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Quality Monitoring of 50 Artificial Turf Football Fields

A study of the correlation between field properties, usage and
maintenance

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ISSS Technical Meeting
October 16th 2008



Project: Quality Monitoring of 50 Artificial Turf Football Fields

- Ordered by Dutch FA
- Research on the aging process of 50 artificial turf football fields
- All fields were constructed in 2001-2002
- Testing of sport functional properties
- Comparing current properties with initial test results
- Field owners provided information on the usage from installation in 2001-2002 until 2008
- Field owners provided information on maintenance performed the fields
- Analyse correlation between properties, usage and maintenance



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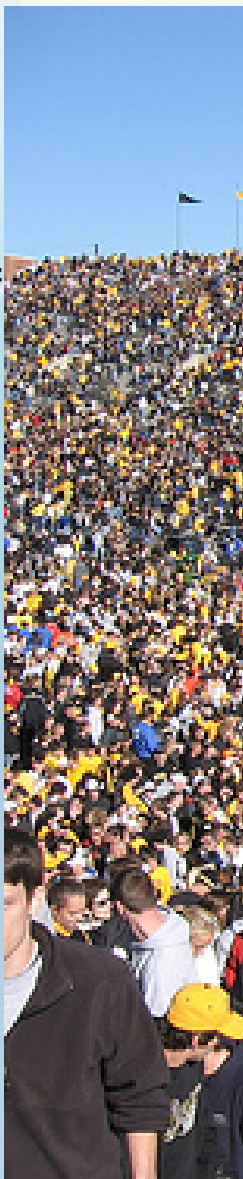
Change in field properties

- What is the actual change in field properties over 6-7 years?
- Can testing be the basis for quality-oriented maintenance and sustainable use of the artificial football fields?
- Should periodic tests become a fixed part of maintenance procedures?
- How important is it to safeguard the quality of artificial football fields from the point of view of fair competition?
- How important is it for the safety of the user that the change in functional properties is safeguarded?



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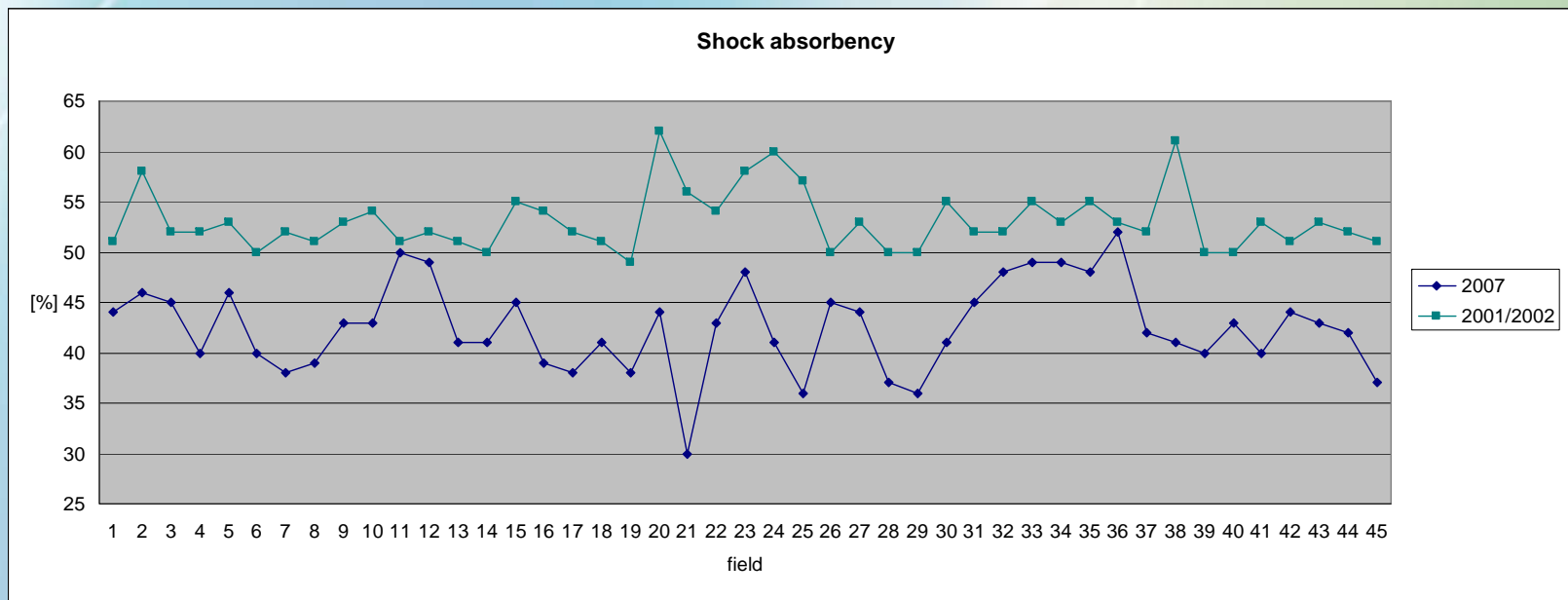


Field performance

Table 3.1 Assessment of functional quality of artificial football fields in 2007 (45 fields)

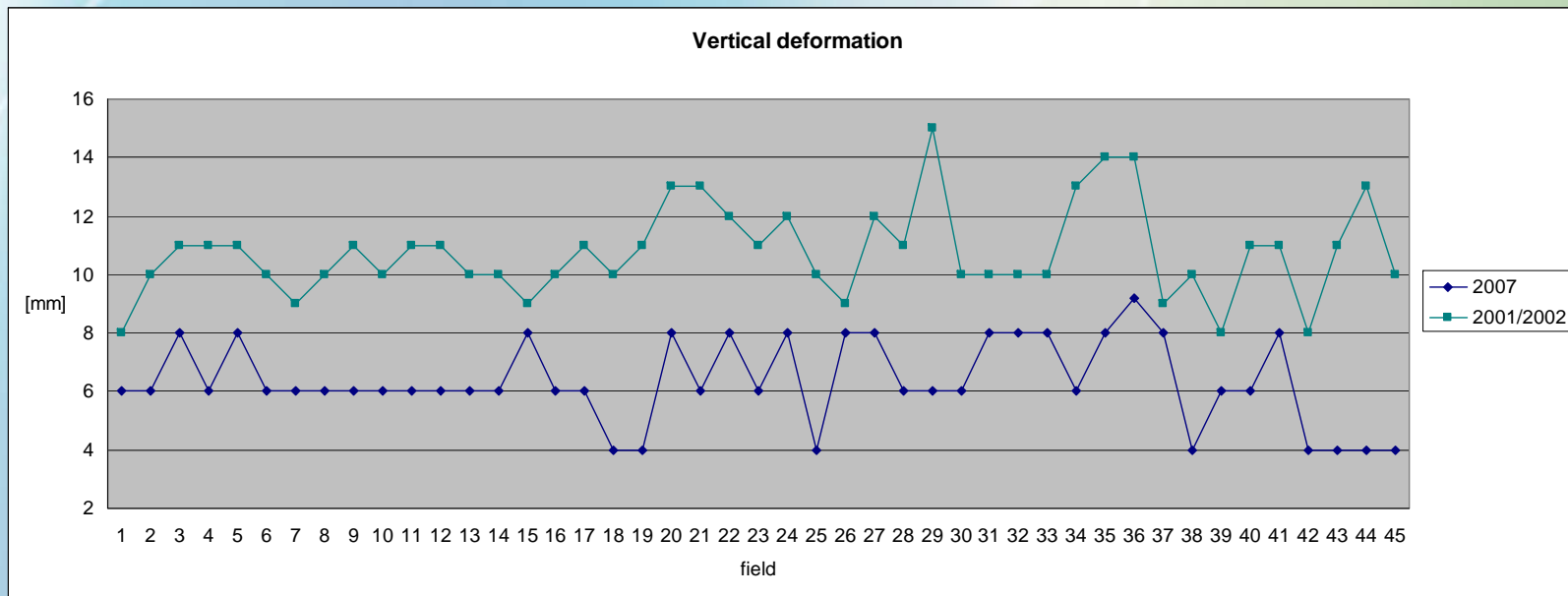
Positive score on	Number of fields
6 2001 standards	1
5 2001 standards	2
4 2001 standards	17
3 2001 standards	10
2 2001 standards	14
1 standard 2001	1
Total	45

Force Reduction



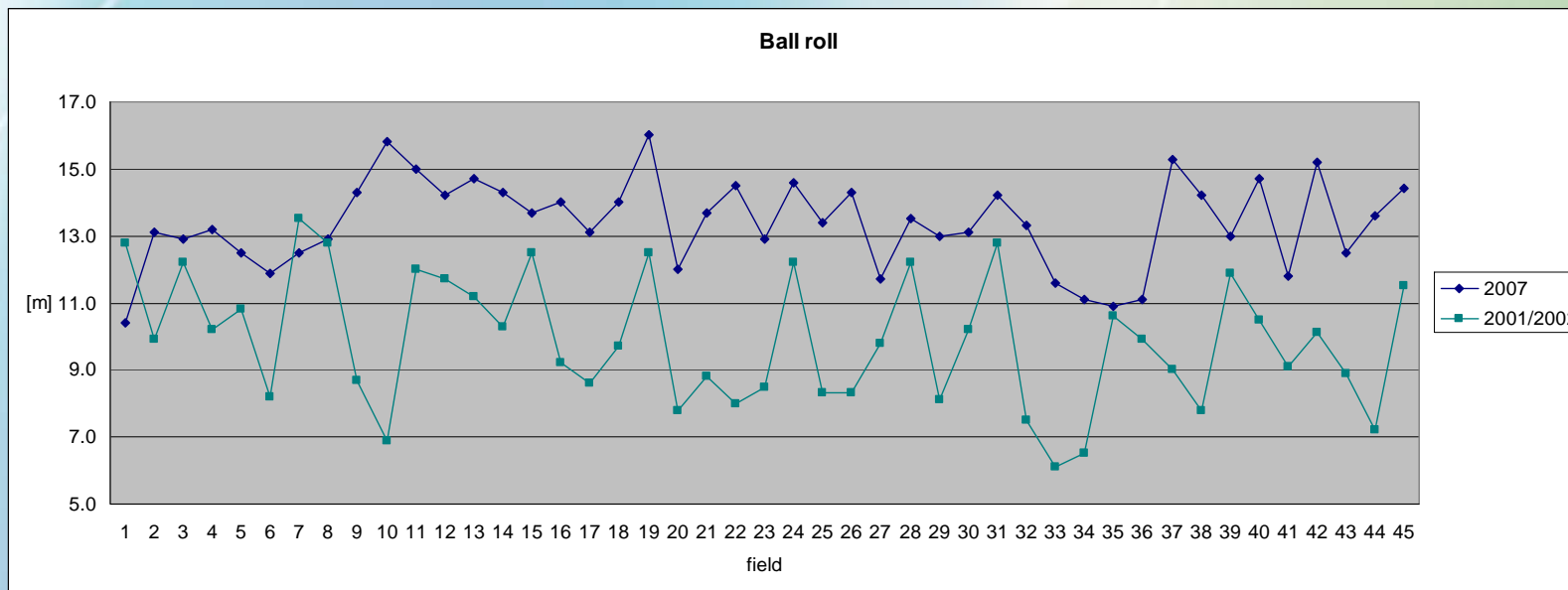
Properties	Average results 2001/2002	Average results 2007	Absolute average change	Percentual average change
Shock absorbcency	53%	43%	-10%	-18.9%

Vertical Deformation



Properties	Average results 2001/2002	Average results 2007	Absolute average change	Percentual average change
Vertical deformation	11 mm	6 mm	-5 mm	-45.4%

Ball Roll



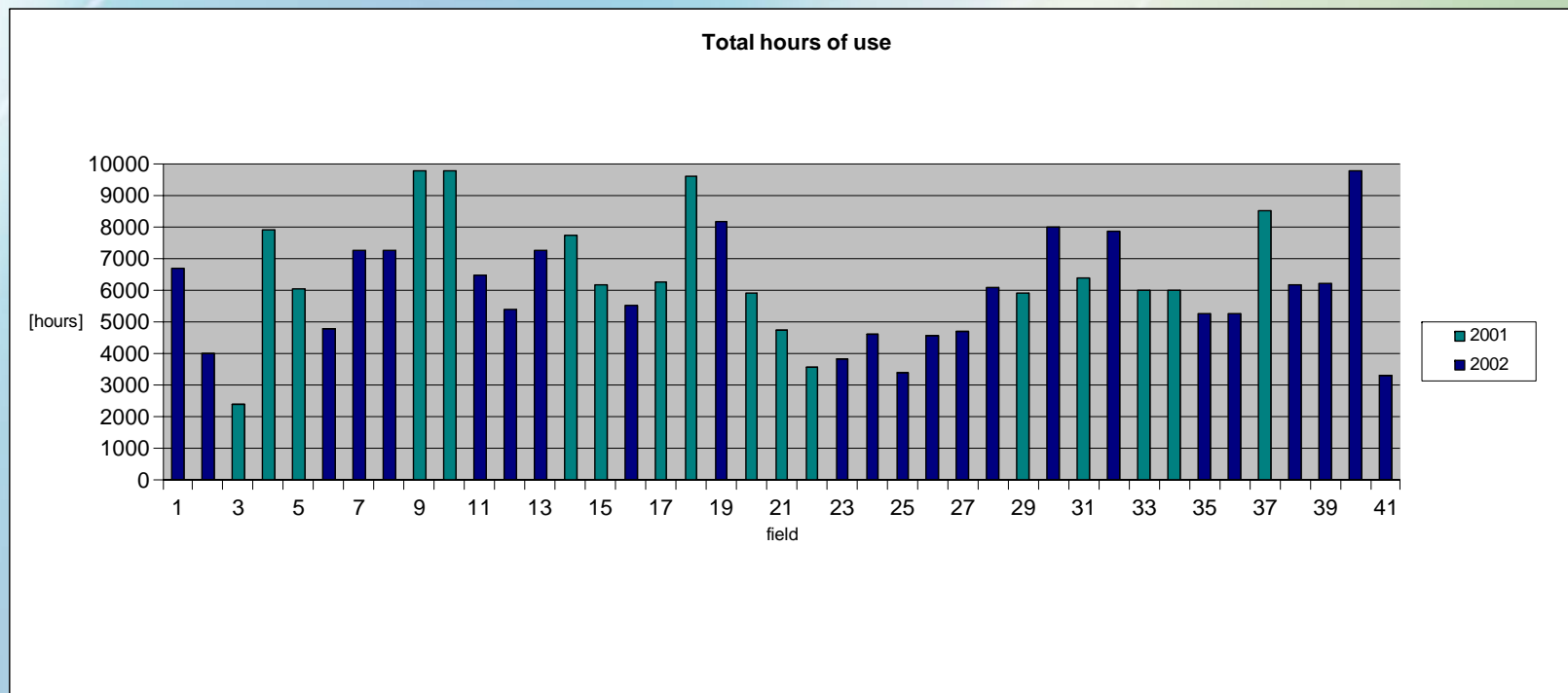
Properties	Average results 2001/2002	Average results 2007	Absolute average change	Percentual average change
Ball roll	9.9 m	13.4 m	+3.5 m	+35.4%

Table 2.5 Results of 2007 study into average functional quality of artificial football fields compared with results of 2001/2002 study

Properties	Average results 2001/2002	Average results 2007	Absolute average change	Percentual average change
Shock absorbency	53%	43%	-10%	-18.9%
Vertical deformation	11 mm	6 mm	-5 mm	-45.4%
Energy restitution	50 %	52	+2 %	+4.0%
Ball rebound (vertical)	0.82 m	0.97 m	+0.15 m	+17.1%
Ball roll	9.9 m	13.4 m	+3.5 m	+35.4%
Traction (rotational friction)	45 Nm	46 Nm	+1 Nm	+2.2%
Layer thickness infill	35 mm	33 mm	-2 mm	-5.7%

To which degree are these results related to usage?
 → stage 2 of the research

Total hours of use



Quality and hours of use

Table 4.1 Assessment of functional quality of artificial football fields in relation to number of hours of use (41 fields)

Positive score op	Number of fields	Average number of hours of use
6 2001 standards	1	5.250
5 2001 standards	2	5.575
4 2001 standards	15	5.120
0 - 3 2001 standards	23	7.005
Total	41	6.205

Force reduction related to use

Table 4.2 Results of study into shock absorbency in relation to the number of hours of use (41 fields)

test results	Number of fields	Average number of hours of use
55 - 59%	0	
50 - 54%	2	5865
45 - 49%	12	5325
40 - 44%	18	6895
35 - 39%	8	6245
30 - 34%	1	4750
Total	41	6205
Standard version 2001		50 - 70%
Standard version 2006		55 - 70%

Vertical Deformation related to use

Table 4.3 Results of study into vertical deformation in relation to the number of hours of use (41 fields)

Test results	Number of fields	Average number of hours of use (in hours)
≥ 9 mm	1	5250
8 mm	14	5370
7 mm	0	
6 mm	22	6665
5 mm	0	
4 mm	4	6825
Total	41	6205
Standard version 2001		8 - 15 mm
Standard version 2006		8 - 15 mm

Ball Roll related to use

Table 4.6 Results of study into ball roll in relation to the number of hours of use (41 fields)

Test results	Number of fields	Average number of hours of use
9.1 - 10.5 m	1	6700
10.6 - 12.0 m	8	5150
12.1 - 13.5 m	14	5885
13.6 - 15.0 m	15	6510
15.1 - 16.5 m	3	8800
Total	41	6205
Standard version 2001	6.0 – 15.0 m	
Standard version 2006	6.0 – 12.0 m	

Critical characteristics

Positive score on	Number of fields with negative score
Shock absorbency	39
Energy restitution	31
Vertical deformation	26
Ball rebound (vertical)	16
Ball roll	3
Traction (rotational friction)	0

To which degree are these results related to maintenance? → stage 3 of the research

Maintenance activities and frequencies

Table 5.2 Frequency of daily/weekly maintenance: drag brushing artificial football fields

Frequency	Number of fields
2 x or more per week	4
1 x per week	11
1 x per 2 weeks	16
1 x per 3 weeks or less	10
Total	41



Table 5.3 Frequency of daily/weekly maintenance: harrowing artificial football fields

Frequency	Number of fields
10 x or more per year ¹	4
2 to 4 x per year	9
Not applicable	28
Total	41



Maintenance activities and effect

Table 6.2 Functional quality of artificial football fields and daily/weekly maintenance: drag brushing (41 fields)

Frequency	Number of fields				Total number of fields
	Complies with 6 standards	Complies with 5 standards	Complies with 4 standards	Complies with 3 or less standards	
2 or more per week	1	1		2	4
1 x per week		1	5	6	12
1 x per 2 weeks			5	10	15
1 x per 3 weeks or less			5	5	10
Total number of fields	1	2	15	23	41

Maintenance activities and effect

Table 6.3 Functional quality of artificial football fields and daily/weekly maintenance: harrowing (41 fields)

Frequency	Number of fields				Total number of fields
	Complies with 6 standards	Complies with 5 standards	Complies with 4 standards	Complies with 3 or less standards	
10 x or more per year	1 ^[1]	1 ^[2]		2 ^[3]	4
2 tot 4 x per year			3	6	9
Not applicable		1	12	15	28
Total number of fields	1	2	15	23	41



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Change in field properties

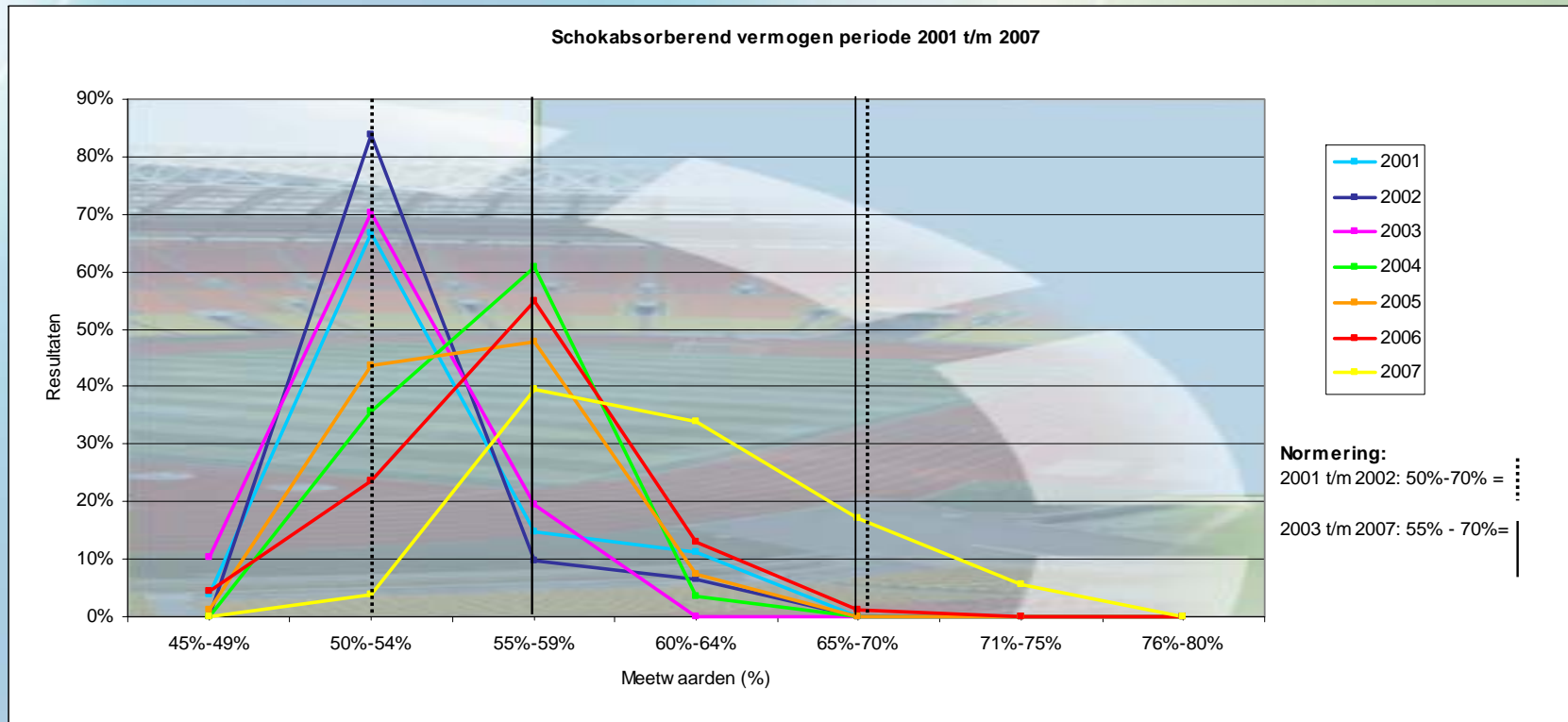
Can field deterioration be slowed down?

Influenced by:

- Product characteristics
 - Products in 2001 different from 2008
 - Standards in 2001 different from 2008
- Usage
- Maintenance

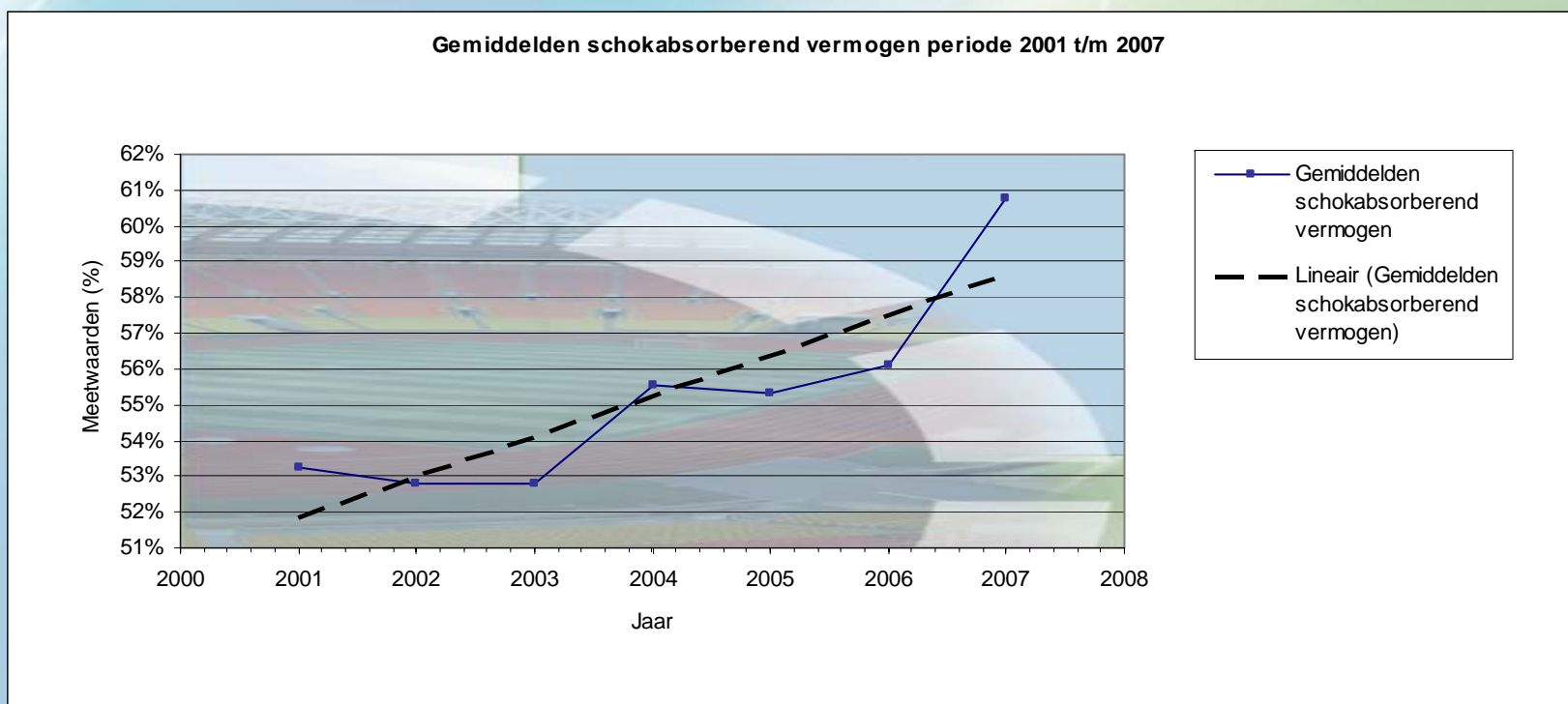
Decrease field deterioration

Setting standards changes performance



Decrease field deterioration

Setting standards changes performance



Product design

Product design changes performance


Microsoft Excel - Multiturf design tool v1.1.xls

File Edit View Insert Format Tools Data Window Help


Type a question for help

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Multiturf Design tool



Introduction

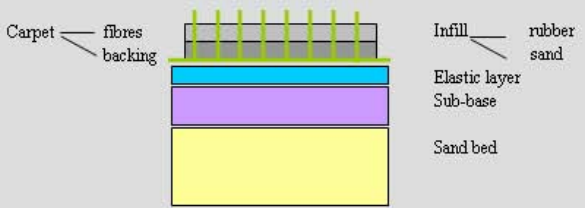
[Info AA test](#) [Info HIC test](#) [To Step 1](#)

Within the European project Multiturf a design tool has been developed for the prediction of some important properties of 3rd generation artificial turf fields based on standard test methods.










With this design tool it is possible to predict :

- force reduction
- energy restitution
- deformation
- ball bounce
- HIC (Head Injury Criterion) (NEN-EN 1177)
- an indication of the risk on injuries

Carpet



Note: *The predictions made with this tool are model calculations. Therefore predictions will not exactly correspond to measurements and can thus not be used in stead of measurements. TNO cannot be kept responsible for decisions based on the predictions.*

The Multiturf project (contract COOP-CT-2005-016456) is sponsored by the 6th framework program of the European Commission.

0. Introduction
1. Data selection and input
2. Calculated results
3. Compaction
4. Trendlines
5. Injury prediction
6. Cost calculation
Material database
Graphs A

Ready



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Change in field properties

To decrease the change in field performance over time:

- Determine what should be the minimum level of each property
- Make separate standards for older fields and test them
- Impact of usage and maintenance needs further investigation
- Stricter standards for new fields seems not to be favorable, however durability testing can now be evaluated with real world situation



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Thank you for your attention

Questions?

