LIFE Project Number

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PROGRESS REPORT No. 2

Covering the project activities from 1.3.2003 to 30.9.2003

Reporting Date

31.10.2003

LIFE PROJECT NAME

Kukkia Circlet:
Environmentally friendly systems to renovate secondary roads

Data Project	
Project location	Finland / Pirkanmaa
Project start date:	1.12.2001
Project end date:	31.12.2004 **Extension date: -**
Total Project duration (in months)	37 months **Extension months**: -
Total budget	1.253.630 €
EC contribution:	626.815 €
(%) of total costs	50 %
(%) of eligible costs	50 %

Data Beneficiary	
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Executive Summary

The project, Kukkia Circlet, has been progressing as planned for the most part. The progress has been described previously in the first Progress Report from 1st December 2001 to 30th September 2002 and in the Interim Report per 28th February 2003 covering the project period from the start until end of February 2003. This second Progress Report will cover the period from 1st March 2003 to 30th September 2003, a period of significant workload to implement Tasks 4 and 5 for the Pilot 2003 as planned.

During the reporting period, the implementation of the Pilot 2003 has been carried out, follow-up tests have been conducted on Pilot 2002 test sections, the Steering Group has had two meetings (18.3.2003 and 22.8.2003) and the work group for Pilot 2003 several operational meetings, the project website has been updated, the production of tools for dissemination (video) have been going on and the dissemination workshop has been prepared. The implementation of **Pilot 2003** has involved **Tasks 1, 4 and 5** and following main items: the environmental permit process with authorities, the preparations for the pilot construction at the chosen sites and in the industrial plants producing the materials for the construction, the final laboratory tests to control and verify the technical and environmental quality of the materials for the different pilot structures, the verification of the plans for the processes from the choice of personnel and equipment to the detailed time table of the implementation, and the sampling and testing as reference for the follow-up. Task 5, the Pilot 2003 construction started more than one month later than originally planned because of the delayed permit decision of the environmental authorities. The delay was mainly about the need for a more detailed survey on the impacts to the lake Kukkia, one of the Natura 2000 areas. A part of finishing works scheduled for October have to be postponed to next spring-summer because of the early arrival of cold and snow. Despite this, the task has been carried out successfully. **Task 6, Impact assessment**, has been carried out with technical and environmental studies for the reference data of Pilot 2003 sites and for the first follow-up period of Pilot 2002. The follow-up of Pilot 2002 has given satisfactory, even good results. **Task 7, Dissemination**, has been carried out like planned though without external participation in the implementation of Pilot 2003 (as well as Pilot 2002 in previous summer). The project and its results so far have been presented during several events in Europe, most widely by the beneficiary during Wascon 2003 in San Sebastian in June 2003. The workshop will be in connection with an international Symposium of ISEG on Environmental Geotechnology and Global Sustainable Development on 8. – 10 June 2004. The video production has been on-going since summer 2002, and the videofilming will continue until May 2004. The Guide has been planned to be an electronic file, available at the project website, and it will be based on the experience and results during the implementation and follow-up of Pilot 2002 and Pilot 2003. The project **deliverables** have included the Interim Report in March 2003, Technical Report on Pilot 2002 and the project in general (annex to Interim Report), and the technical designs and work instructions of Pilot 2003 (in Finnish). Drawing up of the Technical Report of Pilot 2003 and the interim impact assessment reports have started but they will be finished later than scheduled in the proposal in 2002.

The deliverables are available at project **website** (see: http://www.tieliikelaitos.fi/5_4.asp or http://www.viatek.fi/sgt/life).

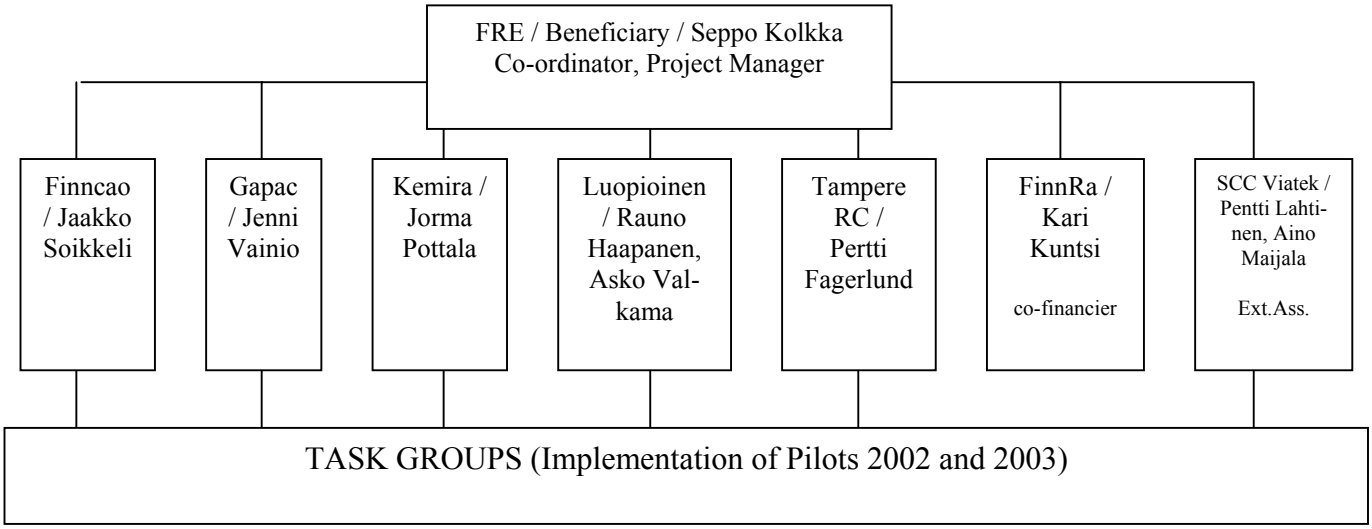
The **costs** of the project, incurred from the 1st December 2002 until 30th September 2003, are roughly 900 000 Euro (about 72 per cent of the budgeted 1 253 630 Euro).

Tampere 31st October 2003

Seppo Kolkka

1. Project management

The description of the project management system is below as a scheme. Senior representatives (like project contact persons) of the beneficiary and the partners, and the external assistant, Viatek, are the members of the Steering Group (SG). The work groups for the implementation of the pilots are composed of the relevant professional expertise of the organisations, mainly being personnel of FRE, Luopioinen and Viatek. Finncao, Gapac and Kemira have taken care of the by-product materials, their quality control and tests. Tampere RC has acted as observer and provided help for the production of video tools for the dissemination. FRE, Luopioinen and Tampere RC have also hired or financed students and other young unemployed but professional persons to work for the project and to learn about the new innovative methods, structures and production processes.



SG has had two meetings during the reporting period: on 18th March 2003 and on 22nd August 2003. Also Pekka Hänninen, the representative of the monitoring organisation SOGES-ELLE in Finland, participated in the meeting in August. The agenda of the meetings always include a survey on the project progress, budget and events, discussion and decision making on the future activities and foreseen problems, and visits to the pilot sites to observe the situation and condition of the pilots. The memoranda of the meetings (in Finnish) are available to the SG on the project website.

Since the start of the project, the project **deliverables** have included the technical designs and work instructions of Pilot 2002 (in Finnish), the 1st Progress Report (from the start until 30th September 2002), the Interim Report in March 2003, Technical Report on Pilot 2002 and the project in general (annex to Interim Report), and the technical designs and work instructions of Pilot 2003 (in Finnish). Apart from the technical designs and work instructions of Pilot 2002, all the above mentioned reports are available on the projects website (e.g. via www.viatek.fi/sgt/life/english/julkaisut_en.htm).

1. Technical Development

After the Interim period until 28th February 2003 and during the reporting period 1st March 2003 – 30th September 2003, the technical development of the project has involved Tasks 1, 4, 5 and 6. Followed, we have shortly described what we have done in regard to each task during the reporting period, and compare the performance against the established time schedule.

Task 1: Material tests

The environmental tests

on the industrial by-product components (fly ash and fibre clay) started in January 2003, and the results were reported to the SG and environmental permit authorities in April 2003. The results are also given as **Annex~1** (in Finnish) of this progress report.
The components were analysed for the total content of inorganic elements. The oven dried sample was extracted into nitric acid in microwaveoven, and the elements in the extract were determined with ICP-MS/AES technique. Additionally, a mixture of fly ash and fibre clay was tested for leaching. The mixture was KCK51 [(fly ash : fibre clay, 1:1) + 6 % FTC]. In this mixture, the fly ash is the environmentally "worst" component and 50 % in relation to fibre clay will be its maximum share (ww). FTC is a gypsum and cement based binder admixture and the quantity is given as percentage of the dry weight of the mixture of fly ash with fibre clay. After 28 days stabilisation process, the leaching test was run according to the Dutch standard NEN 7343 for column tests. The leachates were analysed for the content of inorganic elements with ICP-MS/AES. The results are given in **Table 1**.

Additionally, the TOC of fibre clay was determined with carbon analyser in 600 ^{o}C after extracting the sample of fibre clay in ionised water for 20 hours. The dry matter of the fibre clay was 64 % and TOC 830 mg/kg-dm. The Council decision 2003/33/EC on criteria and procedures for the acceptance of waste at landfills gives a limit value of 30000 mg/kg for inert waste.

Conclusions: **Fly ash and KCK51**. The content of B (boric) exceeds the limit values suggested by Sorvari, but the mobile fraction of B is very small (0,100 mg/kg at L/S10) in the mixture. The boric content is clearly lower than the guide value suggested by the environmental ministry for peat and bark fly ashes in 2002 (PM 11/400/2001 in June 2002 for a decree on the use of industrial waste in soil construction). The Ba (barium) content is also high in comparison with the limit values suggested by Sorvari in 2000, but clearly lower than the guide value suggested by the environmental ministry in 2002. A corresponding conclusion can be taken with respect to the leaching results, and it is noteworthy that the mobile fraction of Ba is small in the mixture KCK51 in comparison with the total content of Ba in fly ash. The leaching of molybdenum exceeds the older guide values but are clearly lower than the guide values suggested by the environmental ministry. The **fibre clay** does not pose any risk at all to the environment, when assessed with respect to the results of these tests.
On the basis of the results it was decided that Pilot 2003 uses mixes having fly ash share at the level of mixture KCK51 or lower. The pilot sites are far from important groundwater sources, and the pilot structures with fibre-ashes will be placed sufficiently high above the level of groundwater.

Table 1: Total content and leaching of inorganic elements

Element	Total content; ICP-MS/AES [mg/kg]					Leaching; NEN 7343; L/S 10 [mg/kg]				
	Components		*Guidelines (Finnish)*			Mixture	*Guidelines (Finnish)*			
	Fly ash	Fibre clay	*Target for clean soil*	*Limit of accep-tance*	*Peat / bark fly ash*	KCK51			*Peat / bark fly ash*	
							Road with no pave-ment	*Road with pave-ment*	*Covered road*	*Road with pave-ment*
			Ref. 1)	*Ref. 1)*	*Ref. 2)*		*Ref. 1)*	*Ref. 1)*	*Ref. 2)*	*Ref. 2)*
As	40,4	1,3	*13*	*60*	*50*	0,004	*0,14*	*0,75*	*0,2*	*0,85*
B	**231**	2,57	*5*	*50*	*320*	0,100	-	-		
Ba	**1290**	89,3	*600*	*600*	*2000*	**29,5**	*10*	*28*	*100*	*280*
Be	3,16	<0,5	*1*	*10*	-	0,01	-	-		
Cd	1,94	0,13	*0,3*	*10*	*14*	0,003	*0,011*	*0,015*	*0,02*	*0,02*
Co	14,5	2,45	*50*	*200*	-	0,021	*1,1*	*2,5*		
Cr	147	12,9	*80*	*500*	-	0,034	*2*	*5,1*		
Cu	101	127	*32*	*400*	*650*	0,713	*1,1*	*2*		
Mo	8,63	1,62	*5*	*200*	*40*	**1,071**	*0,31*	*0,5*	*2,5*	*4*
Ni	92	5,73	*40*	*300*	-	0,126	*1,2*	*2,1*		
Pb	70,1	5,38	*38*	*300*	*230*	0,006	*1*	*1,8*		
Sb	<0,2	<0,1	*5*	*40*	*40*	0,002	*0,12*	*0,4*	*0,12*	*0,4*
Se	<10	<5	*1*	*10*	*20*	0,200	*0,06*	*0,10*	*0,3*	*0,5*
V	87,5	3,79	*50*	*500*	-	0,004	*2,2*	*10*		
Zn	341	67,3	*90*	*700*	*2600*	0,062	*1,5*	*2,7*	*1,5*	*2,7*

References:

1) Sorvari, J. (2000): By-products in soil construction. Acceptance criteria. TEKES/Teknologiakatsaus 92/2000 (in Finnish)
2) YM 11/400/2001; PM of Environmental ministry as background information for the suggested decree on industrial waste for soil construction in June 2002 (in Finnish)

Geotechnical tests

Based on the results earlier in the spring of 2002, Geotechnical test programme for Pilot 2003 was checked and finalised in December 2002. The programme involved control tests of the recipes for the construction of Pilot 2003 structures and for the quality control of the materials (**Annex~2**).

After repeated optimising the work groups approved the fibre-ash mixtures for the different structure types of Pilot 2003 at the end of June 2003. **Table 2** gives a choice of results on the materials that finally were chosen as recipes for the construction (mixes with bold letters). The slow progress of testing did not cause any delay to start construction or mixing of the materials, as the main reason for the delay was the delay of the environmental permit. Additionally, it was decided in the work group in the spring 2003, that mixtures of covering course need further development. These tests on mixtures of crushed stone with filtercake and other stabilising (but commercial) components continued over the summer 2003, until the final decision about components and quantities was made. **Table 3** gives the test results and **Annex~3** shows the report on tests for mix specification (the latter in Finnish). The covering course was constructed at the end of September 2003 / beginning of October 2003 – just on time before the first snow and cold. The details of all mixtures and the results of the geotechnical tests will be compiled into the complete technical report of Pilot 2003 (pending).

Table 2: A choice of the geotechnical test results on fibre-ash and fibre clay mixes in 2003.

FC:FA	ADD	Proctor			UCS			k	SP_o	Thermal conductivity	
		max dry density	w_{opt}	w_o	28 d, dry storage	after F-T test	after HC test			at + 20 °C	at – 10 °C
		kg/m^3	%	%	kPa	kPa	kPa	m/s	mm^2/ Kh	W/mK	W/mK
10:7	FTC 6%	965	45	62	590-700	300-500	-	-	1,1	0,60	0,97
10:10	FTC 6 %	1010	41	54	730	400-450	-	-	1,0	0,61	0,91
10:7	**Ce 6 %**	940	54	-	570	270	-	-	0,7	-	-
10:10	**Ce 6 %**	-	-	-	730-740	-	-	-	0,6-0,7	-	-
10:0	**-**	850	50-60	118	24 - 35	47-61	-	7,3E-10 … 2,7E-09	-	-	-
						66-78		6,0E-09*			
10:0	B 5 %	627	-	106	52-56	-	-	3,8E-10	-	-	-
						71-77		2,7E-09*			

The mix **10FC+10FA+6 %Ce** was used for the light-traffic lanes, the mix **10FC+7FA+6%Ce** for the renovation of the Pihtisalmi road section, and the **100 % fibre clay** for the groundwater protection structure

- FC:FA = proportions of fibre clay (FC) and fly ash (FA), e.g. 10:7 means 10 kg FC and 7 kg FA (wet weight). The relation of 10:0 means fibre clay alone for the groundwater protection application.
- ADD = additive and its relative quantity to the dry mass of FC:FA; Ce = cement, FTC, B = bentonite
- w (opt) is the water content at which the max (dry) density can be obtained (Proctor test result); w_o = water content of the sample at its original state
- UCS = unconfined compression strength test result at a deformation of 10 %. UCS is determined after the freezing-thawing test (F-T) and after the hydraulic conductivity test (HC).
- k = hydraulic conductivity, m/s (also: water permeability); * after freezing-thawing test
- SPo = segregation potential, calculated on the basis of frost heave test results and indicates the frost susceptibility of the test piece. The smaller SPo the better the frost resistance of the material.
- Thermal conductivity is determined according to ASTM D 5334-92 (Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure).

Table 3: A choice of geotechnical test results on mixtures on the covering course material of the different pilot structures. Crushed aggregate #0 …12 mm (the final choice for construction was #0-11 mm).

Additive[1)]	Proportion of additives[2)]	W_{opt}/ρ_d[3)]	UCS	
			28 d/90 d	28 d/90 d; and after F-T [4)]
	%	% / kg/m^3	kPa	kPa
SJ+BIE+KS	5+6+8	10,8 / 1890	210 / 210	30 / 40
SJ+kuja+CaO+KS	**5+4+1+15**	13,0 / 1850	2220 / 1980	850 / 900
SJ+mahk+CaO+KS	5+10+2+8	10,1 / 1880	1010 /910	broken /70
SJ+BIE+Ce	**5+4+4**	6,8 / 2110	3940 / 3880	1290 / 1840

The additives used for the covering courses of separate light traffic lanes was **SJ+BIE+CaO**, for others **SJ+kuja+CaO+KS**

1) SJ = filter waste; BIE = Bitumen (emulsion); KS = Fibre Clay; kuja = blast-furnace slag; CaO = lime; mahk = blast-furnace sand; Ce = cement
2) Proportion in relation to the dry weight of the crushed aggregate
3) Proctor test results: water content to obtain the maximum dry density (ρ-max); ρd = dry density for the test piece
4) After dry storage for 28 d / 90 d, the freezing-thawing test started and the UCS was determined after this test (Freezing-Thawing Resistance)
5) Like 4) but here the test was for Water Resistance

Task 4: Pilot 2003 Planning

The planning period for Pilot 2003 started at the end of the year 2002, but the height and most significant efforts of the planning were during the winter and spring period of 2003.

Year 2003 started with an introductory event for the local inhabitants to present and discuss the plans for the pilot renovation and light-traffic lanes of the municipality, in January 2003. The approval of the audience was wholehearted, especially with respect to the light-traffic lanes by the narrow main road (322) passing through the Luopioinen municipality. After this, the project group was convinced to work for solutions that meet the needs of the users of the roads.

The environmental permit applications for storage of the materials and for construction itself had been submitted in the autumn of 2002. The permit for the storage was submitted on time at the end of March 2003 (dated 28th March 2003 by the Pirkanmaa Environment Centre). The permit for construction needed to be completed with the environmental test results (see Task 1) and with a written statement about considerations of the Natura 2000 region (the lake Kukkia). Also other factors, not related to the project at all, affected the delay of this permit. The environmental permit (finally dated 3rd July 2003 by the Pirkanmaa Environment Centre) included detailed instruction in relation to the transports, storage, treatment, documentation and follow-up at the storage and test sites. The follow-up has to continue at least for two years after the pilot construction. The environmental follow-up includes sampling and analysis of water samples from available wells, and soil samples from the side of the road having fibre-ash structures, at a level under the fibre-ash structural course, and downstream of the groundwaterflow.

Otherwise, the planning work of the previous year continued without problems. The planning was carried out in a small task group of professionals from FRE, Luopioinen and the external assistant Viatek. The intensive work of the group included the detailed technical designs for the different structures, the drawing up of the work instructions, and the orders and agreements / contracts for the materials and equipment needed for the Pilot 2003 construction.

The most difficult process to plan was the light-traffic lanes (later: safety lanes) based on the broadening of the road at its both sides, because of; the cable rooting of telecommunications networks close to the road; the variable ground by the road, from steep rocks and a bridge to low and easy terrains (the project would not include any earthmoving or excavation outside the road sides); and the system to separate the safety lanes for the light traffic from the main road for motor traffic without problems for the winter maintenance. This will be done with help of raised, serrated strips. The FinnRa (Finnish Road Administration) has strict instructions about the characteristic features of light-traffic lanes, and the safety lane structures do not totally fulfil those characteristics. Therefore, it is not possible to use any official signs for light traffic at the ends of these safety lane structures. However, FRE has designed special signs to be used instead, and these have been accepted by FinnRa.

Finally, before the start of Task 5, the detailed layout for the storage and mixing area and practical details of work processes had to be planned, and education of the work force had to be carried out.

Special attention was paid to the questions concerning the assurance of occupational health and safety, and the quality assurance and control for the purposes of pilot project's follow-up.

The work and quality control instructions for the structural courses, the emphasis being on the structural course to renovate a road section and construct a ground water protection structure at Pihtisalmentie (but applicable also for the light traffic lanes) has been published in the website of the project (in Finnish: Pilottikohteiden rakennustöiden työohjeet ja laadunvarmistus, 27.6.2003). The instructions contain descriptions of the structures, time schedule for the construction, details about the material mixes and the characteristics of the components, special advice on construction process with respect to the by-products that differ from the conventional materials, description of the required quality control activities, description of the responsibilities of the participating organisations, and instructions on the actions in case of emergency or exceptional conditions.

Annex~4 gives a map about the section for the light-traffic lanes: the red dots are possible wells, i.e. water sampling points (reference samples for Task 6). **Annex~5** gives a map about the Pihtisalmentie section to be renovated with help of fibre-ash structural courses. The green lines here describe the worst damaged sites for possible renovation, and the red dots soil sampling points (reference samples for Task 6). The instructions do not include, however, any technical and detailed drawings for the structures. These have been made separately by the engineers of FRE. The figures on technical designs were published in the Technical Report of 2002 (see Interim Report), which is available in project's website.

Task 5: Pilot 2003 Construction

The physical preparations26/01/04

The delay of the construction permit (see Task 4) caused delay with the start of Task 5. With respect to the implementation of Task 5, however, this was actually a positive factor. This way it was possible to have final test results of laboratory tests (Task 1) before the start of construction. The storage of by-products at the storage site could start on time, and the preparations and processes not involving by-products could be started at test sites before the effective date of the environmental permit.

The preparations included, for example, clearing of the construction site and special pre-loading for the separate light-traffic lane planned to run on a soft soil (peat) area (**Figure 1**). More of these are described below in relevant sections.

The storage and mixing

The storage and mixing site was at the former, nowadays a closed deposit site of the municipality of Luopioinen. The situation far from any housing area makes it safe to mix dusty materials like fly ash. The mixing process proved to be successful. A part of the mixing was made with a specially constructed mixing shovel (Allu-mixer) and a part with a stack- or clampmixer (compostmixer) – see **Figures 2 and 3**. Especially the stackmixing is an interesting system for high volumes of materials. The materials can be piled into long stacks well before the mixing starts, and the new stacks can be piled behind the mixer at the pace of the progress of the mixing. The dusting of fly ash is temporary; the fibre ash is not a dusty material.

Figure 1: Pre-loading for the light-traffic lane running on a soft peat area. Pilot 2003

Figure 2: Mixing showel at work to mix crushed aggregate with filterwaste. Pilot 2003

Figure 3: Stack mixer at word to mix fly ash and fibre clay. Pilot 2003

The safety lanes based on fibre-ash

The safety lanes were constructed in general as follows: The surface layer at the road edge was cut down. The levelled base was covered with a geonet, and filled in with fibre-ash (about 500 mm). The loose sides of the geonet were folded on the fibre-ash course, and the structure was covered with a thin course of crushed aggregate. The compaction was carried out on the crushed aggregate course. **Figures 4 and 5** explain more.

Figure 4: Crushed aggregate to cover the geonet containing the fibre-ash course. The compaction will be made on the crushed aggregate. Pilot 2003

Figure 5: Compaction on the safety lane. Pilot 2003

Referring to the considerations in the description of Task 4, the design for the special signs to indicate the safety lanes is shown in **Annex~6.** The raised, serrated strips for safety lanes, and some other finishing, could not be totally finished before the snow and cold arrived in Finland. Therefore, these will be carried out during spring 2004, as soon as possible.

The construction of the pilot safety lanes was a totally new process but also the most difficult process of the project. Additionally, it was probably the most expensive structure for the project especially because lacking proper equipment it required a lot of hand work. Pending more detailed assessments, the construction of these structures gave impressions that the structure is feasible only in special circumstances or for special structures (like noise walls at critical sites / steep terrain). In case these structures will be implemented, it is important to make them before any new pavement is spread on the road.

The separate light-traffic lanes based on fibre-ash

The pre-loading to strengthen the soft ground for the light-traffic lane had to be made on two 100 metres long sections in February – March 2003 (see above and Figure 1). A filter cloth was spread on the levelled and frozen ground, and on the cloth two about 200 mm thick layers of moraine. Additionally, a 600 mm thick load embankment was spread on the former construction.

The works started at the end of July. First steps were the removal of topsoil and the levelling of the ground with help of natural aggregates (not the pre-loaded sections). The levelled ground was covered with a filter cloth, and this with 100 mm of crushed aggregates to make it possible to move with the power tools. Edge supports were constructed in order to prevent the fibre-ash spreading wider than the targeted width, and to make also compaction at edges possible. 300 mm of fibre-ash was spread on the aggregate course with help of a lorry and planer. The fibre-ash was covered with 50 mm crushed aggregate and 50 mm with filtercake-stabilised aggregate. See **Figure 6**.

The available but potentially more effective machinery was too wide for the lanes. Therefore, the spreading and compaction of fibre-ash was not sufficiently effective, and the results (like strength development of the structural courses) maybe not at the targeted levels in the future. The proper equipment for narrow sites needs to be developed.

Figure 6: A section of light-traffic lane before finishing. Pilot 2003

The structural course based on fibre-ash to renovate a badly damaged gravel road (Pihti-salmentie)

A photo of the starting condition of the badly damaged village road was taken in the spring 2003, **Figure 7**. The road is much better after construction, **Figure 8**, and we hope that this is a lasting situation. The construction of this short section (500 metres) was carried out in three days at the beginning of August 2003. The covering with filtercake stabilised crushed aggregates was made on 11th August. The process was as follows: The surface was cut and the edge supports for the fibre-ash were formed out of the surface material. Fibre-ash was transported with a lorry to the site, and spread as a 300 mm thick layer with a planer on the ground. This layer was covered with a thin course of crushed aggregate to make the compaction with a roller as effective as possible. After compaction, the fibre-ash course was 200 mm thick. Finally, the compacted structure was covered with 50 mm filtercake stabilised aggregate and compacted again. The finishing of the road edged finalised the job.

Figure 7: The village road in the spring 2003, before renovation. Pilot 2003

Figure 8: The village road in the autumn 2003, after the renovation operations. Pilot 2003

It is very important to note, that fibre-ash cannot be compacted without covering it with a thin course of crushed aggregate at first. We experienced that the process was very effective. In order

to create a full-scale operating and feasible system, the stack mixing area must be bigger and the addition of e.g. cement should be made out of a silo or other container instead of a bag.

The groundwater protection structure based on fibre clay

The groundwater protection structure has been constructed at the beginning of October ('outside' of the reporting period). Unfortunately, there are no photos, only video films, available at the moment of writing this report.

The groundwater protection structure was made at the side of the renovated road section described above. The site does not need any groundwater protection, but the objective is to make a pilot structure to test the effect of fibre clay as the sealing material. The test results (Table 2) were very promising. The pilot structure is about 30 metres long, and corresponds the structure described in the **Figure 9**. The compaction is the most demanding task in the construction of this structure.

The performance will be monitored with help of measuring the hydraulic conductivity of the structure, on site and in laboratory on drilled samples. Also thermoelements have been installed in the structure, and the follow-up of the temperature at different depths of the structure will be continuous at least for a year.

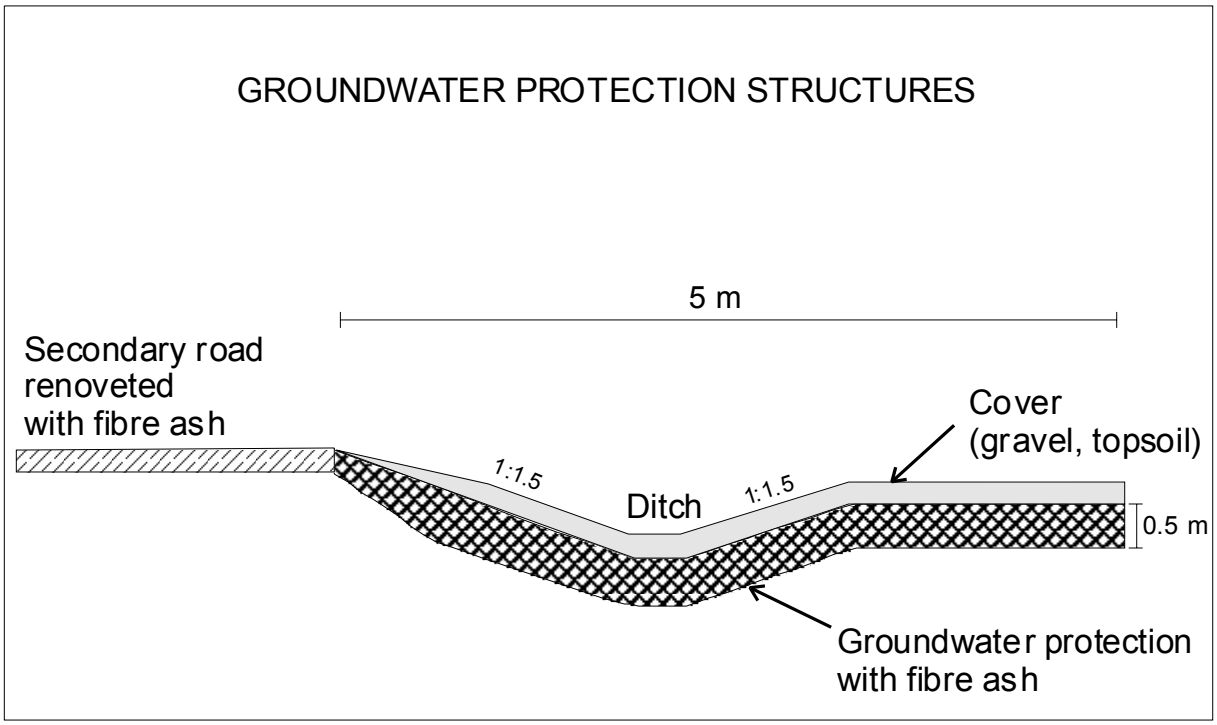


Figure 9: Groundwater protection structure. Dimensioning based on the instructions of FinnRa.

The quality control

The quality control programme was included in the work and quality control instructions. Shortly, the control programme was planned as shown in the Table 4 below. The quality control results will be compiled and presented in the technical report for Pilot 2003 (pending).

Table 4: The quality control programme in short

		Responsible	
		FRE	Viatek, SGT
Before mixing: check of the water content of the components			
	Sampling of the component batches	x	
	Determination of w [%] – to control the mix specifications		x
During the mixing			
	Follow-up of water content (of mixed batches)	x	
	Instructions to adjust the mixes / water content		x
At construction sites			
	Daily log of works (document)	x	
	compaction tests in-situ	x	
	Sampling for laboratory tests and follow-up	x	
	Measurement of the course thickness	x	
	Measurements of compaction / density	x	
	Compaction and UCS in laboratory		x
	Storage of follow-up samples and tests when required		x
Video filming, photos			x

Task 6: Impact Assessment

Pilot 2002

A part of the stabilised road "Pilot 2002" was finished by covering it with a mixture of crushed aggregates and lime-granulated filtercake in September 2002. For the follow-up of the mix characteristics samples have been taken from the covering course in order to analyse the current salt content of the material in the laboratory of Kemira.

The environmental follow-up involves analysing of well water and soil with respect to the reference analyses in the summer 2002. In 2002, the water samples were taken from 10 private wells and 3 drainage ditches close to the stabilised sections, and from soil samples at the side of the road from 7 points. In September 2003, all soil samples were taken close to the sampling points in 2002, but water samples could be taken only from 6 of the private wells. The reason is the very dry period from summer 2002 until spring 2003. The analysis results are given in tables of **Annexes~7 and ~8**. The results indicate no such changes in the road environment that are based on the existence of e.g. fly ash in the stabilised road structure.

The geotechnical follow-up of the Pilot 2002 road is planned to involve:

– Visual assessment of the condition by FRE and Viatek, each autumn: So far, there are no needs for repair of the ash-stabilised sections. Also the reference sections have stayed in a proper

condition or has only minor damage. The video taken from the road section in the spring 2003 also shows this.

- The bearing capacity measurements: The measurements in the spring 2003 were considered unnecessary. The measurements of autumn 2003 have not been done, yet. The measurements should be made during the not frozen, frozen and melted (spring) period, at least in the autumn and in the spring.
- Drill sampling of the road courses, assessment of the structural condition, and measurement of the compression strength: The first sampling has been made in September 2003. The results are pending.

All results of follow-up until the end of year 2003 will be compiled into the interim Impact Assessment Report. This is planned to be available at the end of November 2003.

Pilot 2003

The follow-up at Pilot 2003 sites include similar measurements to the follow-up of Pilot 2002, and the special measurements of the groundwater protection structure. During the reporting period, only reference samples of water from six relevant wells, and of soil from eight relevant points have been taken and analysed. The first follow-up results will be available in 2004.

3. Problems encountered

The project is about testing processes that are not established, yet. During the implementation there are surprises and events – even new needs and ideas for testing - that could not be taken into account when making the plans and budgets for the project in 2001. Thus, we have found that the time schedule and the cost budget are the major problems of the project. So far, however, the problems have not caused need for major project modifications.

4. Dissemination

Dissemination, i.e. Task 7, has been carried out like planned though without participation of any external groups in the implementation of Pilot 2003 (as well as Pilot 2002 in previous summer). The project and its results so far have been presented during several events in Europe, most widely by the beneficiary with a poster at Wascon 2003 in San Sebastian in June 2003 (**Annex~9**). The partners as well as the external assistants have been able to present and inform about the project to their stakeholders during different events and normal business operations. The latest occasion was announced by Jenni Vainio of Gapac, who attended a meeting of the environmental co-ordinators of Georgia-Pacific Europe in France in September 2003. The video production has been on-going since summer 2002, and the videofilming will continue until May 2004.

5. Envisioned progress up to 31.3.2004 (next 6 months)

Task 6: Impact Assessment

The interim Impact Assessment will be drawn up as soon as the results of the follow-up tests in 2003 have been obtained and compiled, and the results discussed. The interim Impact Assessment containing mainly the follow-up results of the year 2003, will be published at the project website. The contacts to the external specialists will be made, in order to have them as evaluators for the project.

Task 7: Dissemination

The workshop has been planned to be in connection with an international Symposium of ISEG on Environmental Geotechnology and Global Sustainable Development on 8. – 10 June 2004. The presentation of the event is given in **Annex~10**. The partners will have started the preparations for the workshop.

The Guide has been planned to be an electronic file, available at the project website, and it will be based on the experience and results during the implementation and follow-up of Pilot 2002 and Pilot 2003. The drafting of the Guide will be on-going.

The first drafts of the edited videos will be shown to the Steering Group in December 2003, and the possibility to create DVD-editions for distribution at the workshop will be discussed.

Task 8: Management and reporting

The Steering Group will have its next meeting in December 2003.

The Technical Report of Pilot 2003 will be prepared and published at the project website.

The Progress Report Nr. 3 for the period 1st October 2003 – 31st March 2004 will be prepared and submitted to the Commission in April 2004.

6. Financial issues

Cost category	Total cost according to the Commission's decision*	Costs incurred from the start date to 30.9.2003	%
1. Personnel	305.834	193.003	63
2. Travel	17.750	14.697	83
3. External assistance	415.903	324.353	78
4. Durables: total non-depreciated cost	-	-	-
- Infrastructure sub-tot.	-	-	-
- Equipment sub-tot.	-	-	-
- Prototypes sub-tot.	-	-	-
5. Consumables	417.903	342.612	82
6. Other costs	63.000	47.129	75
7. Overheads	33.797	16.329	48
SUM TOTAL	**1.253.630**	**938.123**	75

The project has met 75 % of the total budgeted costs at 30th September 2003. The Pilot 2003 construction started more than one month later than originally planned because of the delayed permit decision of the environmental authorities. The delay was mainly about the need for a more detailed survey on the impacts to the lake Kukkia, one of the Natura 2000 areas. A part of finishing works scheduled for October had to be postponed to next spring-summer because of the early arrival of cold and snow. Despite this, the task has been carried out successfully.

7. Progress until 30th September 2003 and planned activities

Following table describes the progress until 30th September 2003 and the envisioned progress for the rest of project period

LIFE02 ENV/FIN/329		Kukkia Circlet															
Tasks		2001				2002				2003				2004			
		1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T
Overall schedule	Base				**S**			**X**			**X**		**X**		**X**		**X**
	Actual				S			X			**X**		X				
1. Material tests	Base				XX	XX	XX	XX									
	Actual				XX	XX	XX	XX	XX	XX	XX						
2. Pilot 2002 Planning	Base				XX	XX	XX	X									
	Actual				XX	XX	XX	X									
3. Pilot 2002 Construction	Base						X	XX	X								
	Actual						X	XX	XX	XX							
4. Pilot 2003 Planning	Base							X	XX	XX	XX	XX					
	Actual							X	XX	XX	XX	XX					
5. Pilot 2003 Construction	Base										X	XX					
	Actual										X	XX	xx			xx	
6. Impact Assessment	Base								XX	XX	XX	XX	XX	XX	XX	XX	XX
	Actual								XX	XX	XX	XX	xx	xx	xx	xx	xx
7. Dissemination	Base							XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
	Actual							XX	XX	XX	XX	XX	xx	xx	xx	xx	xx

Start = S; Progress Report and Interim Report = X;
Base = original plans / application

List of Annexes [1]

1. Report on environmental test results. April 2003 (Finnish)
2. Geotechnical material test programme for Pilot 2003
3. Report of Technical University of Tampere on mix specification (Finnish)
4. Map on light-traffic lanes in Luopioinen
5. Map on the road renovation sites in Luopioinen, Pihtisalmentie
6. Planned sign for the safety lane
7. Pilot 2002 follow-up results on soil 2002-2003
8. Pilot 2002 follow-up results on water 2002-2003
9. Wascon 2003 Poster Presentation
10. ISEG Symposium, June 2004

[1] The annexes will not be included in the pdf-report published in project's www-pages. This is because the same information will be found in other reports as well as in the reports to be published later in 2004. This report is published in the www-pages in February 2004.