

Autonomous mulching today and in the future: robots take care of green Areas along motorways¹

Status quo/ Challenge

2,200 kilometres of motorways and expressways form the Asfinag network. ASFINAG Service GmbH ensures smooth operation: it cleans rest areas and parking lots, clears the snow, is responsible for repairs and renewals on the track, monitors and cleans the tunnels, etc. Another task that not everyone immediately associates with the operation of roads: the cutting of plants along motorways and expressways. The plains and embankments must be cleared of grass and all kinds of proliferating weeds at least twice a year. Simple terrain is mulched with classic 2-axis machines. Such tractors cannot work on green areas with an inclination - the inclination would be too steep. Remote-controlled robot arms are used for the first few meters next to the roadway of such areas. One employee controls up to three of the arms simultaneously from one vehicle. The vehicle thereby crawls along the edge of the road. Often and especially in urban areas, the uprights of lamps and vehicle restraint systems ("crash barriers") get in the way. In such situations, another person is needed for the more complex vehicle steering. The employees of ASFINAG use remote-controlled caterpillar mowers to cut green areas outside the reach of the robot arms. Spines on the locomotion chains provide the necessary support despite the steep slope of the embankments. One person controls the machines (0.5 to 1.5 m cutting surface) from the edge of the road. The caterpillars' journey is also not free of obstacles. Sometimes trees, manhole covers and the like get in the way. The disadvantage of both the remote-controlled arms and the crawler mowers is that in some cases a roadway has to be blocked.

Another potential application for an autonomous mulcher is keeping the ASFINAG Corporate Network (CN.as), an optical waveguide, clear. This applies to tens of kilometres over a width of approx. 2-5 metres.

Trimming the green areas is important. However, the activity ties employees whose pronounced technical specialisations are needed for other purposes: e.g. for inspection of buildings, work on water protection facilities or incident management.

Desired result

This is how ASFINAG Service GmbH envisions mulching: The responsible employee drives to the deployment site, places the robot and starts it. That's about it, ideally. The employee only spends a short time in the area of operation. The machine starts, the employee can do other important tasks in the meantime. He/she returns to the unit when it reports that the green area has been mulched.

¹ This is a rough translation from German of the open innovation challenge:

<https://innovationspartnerschaft.at/challenge/autonomes-mulchen-heute-und-in-der-zukunft-roboter-ubernehmen-grunsnitt-an-der-autobahn>

As a result, personnel resources are used efficiently. In addition, the support provided by robots has a positive effect on the protection of workers: the stay in the danger zone of the machine is as short as necessary, the exposure to neophytes and the blazing sun is minimized.

If an intervention is necessary, the Robot operator is immediately informed (status and alarm messages on the mobile phone). The control center / head office can also monitor the use and location of the robot via a web application. Statistical evaluations (big data) help to optimize the use of the machine.

An essential effect: Drivers on the motorway are not affected by the green-cutting activities. All lanes remain available.

Important to know:

- Safety and reliability count. The limits of the machines in this respect may also be included in the contributions to that Challenge.
- The mowing areas of the motorway maintenance are depicted geographically in the GIS of ASFINAG as polygons. The data can be made available to mulching robots as ESRI shape files. The maximum positional accuracy of the demarcation is +/- 0.5 metres. Furthermore, a high-resolution height model (laser scan) can be transmitted (accuracy in the cm range). It is desired to transfer the position data and other information on the mowing robot directly online into the ASFINAG GIS via interfaces.
- Ground unevenness must be dealt with effectively. Common sized mulching heads and equipment that are not too wide are advantageous. The machines are currently equipped with flail mowers or forest mulchers. By reducing the use of personnel, various areas could be mowed more often and forestry mulchers could thus become superfluous. All in all, however, autonomous robots must not shy away from a comparison with the output/performance of current machines.
- From an operational point of view, a device will prevail if its purchase and operation (energy, maintenance, personnel commitment) are below the costs of the current devices and their operating costs after just a few years. For maximum usability, additional manual or remote operation may be helpful.
- Green areas are not traffic areas (official approvals and releases for use may nevertheless be required).

Summary of the challenge

Which machines mow grass strips on roads autonomously and reliably now or in the future?

Now it's your turn!

Dare to enter into a dialogue with ASFINAG via this challenge - **even if your device or your development is still in its infancy or the ideal state described is only achieved with compromises**. Also submit a contribution if your partial solution has the potential to make autonomous mulching possible in combination with others. An early exchange helps all parties. Submissions as a consortium are possible.

Click on the button "Idee einreichen". Please post a short description of your product or approach until 08 August 2018. This is mandatory. You can attach one PDF document. Please also send the moderator of this challenge a first rough cost estimate as well as additional content intended only for the jury as a PDF file. Jury members are committed to confidentiality.

We are in the market exploration phase with the Challenge. ASFINAG Service GmbH wants to get an overview of what is possible now and what is possible in the future and where the limits may lie. Therefore, in the "Call for Ideas" phase, the first step, the following is not sought: completely new concepts developed especially for this challenge, detailed technical drafts or feasibility studies. The following therefore applies to all parts of the submission: **Keep it short** (up to five A4 pages or ten presentation slides in total). Focus on how you meet the evaluation criteria listed below and contribute to achieving the desired result.

For this challenge, **submit machines that mulch simple flat surfaces autonomously as well as equipment that copes with slopes with a maximum gradient of 55°**. However, please indicate for which field of application your machine is suitable (off-road capability, gradeability due to weight, drive technology,.....).

Your gain

The aim of this challenge is the exchange and preparation of further steps.

An internal jury first examines all submissions according to the evaluation criteria. The 3 - 5 most suitable submitters will receive an invitation to the innovation dialogue (this is a market exploratory meeting). During this conversation you will have time to deepen the skills of your devices and the application case.

The results of the challenge are included in possible calls for tender under the Federal Procurement Act. An early deployment of autonomous machines is part of the project team's vision. In order to be able to observe the applicability, ASFINAG Service GmbH is considering a testin phase depending on the findings of the Challenge.

Advertising your solution and your company

The IÖB Service Centre advertises that Challenge and thus also draws the attention of other public clients to the machines and companies posted online. In addition, the Challenge is communicated and presented in the international network of the IÖB Service Centre.

Evaluation criteria and weighting

- **Productivity: 22%**
- **Degree of autonomisation: 21%**
- **Price indication: 18%**
- **Usability / Simplicity in operation: 16%**
- **Communication with operator and control centre: 16%**

unofficial translation