing taxiways, for instance) that were not planned simultaneously, the runways were often (every one to two years) unavailable. This meant we had to adjust runway use more frequently than was necessary. On top of that, air traffic at Schiphol continued to increase and the runways reached the end of their working life more quickly. The pressure on maintenance – and therefore the impact on the operation – also grew. This combination of factors was the reason why we revised our maintenance strategy.

The RMS that we currently use was realised between 2014 and 2018. Its strength can be attributed to the fact that it was developed after rigorous collaboration with parties within and outside of the aviation industry, such as LVNL, airlines, parties in the local community and suppliers. As a result, the strategy is based on:

- a comparison between earlier runway maintenance strategies at Schiphol and at other airports (including London Heathrow and Dubai);
- analyses of the impact of various potential strategies on the parties involved;
- a benchmark study and seminar on runway maintenance with other airports (including London Heathrow, Copenhagen, Brussels, Munich and Singapore);
- research into optimal runway maintenance periods;

- investigations by Schiphol Local Community Council into the preferences regarding length and timing of maintenance;
- the need for major maintenance in view of how old our runways are.

The RMS was finalised by all relevant parties and board of directors at Royal Schiphol Group and then presented to Schiphol Local Community Council in 2018. Since then, runway maintenance is planned and carried out in accordance with the RMS.

Runway Maintenance Strategy at a glance:
The choices made and the in-depth maintenance strategies are detailed in the RMS. These are based on the above analyses and the impact of maintenance on the parties involved. The RMS is based upon the following themes:

- An integral approach: we carry out all necessary work (maintenance and adjustments) at once and therefore no longer determine the timing of maintenance solely on the basis of the lifespan of (parts of) the runway. Due to this integral approach, the runways are out of use less frequently. This may sometimes mean that some parts of the runway are not yet at the end of their useful life when we carry out maintenance. On the other hand, it means we can limit hindrance in the operation and for the local community. The schedule is set for 15 years and recalibrated every 5 years.
- Various kinds of runway maintenance: Based on comparative research on runway maintenance at other airports, among other things, we have defined different types of maintenance. These take place according to a fixed cycle, as shown in the table below. Within the frameworks of these kinds of maintenance we combine different works. New construction projects are not included here but, based on the integral approach, are aligned with the maintenance periods.

	Objective	Indication time runway not in use	Cycle
Major runway maintenance (heavy)	Clustering of large-scale and time-intensive replacements to guarantee functions for 15 years.	10-20 weeks (24/7)	- 1 runway per year: heavy or medium major maintenance - Cycle: heavy runway maintenance is followed by medium runway maintenance 7-8 years later and vice versa.
Major runway maintenance (medium)	Maintenance of elements that wear down faster, such as the runway surface at a Touch Down Zone, to guarantee safety and reliability for another 7-8 years (until the next heavy moment).	4-5 weeks (24/7) or 14-20 weeks (only during the night)	
Regular runway maintenance	Ensuring operational quality and preventing unnecessary accelerated degradation of assets. Maintenance that cannot wait until the next	1-1.5 weeks (24/7)	- Annually - Maximum of one runway at a time in maintenance.

	medium/heavy maintenance moment.		
Short runway maintenance	Ensuring operational availability / EASA compliance	1 night	- High frequency (every 4-6 weeks)

- Legal framework: when planning runway maintenance, we take into account the agreements regarding strict preferential runway use and noise standards. Schiphol is certified under European regulations (EASA) and we must therefore continue to meet all certification requirements included in the EASA regulations. We carry out maintenance to keep the runways safe and comply with the applicable rules. In addition, we take the Working Hours Act into account when planning and carrying out runway maintenance.
- Technology: based on the analyses and comparisons of maintenance and technical designs of runways at other airports, the following points of attention have been drawn up with regard to the technology:
    - No maintenance during winter as some works cannot be carried out then (such as laying certain types of asphalt or placing lighting in the asphalt).
    - No major heavy maintenance during the night only, because the timeframe (from 8:00 PM to 6:00 AM) is too short to carry out the work associated with this maintenance. It is technically not possible to replace drainage channels or work on cabling and deeper asphalt layers only at night.
    - Also no major medium and regular maintenance during the night only, because the timeframe (from 8:00 PM to 6:00 AM) must also take into account the construction and dismantling of the work site (and making the runway available again). This leaves little time to carry out the work associated with medium and regular maintenance and increases the chance that the work will overrun. In addition, any delay is also less easy to catch up on. If we only carry out work at night, maintenance will take around four times longer than if the runway is completely closed and we can work during the day.
    - Maintenance in winter and at night requires specific asphalt properties due to the temperature and humidity, which the asphalt that we often lay at Schiphol does not have. To increase flexibility when replacing the asphalt, we have developed a new type of asphalt together with the contractor. This type of asphalt meets the requirements for the paving of runways, but has less strict requirements for the weather conditions to be able to carry out the work.

  The way the runways were constructed plays an important role in whether we can only carry out maintenance at night. Replacing certain parts, such as power cables that are buried along the runway, is so much work that it is not possible to carry it out at night and keep the runway operational during the day. We therefore consider alternatives when carrying out major maintenance. We weigh up the impact if we choose an alternative, along with the benefits it will provide in the future.
- Operation

  The following points of attention were compiled based on analyses.

    - Due to the operational complexity of the airport, it is preferable to take only one lane out of service for major maintenance each year. There are never two runways undergoing maintenance in the same year.
    - Avoid maintenance of the runways during the May and summer holidays so that as many as possible are available during the busier holiday periods.
    - Plan maintenance as much as possible in spring and summer, avoiding the May and summer holidays. The weather during that period is generally better, which means there is less chance of work being delayed. This way we can better predict the effect of the work on the operation.
- Local environment
  The following points of attention concerning our neighbours were formulated after discussions with local community partners.
    - The winter months (November to March) are preferred for major and regular maintenance rather than the summer months. If that is difficult for technical or other reasons, the months April and October are preferred.
    - It is not desirable to move night flights to runways they don't usually make use of in the event of runway maintenance.
    - Preferably no maintenance during weekends or on holidays. That's when local residents are at home, sleep in longer and are more disturbed by non-standard runway use.
    - As much as possible, combine activities that could lead to the runway temporarily not being available at an earlier or later time.
    - Ensure communication about (the planning) of runway maintenance well in advance.
    - Carry out the minimum amount of major runway maintenance. Preferably once every 10 to 15 years.
    - Keep runway maintenance as brief as possible, unless that means that maintenance will need to be done in summer. In that case, local residents would rather have a longer period of maintenance in winter.

We used these analyses to determine in which period we can best schedule major maintenance. We made calculations for various scenarios regarding the duration of maintenance, the expected consequences for the operation and the environment, and the cost of maintenance. The analyses showed that both heavy and medium maintenance on almost all runways should preferably be carried out during a complete closure in the summer.

At the same time, we realise that local residents experience noise nuisance differently than we calculate it in the analyses. That is why we have chosen to give preference to the environment and to carry out major maintenance ideally during a complete closure in winter or at least outside the summer months (June, July and August). We take into account that the work may take longer than planned due to bad weather.

After the analyses, we drew up a detailed maintenance strategy for each runway. You can read the most important considerations and results below.

<u>Evaluation and further development of RMS</u>

Since the introduction of the RMS in 2018, all runways have now undergone major maintenance at least once, or major maintenance is in preparation (see figure below). We have taken this opportunity to evaluate the RMS and see what we can improve.

In addition, the Ministry of Infrastructure and Water Management encourages the evaluation of the RMS and recommends discussing this with all stakeholders. We therefore carry out the evaluation in consultation with stakeholders from the operation, local residents and administrators. We aim to complete the evaluation by the end of 2023 and a report will follow with any changes to be implemented and aspects to be further investigated.

Annex 1 – Implementation RMS and maintenance outlook per runway
This annex briefly details what the current RMS means for the planning of major maintenance on each runway.

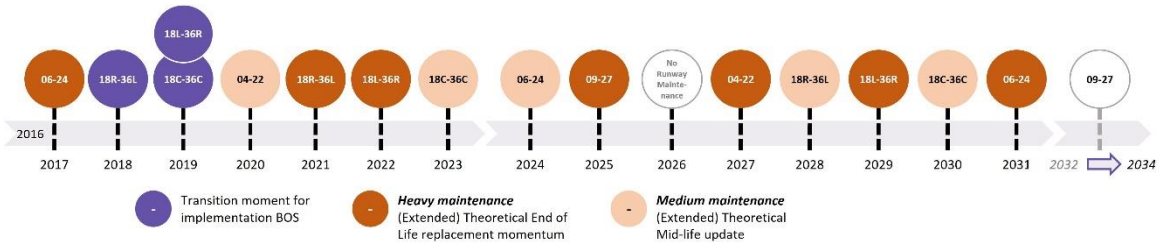

Figure 1 – Runway maintenance for the period 2017-2032

Kaagbaan (06-24)
We conducted large-scale maintenance on the Kaagbaan Runway in 2017. The runway had turned 60 years old and we needed to replace several elements, such as drainage channels and lighting cables. In addition, we replaced a significant proportion of the asphalt pavement. These significant replacements mean that the maintenance done in 2017 could be classed as heavy. As a result of this maintenance, most runway elements will last another 15 years.

Some parts (including the Touch Down Zone) require some maintenance after around 7 years. We have clustered this in a medium maintenance package for 2024. Subsequently, with an integrated approach in mind, necessary modifications and major adjustments on and around the runway are also planned for 2024. For example, a new intersecting taxiway that is necessary for safety reasons.

Polderbaan (18R-36L)
The Polderbaan has been deployed since 2003. Based on a lifespan of 15 years and the intensive use of this preferential runway, the top layer of the runway surfacing had to be replaced around 2018. This was its first heavy maintenance. However, at the time of the development of the RMS, a major maintenance event was also planned in 2021. In order to get into the correct RMS cycle (heavy maintenance every 15 years and medium maintenance after 7/8 years in between), we decided in 2017 that heavy maintenance should only be planned for 2021. To bridge the period between 2018 and 2021, a number of repairs and necessary life-extending works were carried out in 2018.

Zwanenburgbaan (18C-36C)
The Zwanenburgbaan Runway was commissioned in 1968 and therefore turned 50 years old in 2019. At the time of the development of the RMS, the runway was due for large-scale replacements in 2019 and 2023. These included the renewal of the drainage channels and lighting cables, which dated back to when the runway was first constructed. Because both periods of maintenance in 2019 and 2023 would lead to long periods of unavailability, we decided in 2018 to schedule heavy maintenance for 2023. In 2019 we carried out maintenance to prolong the lifespan of the runway and bridge the gap between 2019 and 2023.

Aalsmeerbaan (18L-36R)
The Aalsmeerbaan Runway primarily dates back to 1967 and was therefore 55 years old in 2022. When we established the RMS, the Aalsmeerbaan was due for major replacement works in 2019 and around 2022. Given the age and condition of parts of the runway, we envisioned the first heavy maintenance to take place in 2022. This included the replacement of large parts of the runway surface, the lighting system and rainwater drainage system, and the installation of drainage channels.

However, some work planned for 2019 could no longer be postponed due to its technical condition. This led to a transition moment in 2019. As a result of the coronavirus pandemic, we were forced to reduce the scope of the scheduled works for 2022. Some parts of the runway underwent maintenance to prolong the lifespan. Large-scale replacements were postponed until 2029.

Buitenveldertbaan (09-27)
The Buitenveldertbaan Runway was completed in 1967 and is almost 60 years old now. Between 2004 and 2016, various parts of the runway underwent major maintenance. This means that the lifespan of those various parts differs. During the previous period of works in 2016, the drainage channels along the runway were replaced as they had reached the end of their working life. Within the RMS, we consider this to be typical heavy maintenance. Because in determining the work for 2016 we mainly considered the lifespan of the various runway components, in 2025 large-scale replacement of components (some of which date back to 1967) and therefore heavy maintenance will again be required.

Because we want to have an integral approach to maintenance from now on, we decided to include the replacement of parts that are not yet at the end of their lifespan in the maintenance planned for 2025. This means we can postpone the following major maintenance moment to 2034 and that no major maintenance will be required in the meantime.

Oostbaan (04-22)
The Oostbaan Runway dates back to 1945. When we were drawing up the RMS, this runway was due for medium major maintenance in 2020. We did some additional works at that time too, so that the runway would remain fully operational for another 7 years. We expect to carry out heavy maintenance in 2027 that will include a large-scale replacement of the rainwater drainage system.