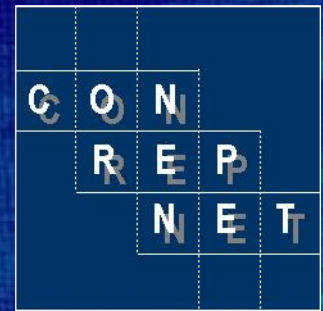


CON REP NET

Thematic Network on Performance Based Rehabilitation of Reinforced Concrete Structures



Work package 3

WP Leader : Josse Jacobs - CSTC

February 2004



WP 3 : Actual practice

- **Running actions**

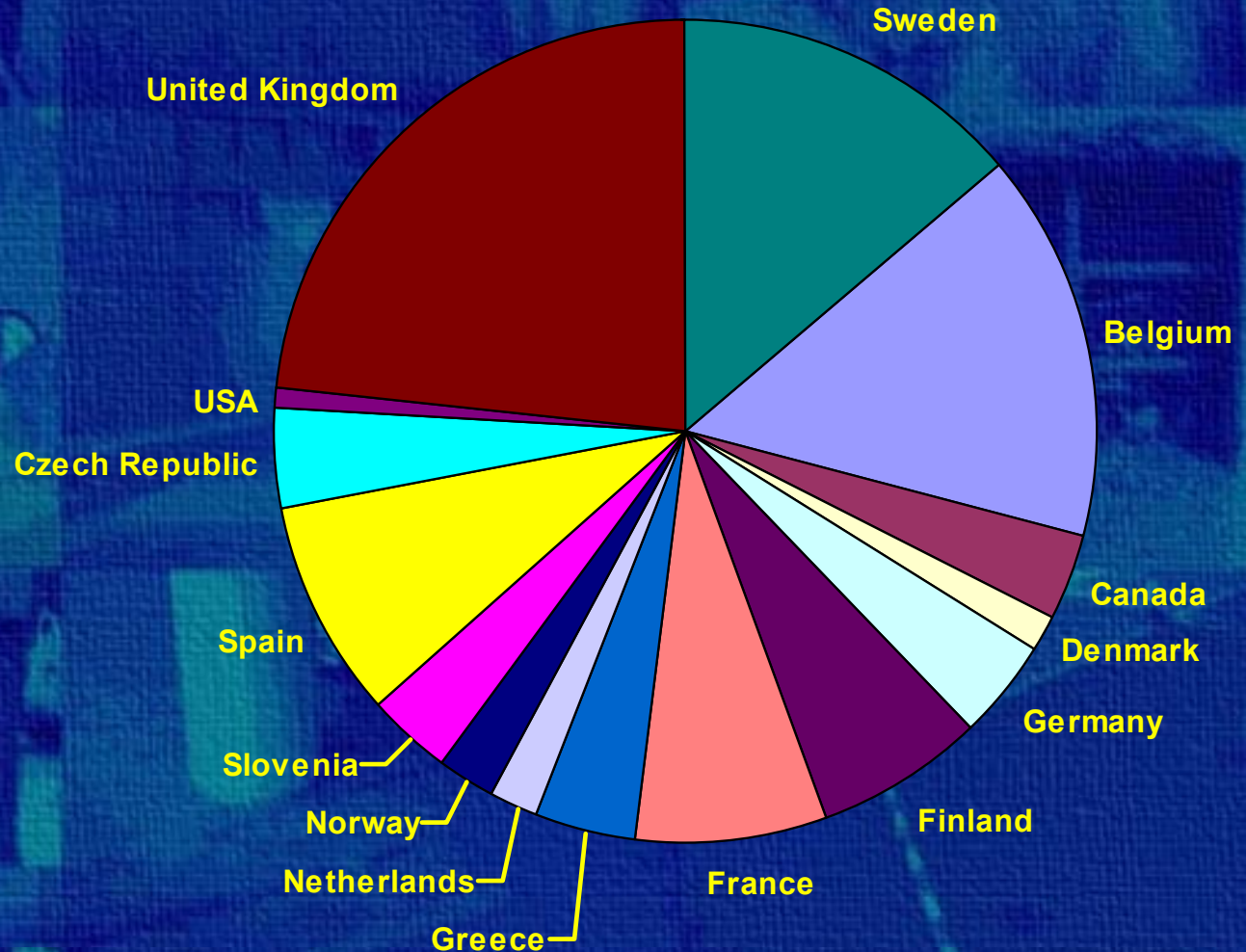
- Define current industry practice
 - Inquiries on inspection methods
 - Inquiries on repair methods
- Define research state of the art
 - Inquiries on research actions

- **Future action**

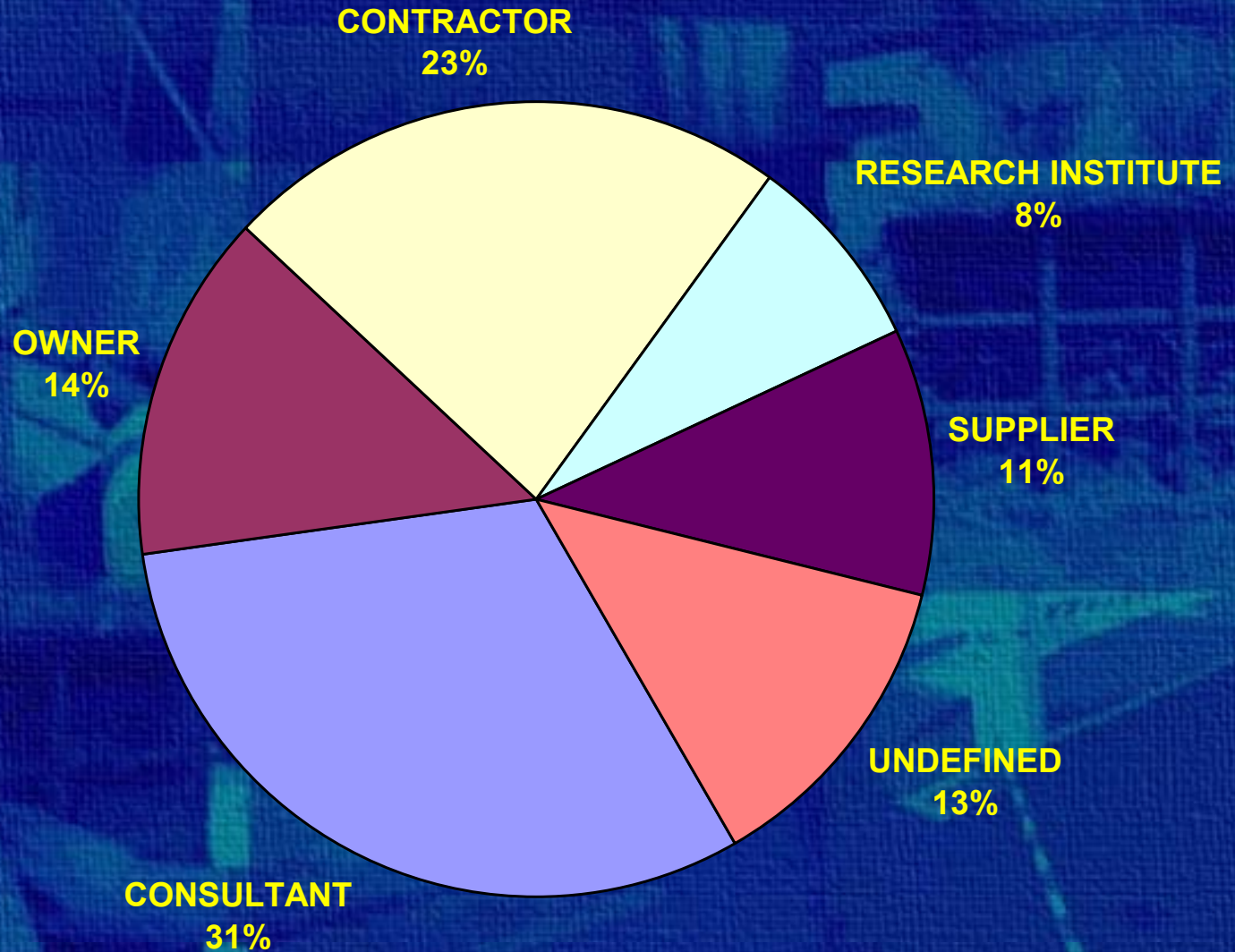
- Standards, guidelines and recommendations

WP 3 : Actual practice : Results

Total	150
Belgium	23
Canada	5
Czech Republic	6
Denmark	2
Germany	6
Finland	10
France	11
Greece	6
Netherlands	3
Norway	3
Slovenia	5
Spain	13
Sweden	21
United Kingdom	35
USA	1

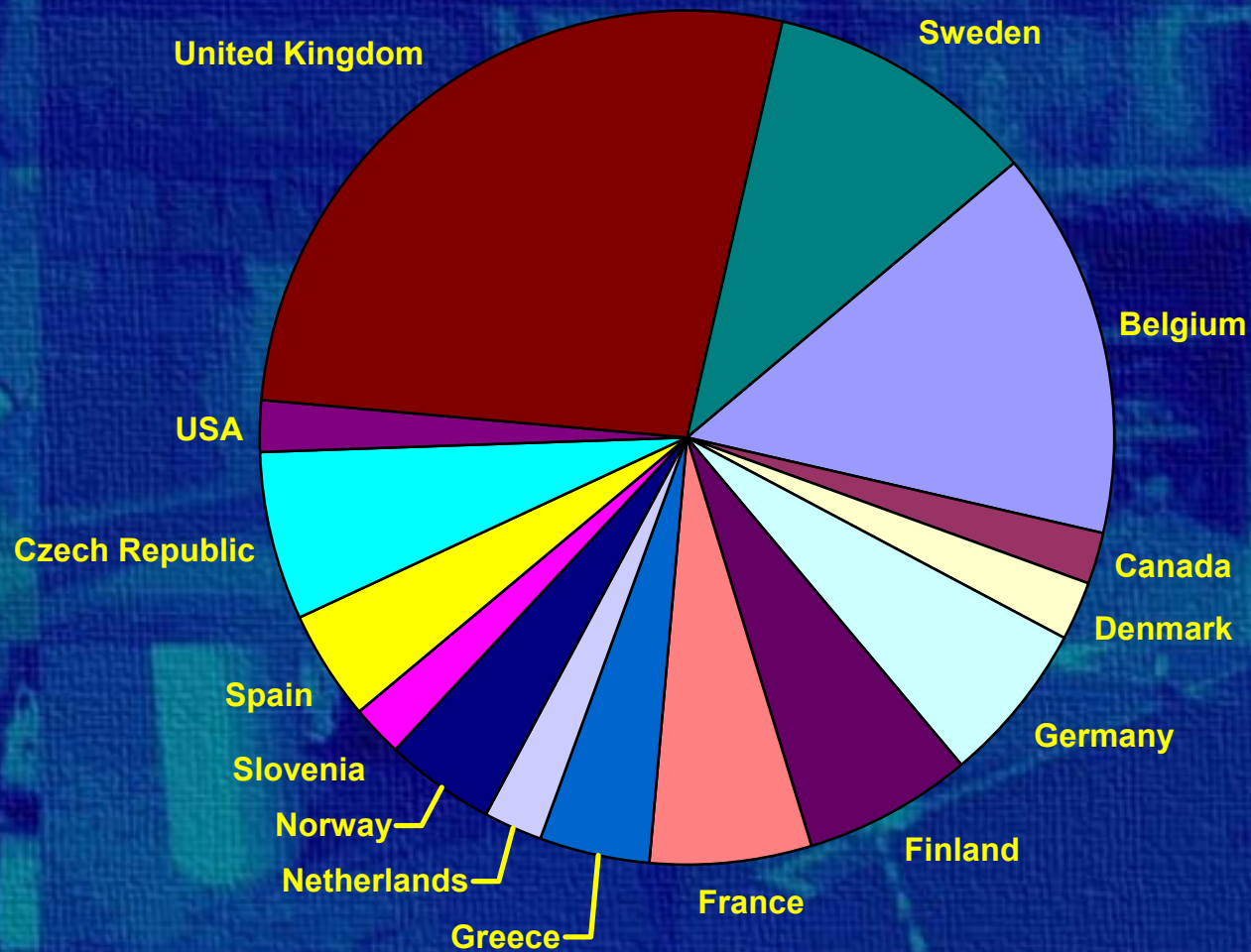


WP 3 : Actual practice : Who answered?



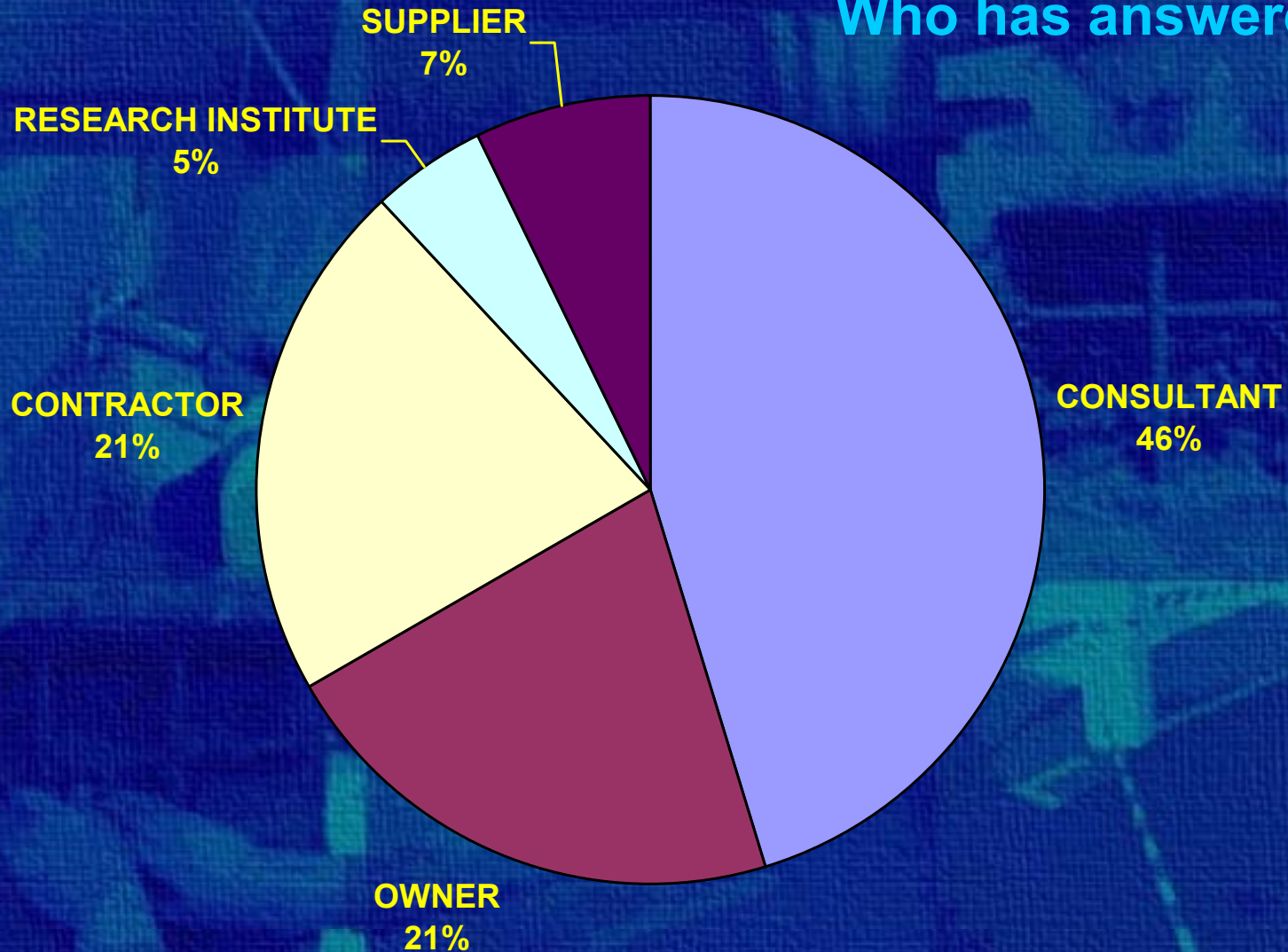
WP 3 : Actual practice : Inspections techniques

Total	48
Belgium	7
Canada	1
Czech Republic	3
Denmark	1
Germany	3
Finland	3
France	3
Greece	2
Netherlands	1
Norway	2
Slovenia	1
Spain	2
Sweden	5
United Kingdom	13
USA	1



WP 3 : Actual practice : Inspections techniques

Who has answered?



WP 3 : Actual practice : Inspections techniques

Importance of repair

	Employees	Repair	Min	Max
CONSULTANT	10865	5,6%	0.4%	87.5%
OWNER	39175	0,3%	0.1%	33.3%
CONTRACTOR	3837	11,4%	0.3%	83.3%
RESEARCH INSTITUTE	231	8,7%	5.0%	32.3%
SUPPLIER	600	15,0%	-	-
OTHER	1220	3,9%	3.0%	60.0%
Total	55928	2,4%	-	-

WP 3 : Actual practice : Inspections techniques

What is answered?

	Not known	Never	Rarely < 5%	Some- times 5%-30%	Often > 30%	Fut.	Subc.
Visual inspection	0	0	1	2	45	2	3
Rebar location	2	1	4	12	29	1	7
Carbonation depth	0	3	3	13	28	2	14
Chloride content	0	5	5	14	23	2	16
Potential measurements	1	9	11	11	15	3	10
Corrosion current measurements	2	11	23	5	3	5	13
Drilling Core tests	0	1	8	16	23	0	16
Loading tests	0	15	22	8	3	0	11
Monitoring	1	11	21	10	4	1	11
Petrographic analysis	1	10	21	11	4	0	15

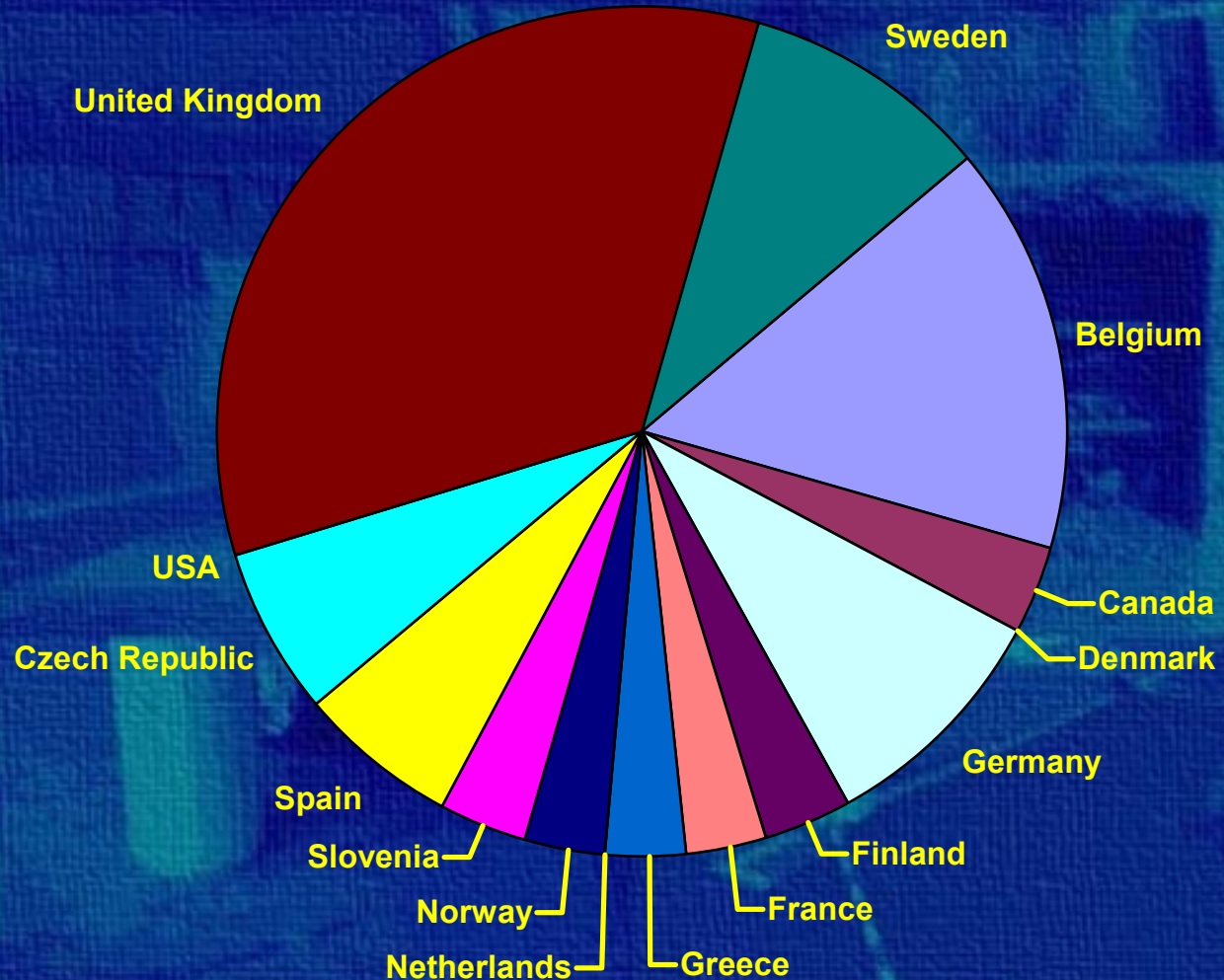
WP 3 : Actual practice :

● Conclusions regarding inspection

- Visual inspection is common use
- More complicated tests are
 - Less frequently done
 - Often subcontracted
- Owners easily subcontract
- General intention to use more (new) inspection methods
- 50% uses procedures developed in the company
- 75% takes (sometimes / on demand) care of follow up after repair
- Only 5% doesn't evaluate results manually, about 50% uses computer
- 25% develops its own software
- Some software and other actions are mentioned

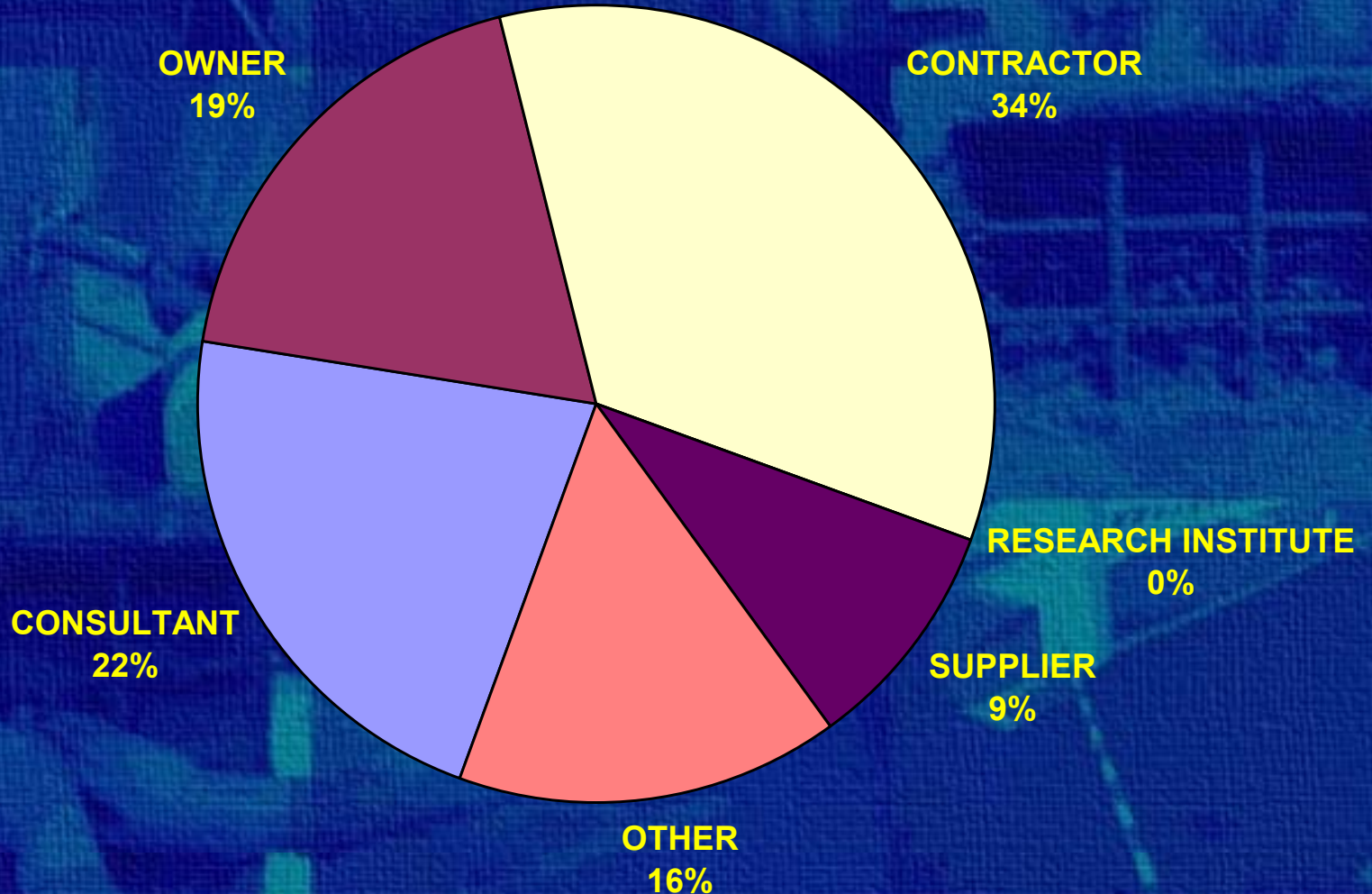
WP 3 : Actual practice : Repair Methods

Total	32
Belgium	5
Canada	1
Czech Republic	2
Denmark	0
Germany	3
Finland	1
France	1
Greece	1
Netherlands	0
Norway	1
Slovenia	1
Spain	2
Sweden	3
United Kingdom	11
USA	0



WP 3 : Actual practice : Repair methods

Who has answered?



WP 3 : Actual practice : Repair methods

- **According to contractors answers**
 - Contractor chooses repair method : 56%
 - 10% to 100%
 - Contractor performs inspection : 50.8%
 - Special techniques

WP 3 : Actual practice : Repair methods

	Not known	Never	Rarely < 5%	Some- times 5%-30%	Often > 30%	Fut.	Subc.
Patch repairs	0	2	1	8	19	1	8
Sprayed methods	0	4	6	13	7	0	7
coatings	0	1	8	7	14	0	9
Electrochemical techniques	1	7	11	6	5	1	8
Crack injection	0	1	7	17	6	0	11

Other : strengthening, inhibitors

WP 3 : Actual practice : Repair products

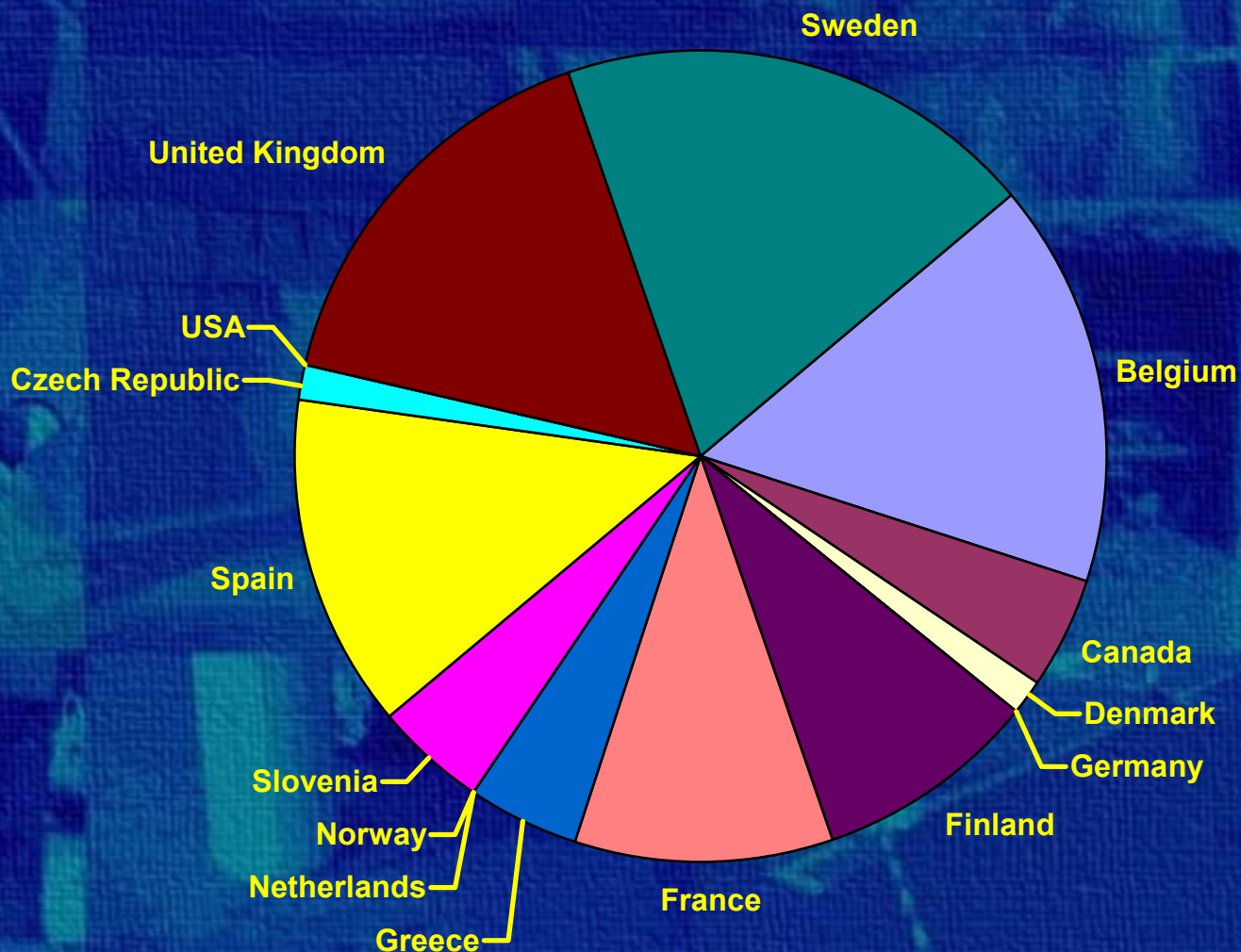
	Not known	Never	Rarely < 5%	Some- times 5%-30%	Often > 30%	Fut.	Subc.
Cement based mortar	0	1	4	6	20	0	7
Polymer based mortar	0	3	5	11	11	0	7
Impregnation	1	5	14	5	4	0	8
Cement based coatings	1	3	11	11	4	0	6
Resin based coatings	0	6	9	9	4	0	8
Realcalisation	2	12	8	4	2	2	6
Chloride removal	1	12	11	2	3	1	7
Cathodic protection with impressed current	0	12	9	5	4	2	8
Cathodic protection with sacrificial anodes	0	14	11	4	1	0	6

WP 3 : Actual practice : Repair products

- **Quality control :**
 - Before and after : by owner
 - During work : by contractor
- **Quality control only in 42%**
- **Mainly same test as used for inspection**
 - Pull-off test
 - Monitoring always when CP

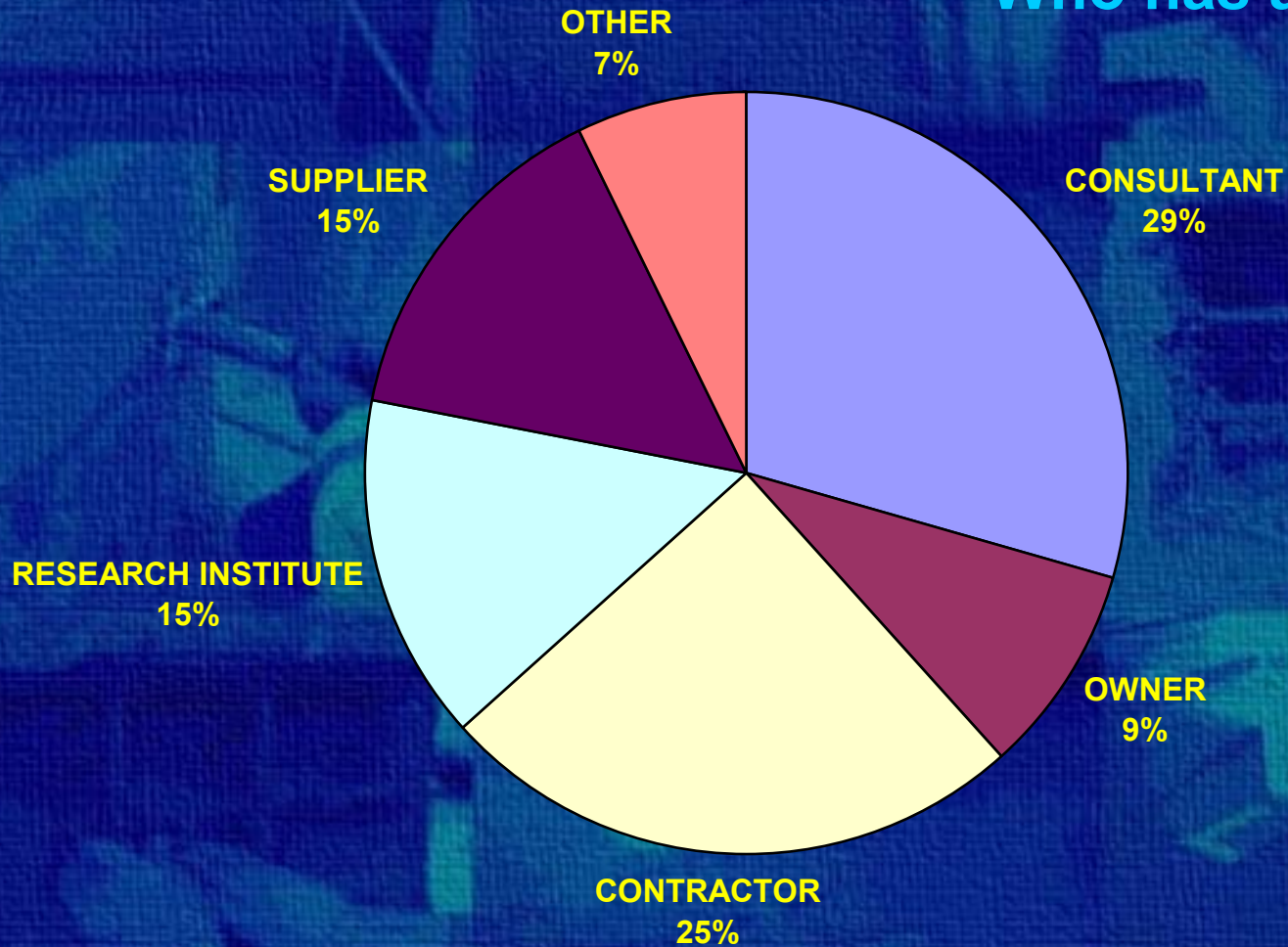
WP 3 : Actual practice : Research

Total	68
Belgium	11
Canada	3
Czech Republic	1
Denmark	1
Germany	0
Finland	6
France	7
Greece	3
Netherlands	0
Norway	0
Slovenia	3
Spain	9
Sweden	13
United Kingdom	11
USA	0



WP 3 : Actual practice : Research

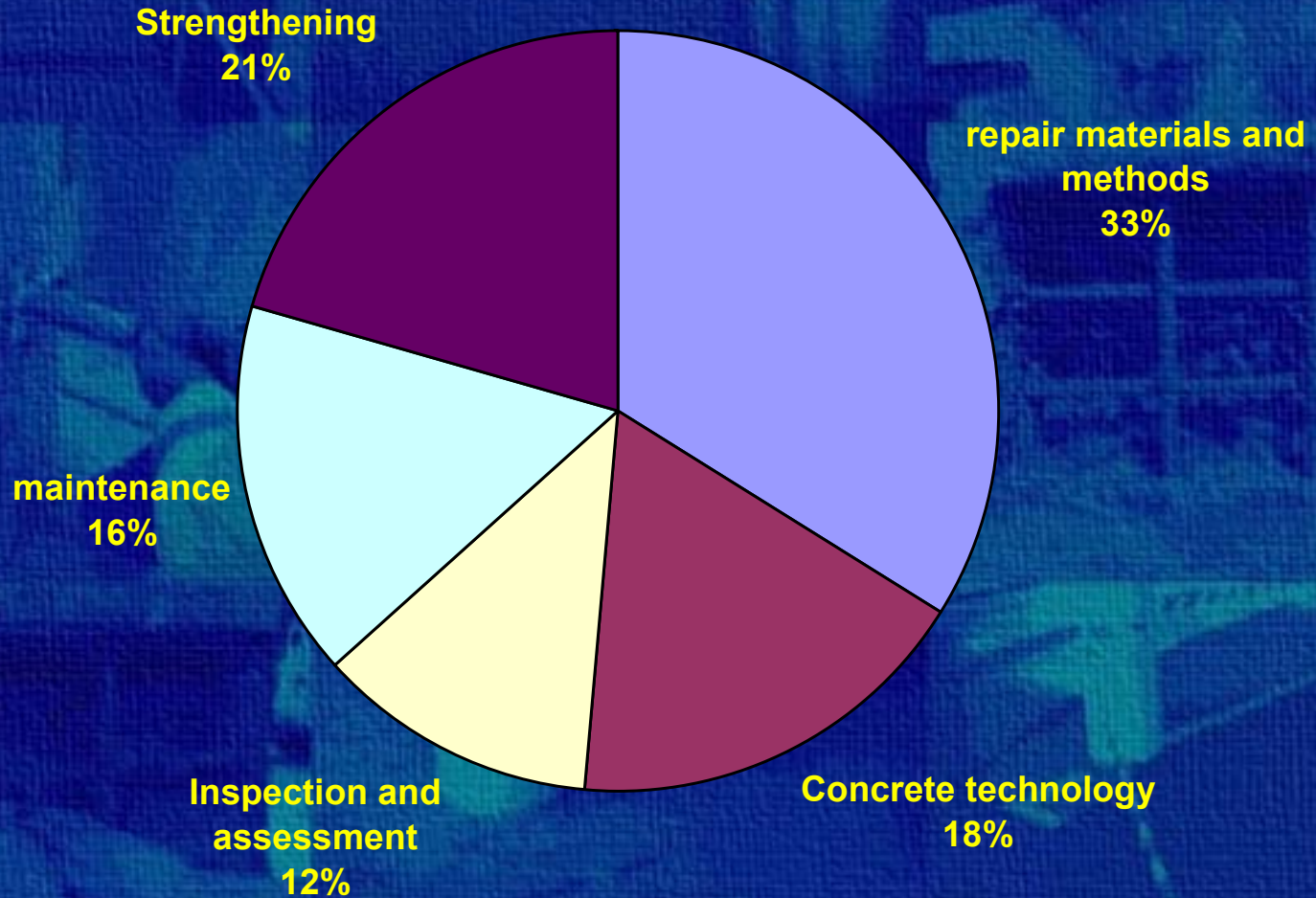
Who has answered?



WP 3 : Actual practice : Research

- 68 projects = 66 different projects
- Period : from 1995 to 2004
- Budget (45 projects) : 40.000.000 €
- Funding (64 yes, 2 no, 2 no answer)
 - Private 32
 - National 36
 - International 24

WP 3 : Actual practice : Research items



WP 3 : Actual practice : Research

- Actual situation

	Yes	No
Are results general available	37	25
Are the results used	46	12
Is further research necessary	49	6
Is it planned	33	17
Are partners being searched	16	37