

Amsterdam Airport Schiphol “Create a Barrier of Silence” Design Contest

Doug Barrett



HARRIS MILLER MILLER & HANSON INC.

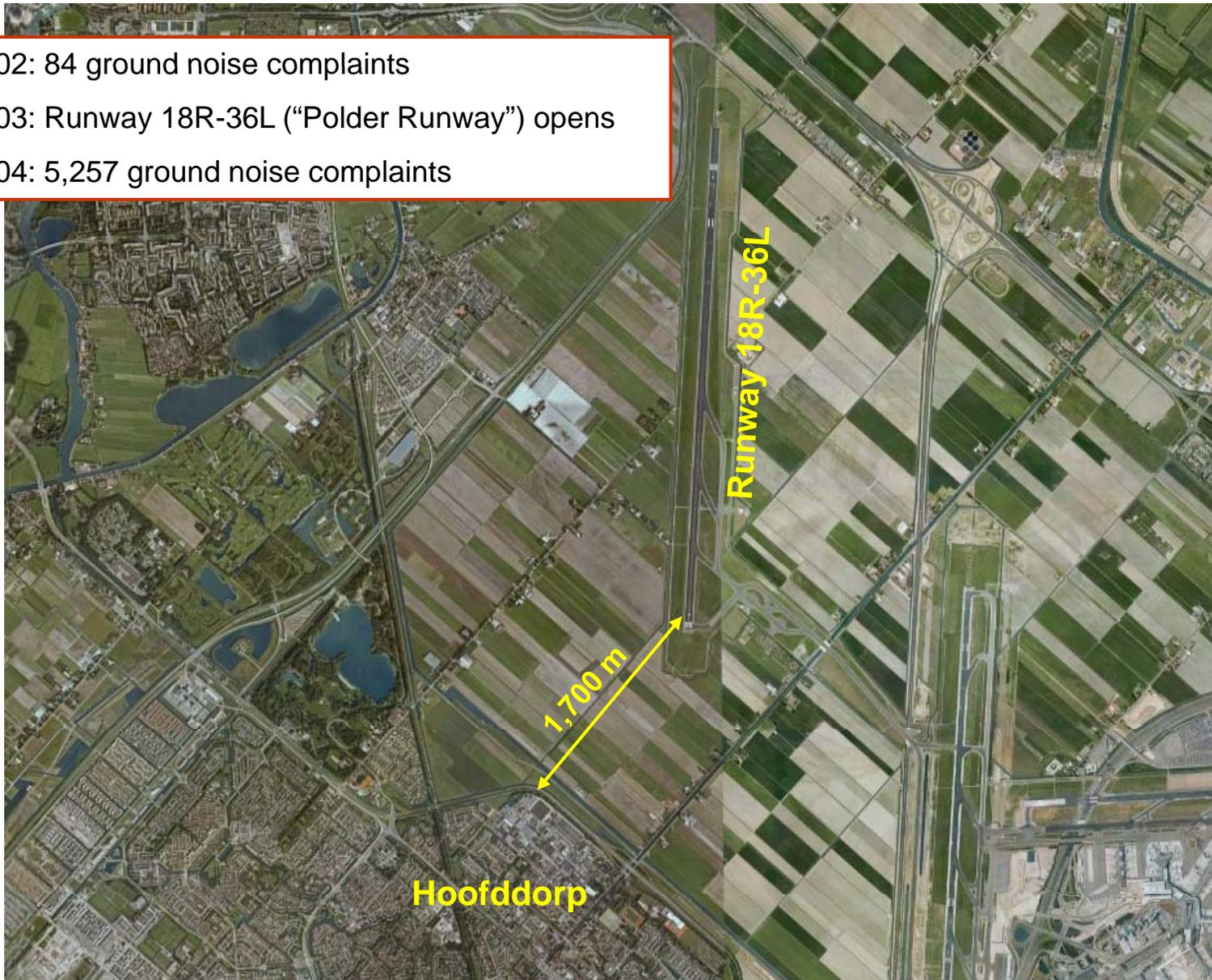
spf:architects

TRB Committee ADC40 Summer Meeting

Dayton, Ohio

July 2009

2002: 84 ground noise complaints
2003: Runway 18R-36L ("Polder Runway") opens
2004: 5,257 ground noise complaints



Complaints led to preliminary investigation (2004 – 2006)

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- **2003 Environmental Impact Report for the new runway had underestimated or not anticipated the degree of annoyance and complaints**
- **2004 investigation “to determine the cause of the nuisance, to acquire an insight into its extent and to analyze possible limiting measures”**
 - Conducted by Wyle, TNO, and NLR
 - Monitored by technical supervision group (SHP, residents, municipality)
- **Results (Feb. 2006):**
 - Transfer of ground vibrations too weak to produce observable vibration levels
 - Airborne sound transfer path may produce nuisance under favorable propagation conditions
 - Confirmed primary cause of nuisance was low frequencies typical of aircraft ground noise
 - Identified goal of 5 to 10 dB reduction at 31.5 Hz

Design contest announced (March 2008)

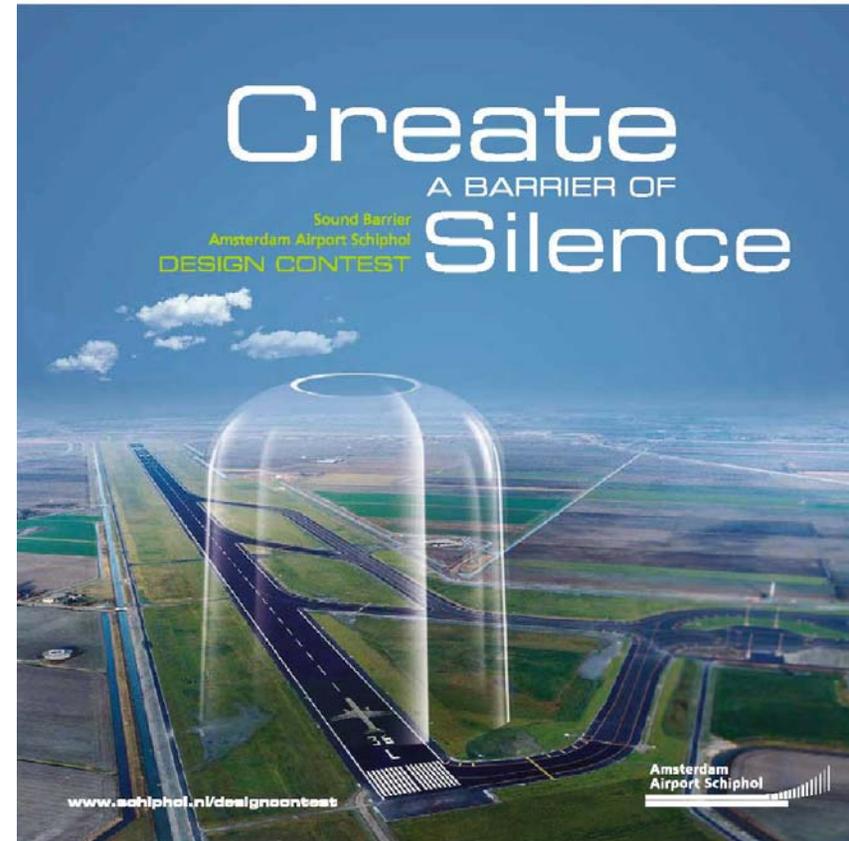
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- **Two phases:**
 - Phase 1: rough plans submitted (2 months)
 - Phase 2: shortlisted applicants develop preliminary designs (4 months)
- **Prizes**
 - Grand prize €750,000
 - Two additional prizes of €250,000 each



Design Criteria

1. **Improve quality of life in Hoofddorp-Nord by reducing LFN by 7 dB.**
2. Allow the design to interact with the landscape in a way that will improve the quality of life in the Haarlemmermeerpolder.
3. Create a landmark for the international “hub of sustainability.”
4. Create an idea that accentuates the innovative power of Amsterdam Airport Schiphol.
5. Think beyond the boundaries of possibility, go beyond your imagination and create a unique landmark in a unique area.
6. Make it profitable.
7. Create a design that fits the requirements of an international airport.
8. Meet legal standards and requirements.
9. Create a design that can be realized in 18 months.
10. Combine function and design in a unique design which will achieve more than just sound reduction.

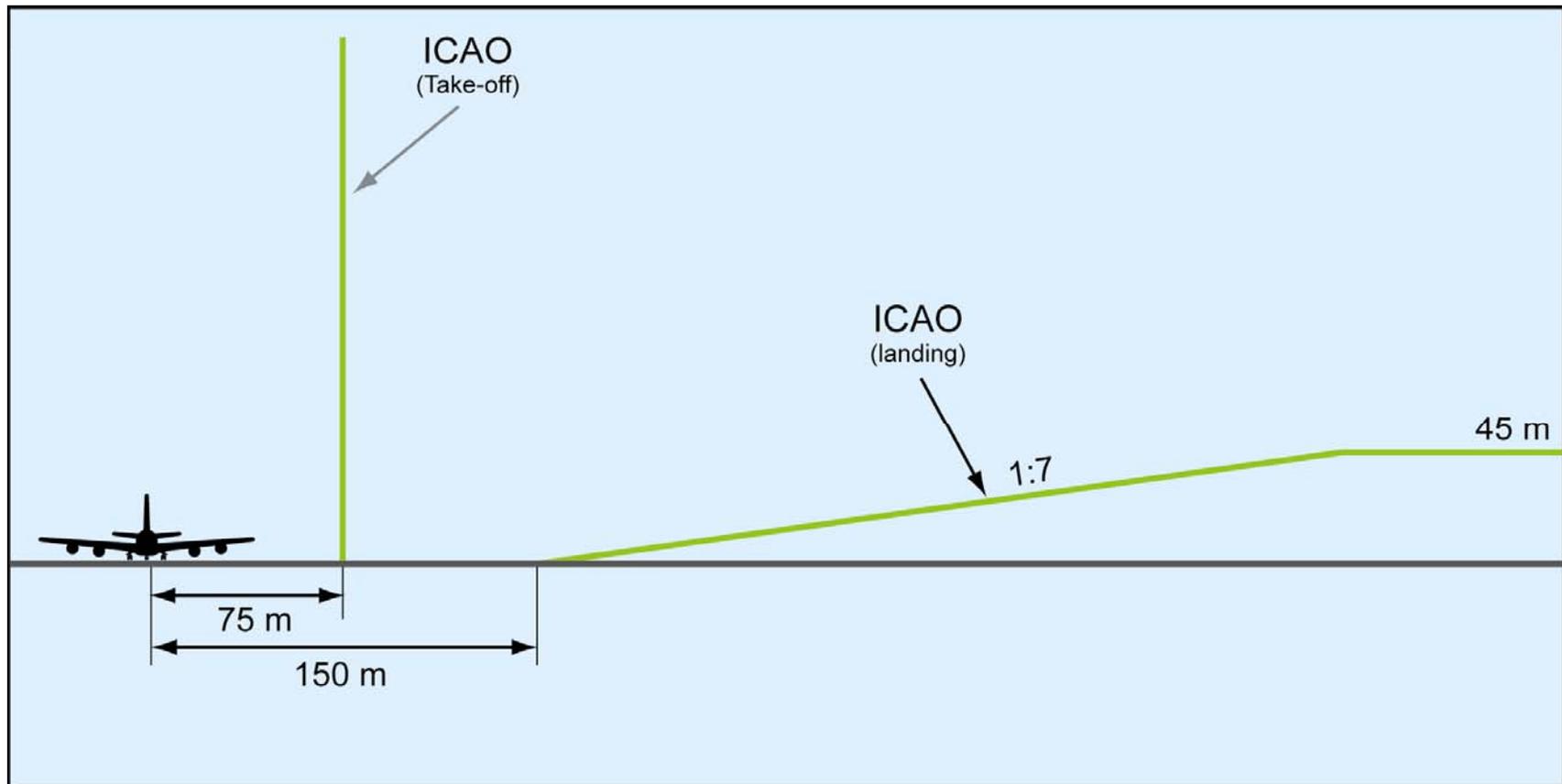




Basemap: Google Earth

ICAO Development Restrictions

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Space and height restrictions for take-off and landing

Phase 1 Submittal: Arrivals



Hoofddorp

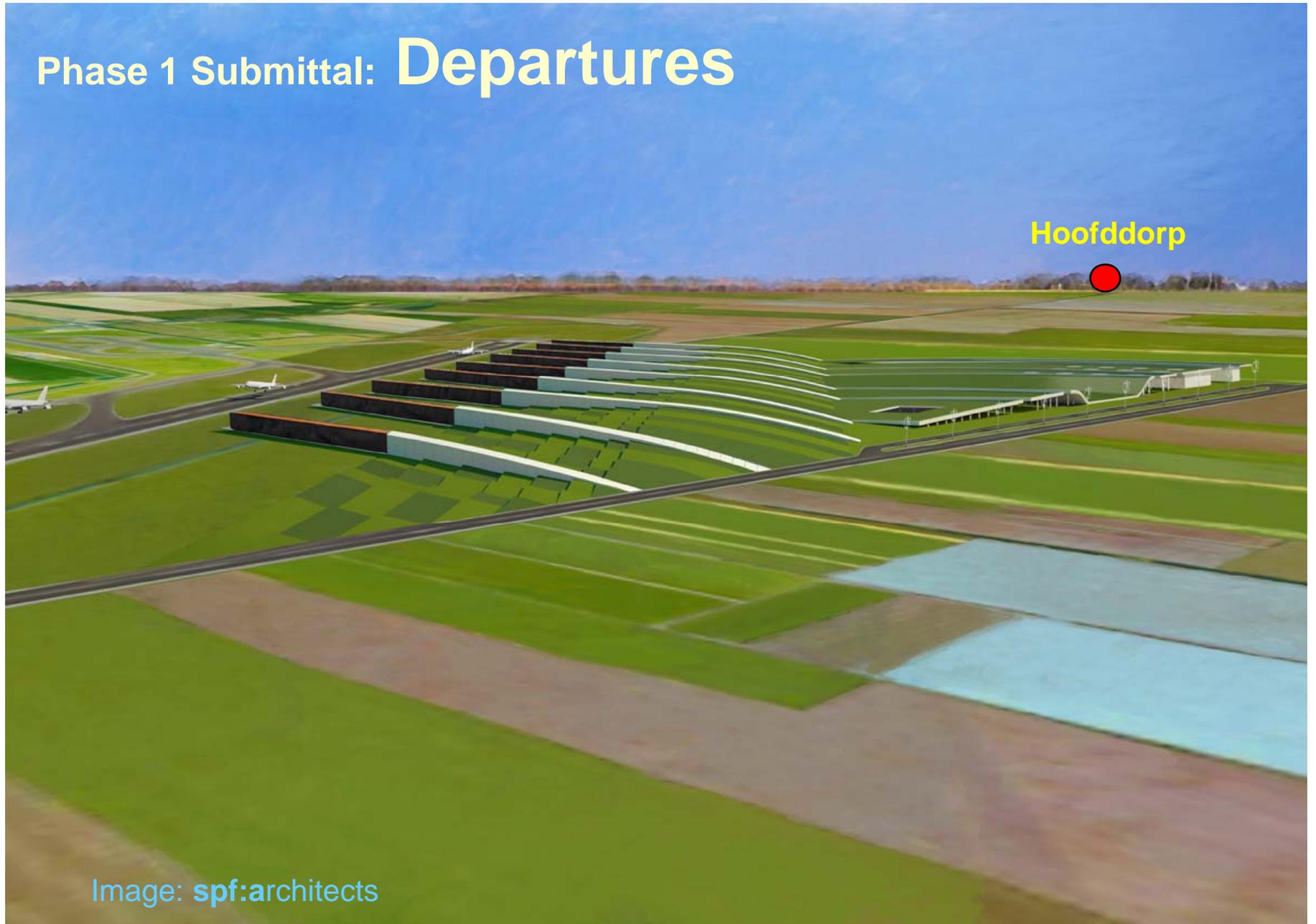
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Phase 1 Submittal: Departures

Hoofddorp



Image: [spf:architects](#)



Phase 1 Submittal: Departures

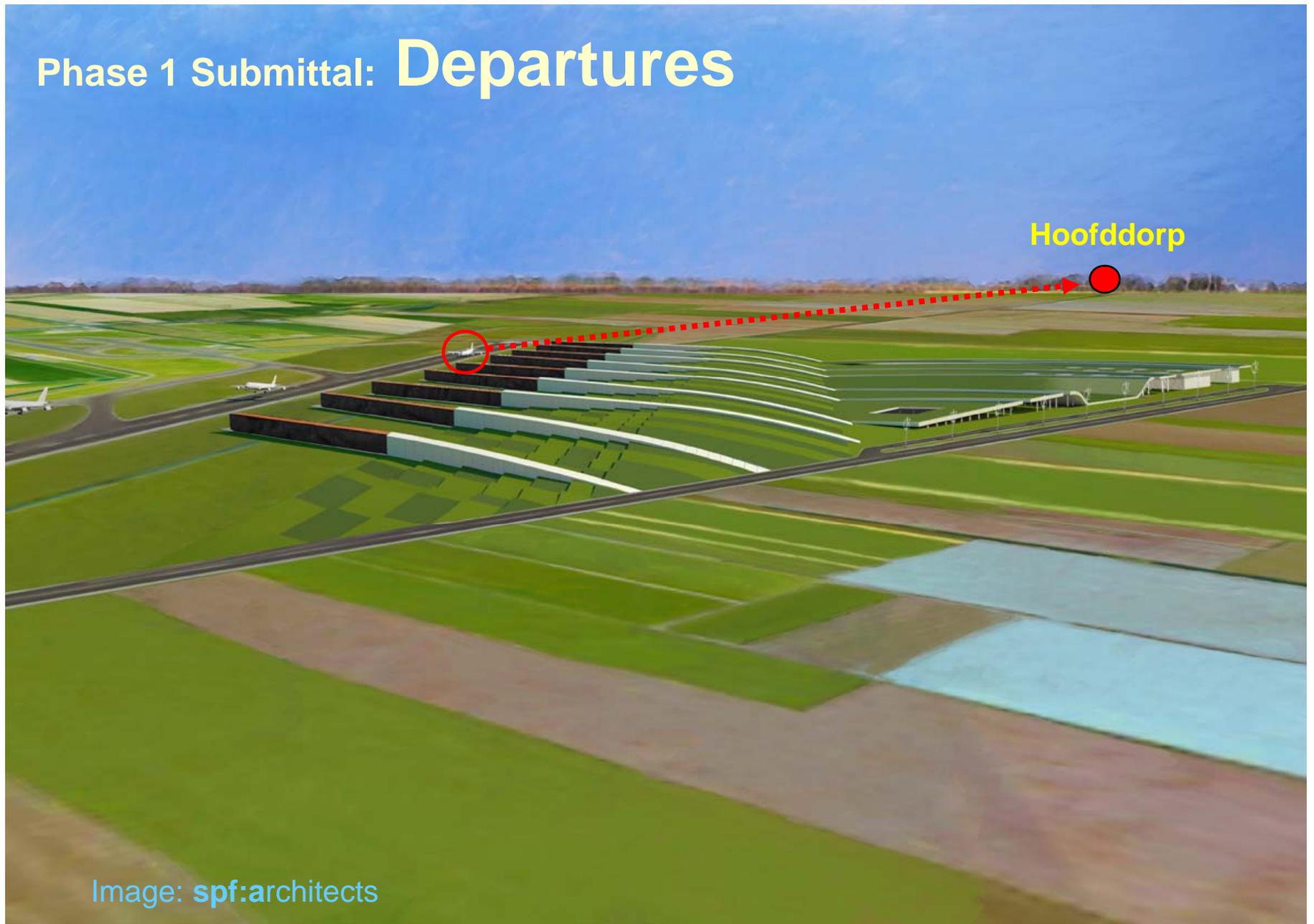


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Phase 1 Submittal: Departures

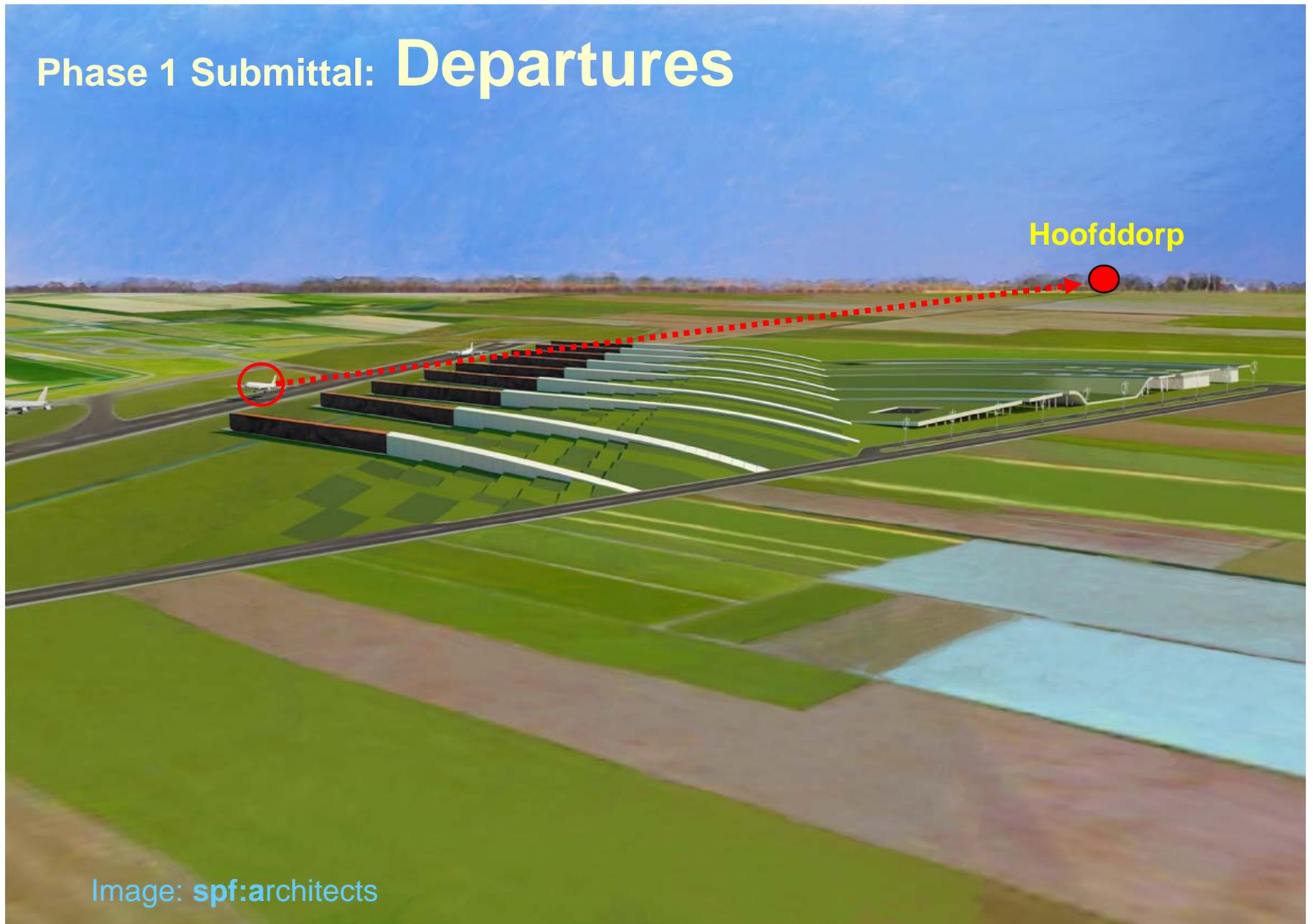
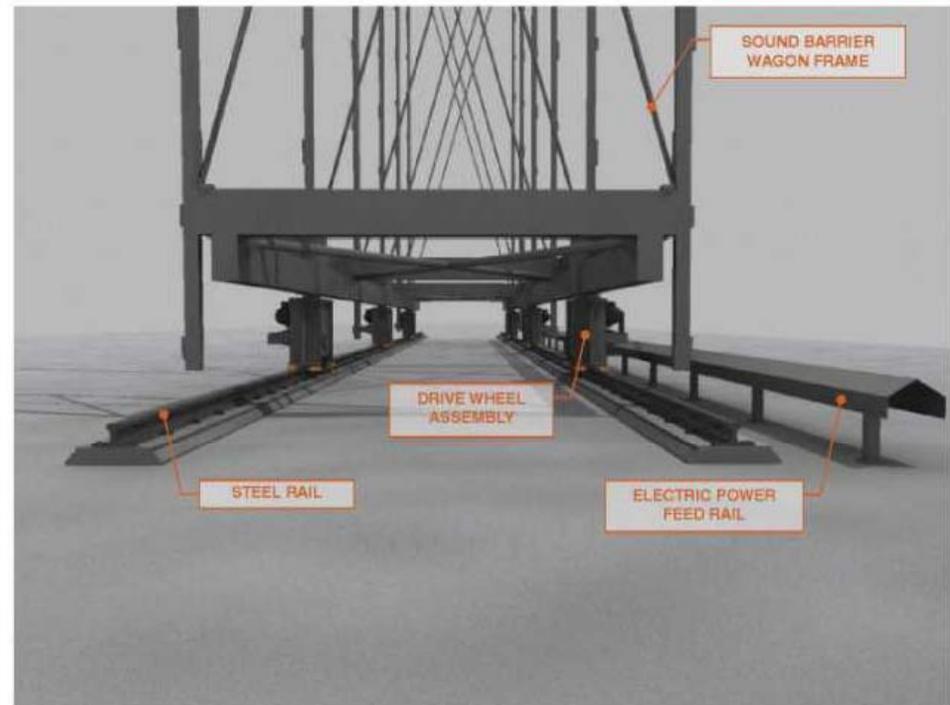
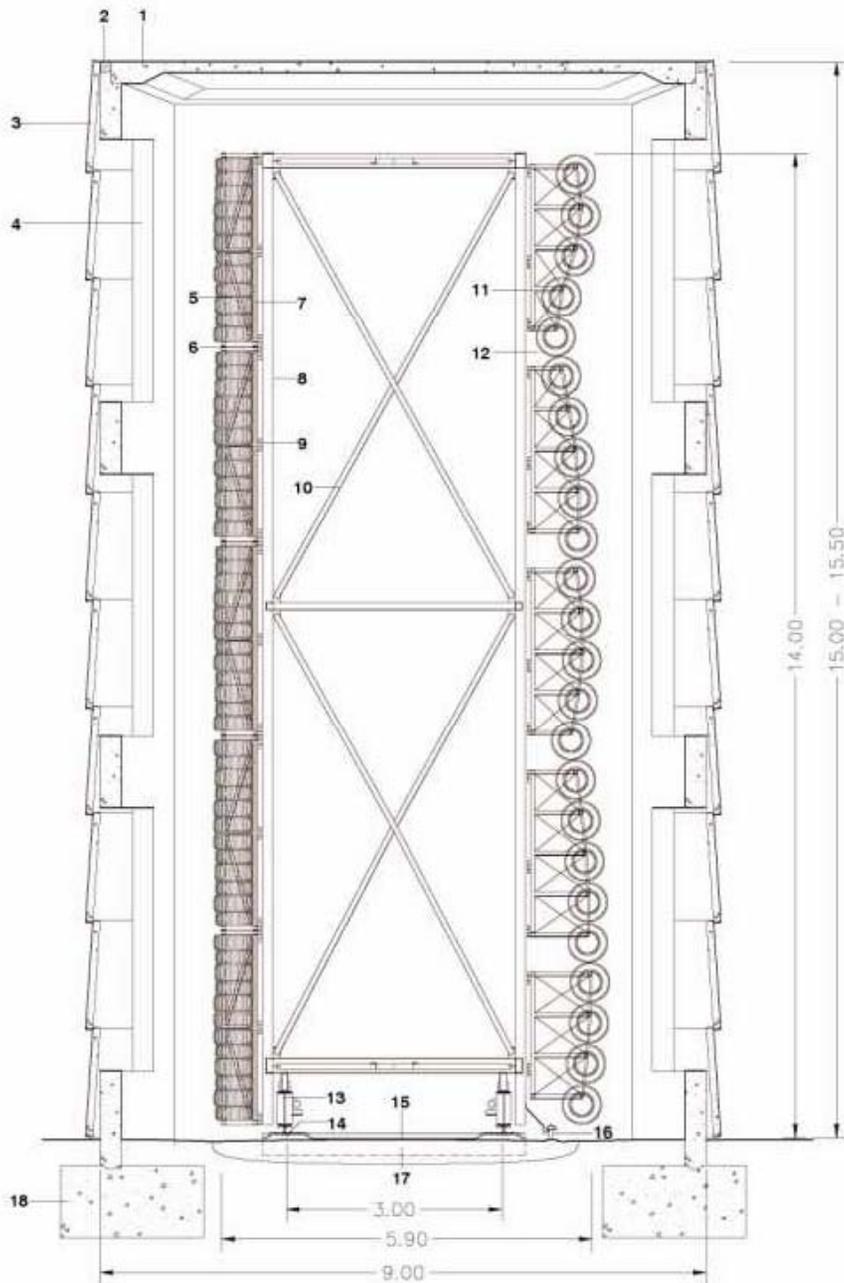


Image: [spf:architects](#)

How to Move a Noise Barrier



Concept: Uni-Systems

Images: [spf:architects](#)

Phase 1 design concept presented by SPF architects

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- **Nine 12.5-meter high retractable noise barriers**
- **Recycled tires**
- **Landscaped terraces between barriers**
- **Wind turbines**
- **LED lighting on ends of barriers**

M . A . S . H .
Mobile Absorptive Sound Harness

Shortlisted! Now what?

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- 97 entries from 17 countries around the world, including China, Japan, New Zealand, the United States and several European countries
- SPF:architects team among 9 shortlisted in July 2008
- Four months for preliminary design; Phase 2 submittals due December 2008
- Further acoustical design to optimize performance led to revised design concept

Phase 2 Submittal: Arrivals



Image: [spf:architects](#)

Phase 2 Submittal: Departures



Image: [spf:architects](#)

Phase 2 Submittal: Departures

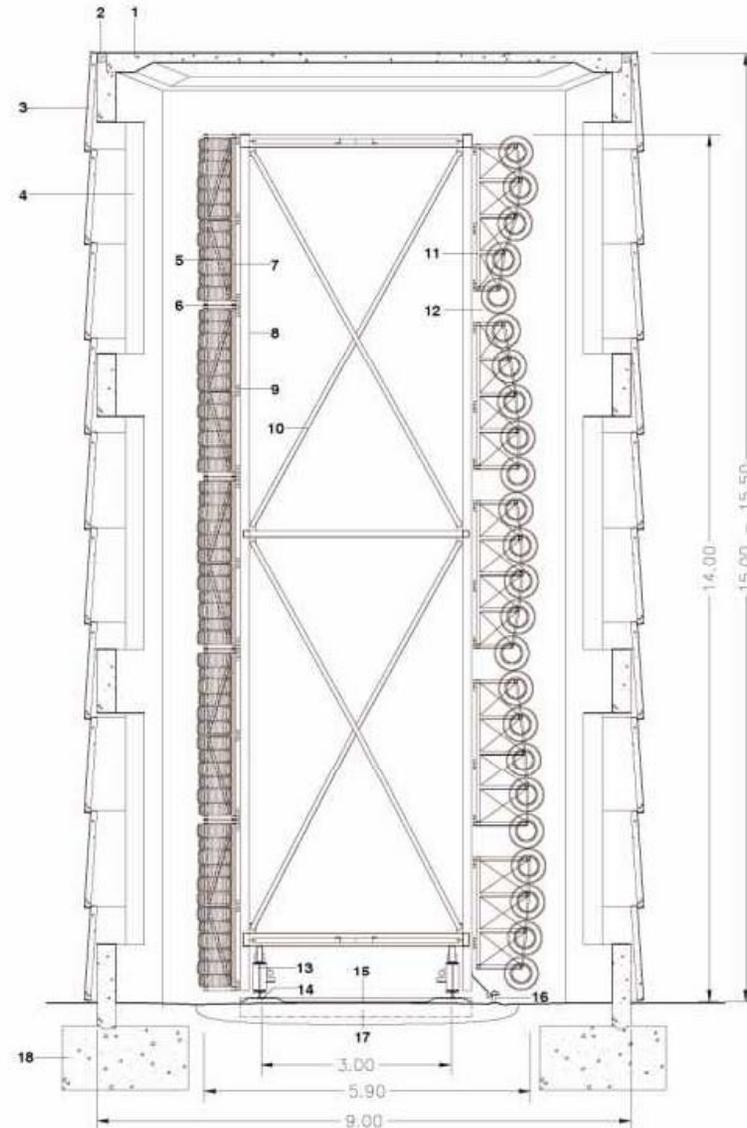


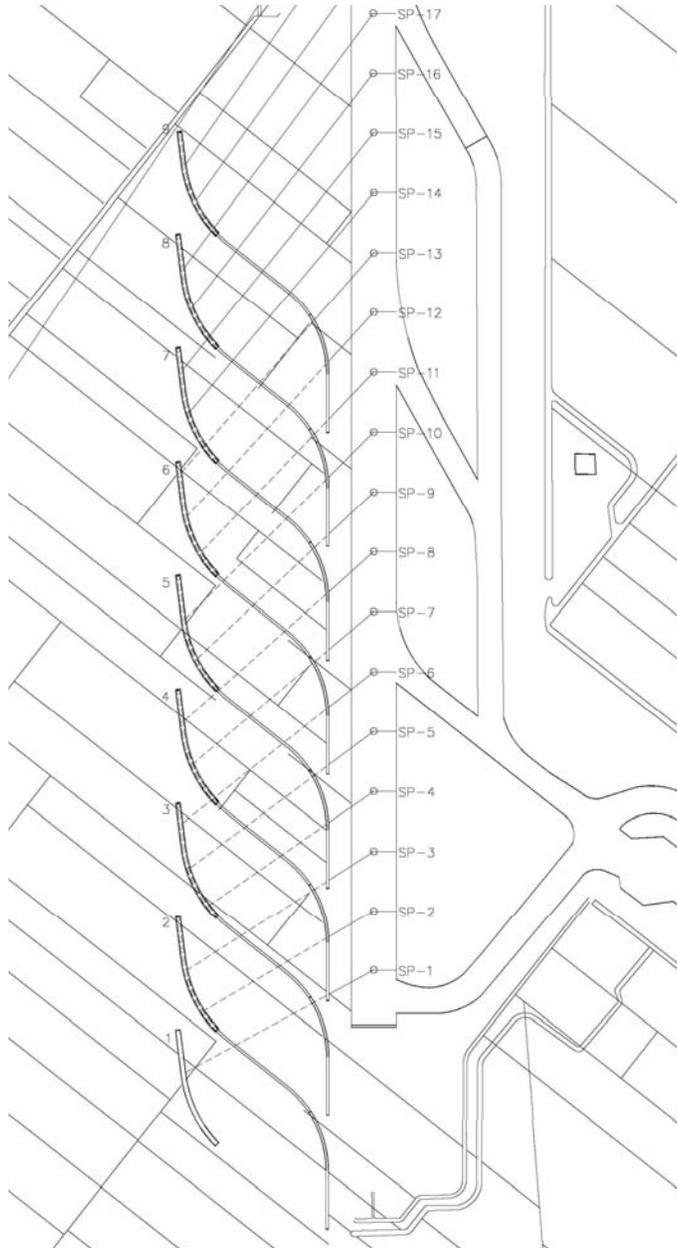
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Phase 2 Acoustical Analysis

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- Barrier effect (diffraction)
- Horizontal flanking
- Transmission loss
- Resonances
- Standing waves

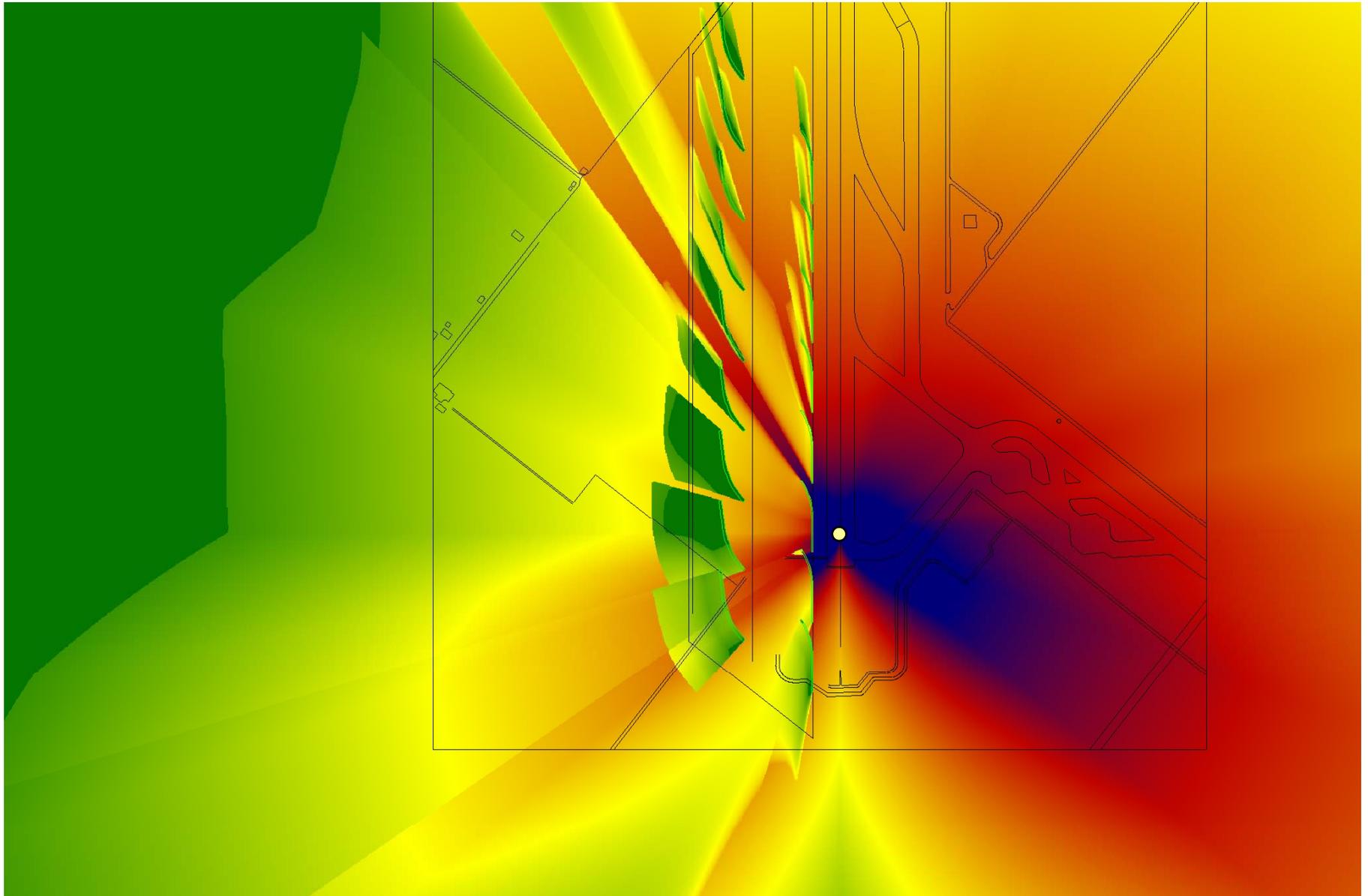




Improve quality of life in Hoofddorp-Nord by reducing LFN by 7 dB

	<u>Insertion Loss (dB @ 31.5 Hz)</u>			<u>Weighted</u>
	<u>1st Barrier</u>	<u>2nd Barrier</u>	<u>Total IL</u>	<u>Segment</u>
SP-1	-7.7	-1.3	-9.0	-14.1
SP-2	-7.7	-1.2	-8.9	-16.9
SP-3	-7.7	-1.3	-9.0	-19.2
SP-4	-7.5	-1.3	-8.8	-20.3
SP-5	-7.5	-1.4	-8.9	-21.5
SP-6	-7.5	-1.5	-9.0	-22.4
SP-7	-7.2	-1.4	-8.6	-22.7
SP-8	-7.1	-1.5	-8.6	-23.4
SP-9	-7.1	-1.4	-8.5	-23.9
SP-10	-7.1	-1.5	-8.6	-24.6
SP-11	-6.8	-1.4	-8.2	-24.8
SP-12	-6.6	-1.6	-8.2	-25.3
SP-13	-5.4	-1.5	-6.9	-24.6
SP-14	-4.2	0.0	-4.2	-22.4
SP-15	-4.2	0.0	-4.2	-22.9
SP-16	-4.2	0.0	-4.2	-23.4
SP-17	-4.2	0.0	-4.2	-23.8
SP-18	-4.2	0.0	-4.2	-24.3
SP-19	-4.2	0.0	-4.2	-24.7
SP-20	0.0	0.0	0.0	<u>-20.9</u>
				-8.1

Multiple diffraction calculations consistent with: Foss, Rene N. "Noise Barrier Screen Measurements: Double Barriers." Research Program Report 24.3. Olympia, WA, Washington State Highway Commission, August, 1976.



Create a landmark for the international
“hub of sustainability.”



Image: **spf:architects**

Create an idea that accentuates the innovative power of Amsterdam Airport Schiphol.

Think beyond the boundaries of possibility, go beyond your imagination and create a unique landmark in a unique area.

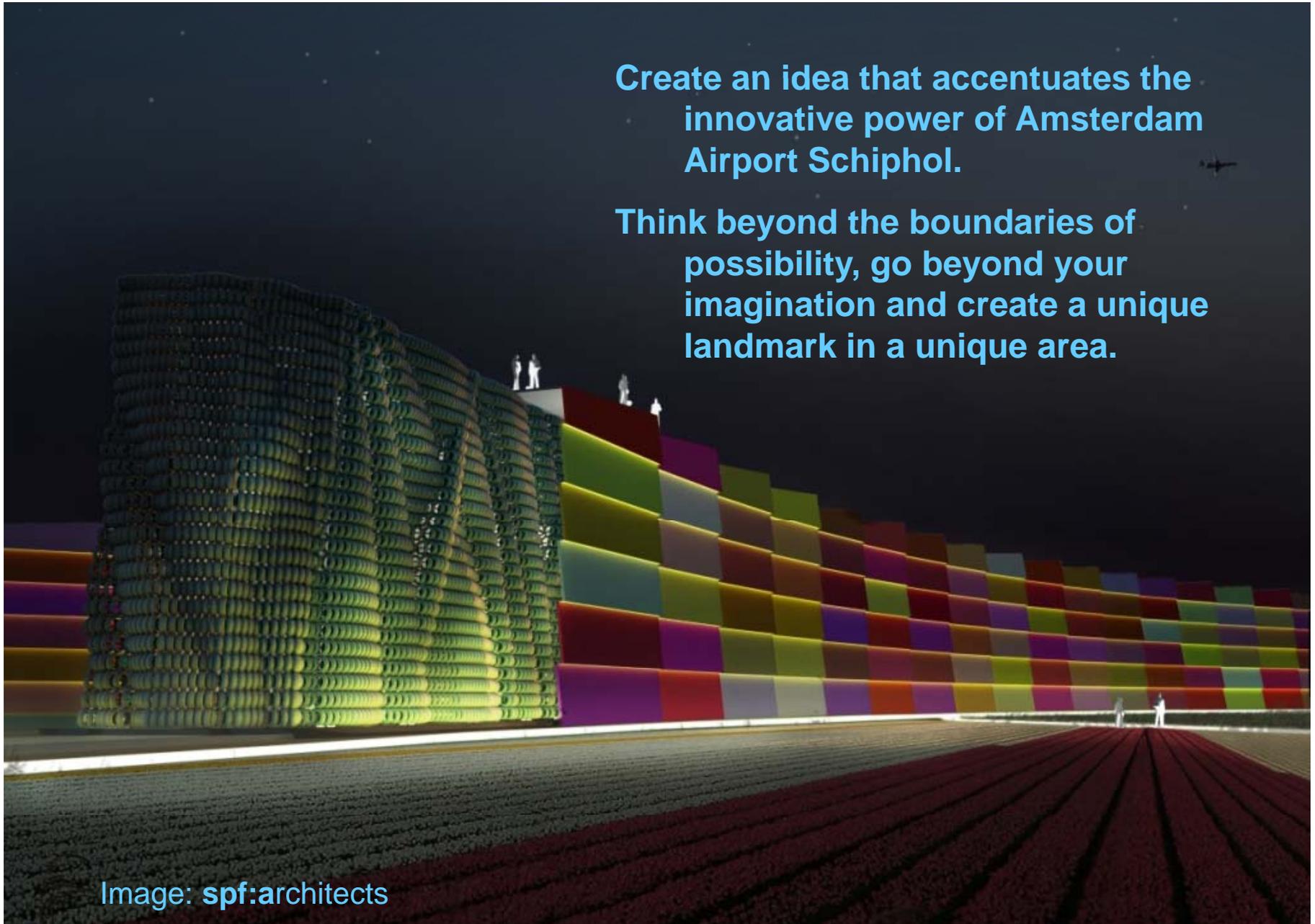


Image: **spf:architects**

Allow the design to interact with the landscape in a way that will improve the quality of life in the Haarlemmermeerpolder.



Image: [spf:architects](#)

Combine function and design in a unique design which will achieve more than just sound reduction.

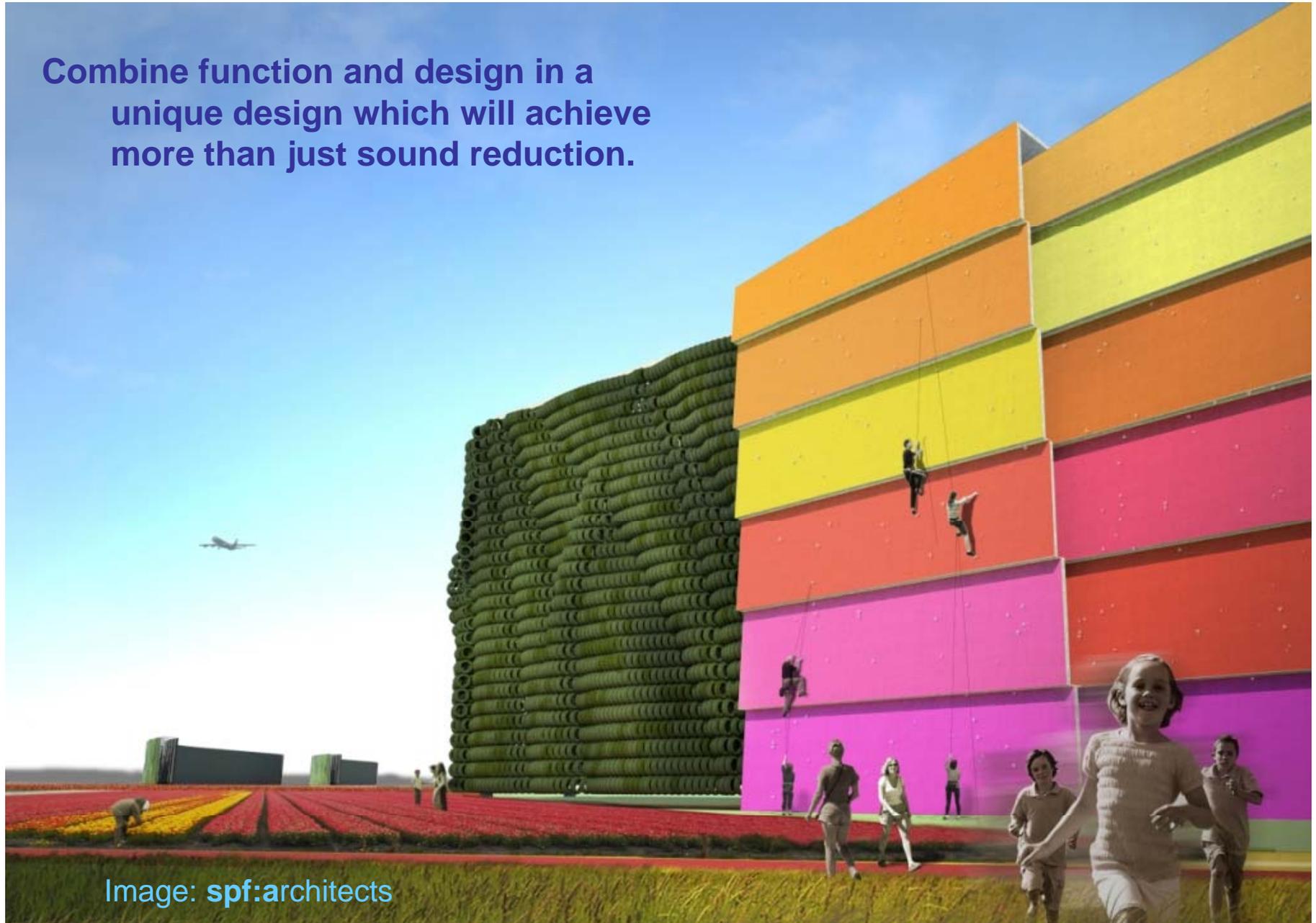


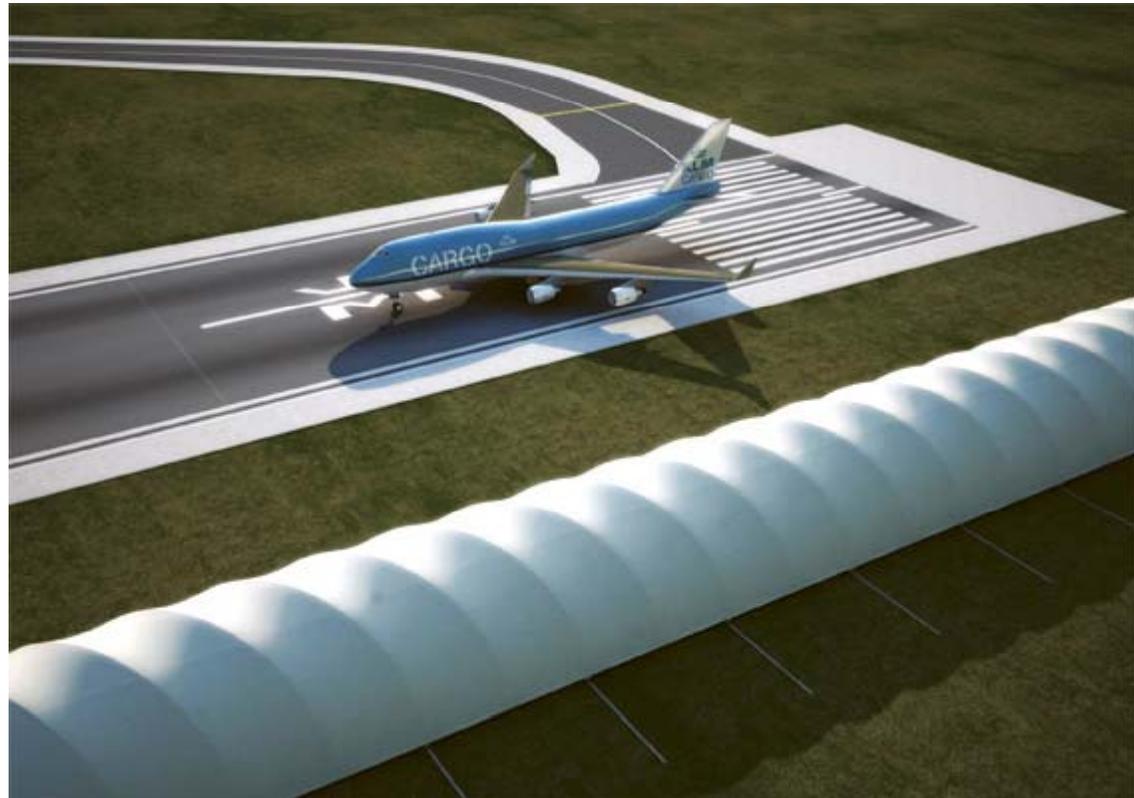
Image: [spf:architects](#)

Phase 2 Winner, January 2009

Ecobarrier

by Toine van Goethem

“Of all entries, the Ecobarrier achieved the highest scores in terms of sustainability, innovation and noise reduction.”



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