



# **Public Final Report of IST HPCN Industrial Sector Group: Construction**

[Annex to Public Final Report of ESCALATE]

ESCALATE TTN/D3.3.1 - Annex I

Margaret Cecil-Wright

IT Innovation Centre

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## Abstract

The Construction Sector Group of the HPCN-TTN Network, co-ordinated by ESCALATE, demonstrated specific and general benefits of HPCN solutions to the construction, civil engineering and water engineering industries in Europe. With member TTNs in Denmark, the Netherlands, Spain, Sweden and the UK, it presented the results of the following PSTs: 3DEMO, CAT, DVMFLOW, HIPERBUILD, HIPERWATER, IDASTAR and visCity. Industry targets included architects, building designers, HVAC specialists, urban designers and planners, water engineers, bridge designers, civil engineers and structural engineers. The Sector Group also brought together technology suppliers and developers in the areas of aerodynamics, numerical simulation, CFD (Computational Fluid Dynamics), 3D CAD visualisation and VR (Virtual Reality).

## Synopsis

The Construction Sector Group was one of the Industry Sector Groups of the ESPRIT funded HPCN-TTN Network ([www.hpcn-ttn.org](http://www.hpcn-ttn.org)). Overall, the Network helped to fund more than 170 projects which developed and produced new computing applications for a wide range of industries. Seven of these projects were affiliated to the Construction Sector Group, which was co-ordinated by the ESCALATE technology transfer node (TTN).

HPCN (high performance computing and networking) creates a virtual supercomputer by linking processors to work together on complex tasks. Some companies achieve this by networking their existing desktop PCs to work in parallel using specially adapted software. The competence of this technology to optimise processes, together with its new affordability, makes it ripe for mainstream adoption by small to medium sized enterprises (SMEs).

The Industry Sector Groups (e.g. medical, aerospace, retail, etc.) were established in the HPCN-TTN Network to enable technology transfer to take place on a European scale. Their aim was to give a 'European dimension' to public awareness of the projects' results. Each Sector Group's membership comprised TTNs with projects relevant to that industry.

The seven projects attached to the Construction Sector Group were developed for use in architecture, water engineering, bridge design, structural engineering, building design, coastal management and urban planning. The following were some of our most successful actions:

- Five projects were presented at Construmat, an international exhibition in Barcelona. This included demonstration to a select audience of 80 people at a seminar.
- A professional PR journalist was hired for the press campaign in Sweden. A two-page article in a popular scientific journal has described the HPCN-TTN Network and individual projects in the Construction Sector Group, with links to their websites.
- Four workshops in the UK, hosted by recognised industry organisations, have presented projects from Denmark, Ireland, Italy, the Netherlands, Scotland, Spain and Sweden. The audiences were professionals in the bridge design industry, the water engineering industry, the architectural industry and the building design industry.

Through these activities and others the Construction Sector Group has cultivated interest in the benefits to be gained from HPCN. We know this because our workshops have been over-subscribed and the press has been keen to publish articles about this new technology. Discussions are continuing between technology providers and end-users introduced through our activities.

The companies who were involved in the projects are leading the way as early pioneers of tomorrow's technology. The TTNs in the Construction Sector Group, acting as catalysts, have created the conditions in which further technology transfer can take place. In some cases (i.e. when they have a technical role in the new application) the TTNs are aware of progress and dealing directly with potential new end-users, but in many others technology transfer is happening without our knowledge as companies find their own routes to acquire the systems they need.

In a few years' time the systems developed in the projects, or others like them, will be mainstream. At that point we will be able to look back and say with confidence that we were proactive contributors to that process of technology transfer.

## **Construction Sector Group membership**

ESCALATE (UK) - Co-ordinator

DANHIT (Denmark)

DUTCH-TTN (the Netherlands)

ENTICE (Scotland, UK)

HIPERTTN-UPV (Spain)

PDC-TTN (Sweden).

## **Main Contact**

Margaret Cecil-Wright

Construction Sector Group Co-ordinator

ESCALATE (UK)

Tel: +44 23 80 760834

Fax: +44 23 80 760833

E-mail: [ttn@it-innovation.soton.ac.uk](mailto:ttn@it-innovation.soton.ac.uk)

## Executive Summary

The Construction Sector Group of the HPCN-TTN Network had TTN members in Denmark, the Netherlands, Spain, Sweden and the UK. They brought seven projects to the group which targeted the following sub-sectors of the construction industry:

- bridge design and aerodynamics
- building design, architecture and urban design
- water engineering

### Events and contacts

A total of 10 events were attended or organised:

- 2 major construction exhibitions
 

Spain	(Construmat)
UK	(Scotbuild)
- 2 international conferences
 

Denmark	(bridge design)
UK	(water engineering)
- 2 exhibitions of new technology
 

France	(MICAD)
Finland	(IST'99)
- 4 industry workshops
 

UK	(bridge design)
UK	(visualisation for architects)
UK	(water engineering)
UK	(visualisation for building designers)

As a result of these events the TTNs have at least 500 useful new contacts who have shown a special interest in HPCN applications.

### Press Cuttings/Publications

Ten news items have been published as a result of the following activities, with more expected after the end of the project

- Scotbuild
 

4 articles about visCity (3 local to Scotland, 1 national)
1 feature in Scotbuild catalogue
1 conference paper (HIPERBUILD)
- MICAD
 

1 article about the Sector Group and specific projects
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- Construmat
 

1 article about the Sector Group and specific projects
--
- CCWI'99
 

1 conference paper (HIPERWATER)
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- Press campaign (UK)
 

1 press release on AlphaGalileo website
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- Press campaign (Sweden)
 

1 article, national journal, about 3DEMO and other projects
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### Network synergy

Eight projects from six TTNs outside the Sector Group were promoted. These came from Austria, Spain, Ireland, Italy, France and Germany.

### **Added value of Sector Group**

By working as a team, rather than individuals, the TTNs in the Construction Sector Group achieved:

- A pan-European audience, with new contacts and markets in other countries;
- Better knowledge of the industry;
- Improvement in their technology transfer methods by learning strategies from each other;
- A larger database of contacts.

The TTNs who contributed most were the ones who gained most.

### **Conclusions**

Through the work of the Construction Sector Group and other initiatives in the HPCN-TTN Network, the conditions will soon be right for take-up of HPCN on a large scale.

The Construction Sector Group as it exists now will not be around when this take-up is apparent. It is hoped that a similar network of technology transfer experts in Europe will be enabled through the IST programme to continue this work and see it through to a satisfactory conclusion.

## Mission Statement

The overall aim of the TTNs of the Construction Sector Group was to improve the competitiveness of SMEs in the European construction industry by promoting new take-up of HPCN applications. They did this by working together as a pan-European team, demonstrating the benefits of HPCN as exemplified in projects sponsored by the European Commission as part of the HPCN-TTN Network.

## 1 Structure of the Group

### 1.1 Sector Overview

#### *Background to Sector Groups*

Within the HPCN-TTN Network initiative, Industrial Sector Groups were defined which brought together and concentrated the TTNs' experience in specific industrial areas where the usage of HPCN had been defined as a factor that could significantly improve the competitiveness of businesses.

The Sector Groups aimed to disseminate results and solutions in their specific area of industry with a view to promoting HPCN technology. The main targets were SMEs within Europe, to help them to increase their commercial advantages and their direct economic benefits.

#### *The construction industry*

The construction industry comprises many sub-sectors, several of which are involved in any major project. Unlike the auto industry, for example, where mass-production helps to cut costs, each project in the construction industry is a one-off venture with a unique combination of partners. Some projects may involve in excess of 20 partners including, for example, the client, a civil engineer and/or consultancy, an architect, a construction company and suppliers of different building materials.

Communication between these parties involves a lot of paperwork. Although the most important players use sophisticated software to work with their designs, their systems are rarely compatible with others in the chain. This lack of standardisation - particularly between CAD packages and other software - still presents a major hurdle to investment in new systems by SMEs.

That said, a survey of the industry conducted by ESCALATE in the first year of the project indicated that there was considerable interest in affordable, advanced computer applications, but information was not being transferred from research centres and the largest companies to the smaller end of the market. Many SMEs said they would like to be presented with case studies communicating the benefits of HPCN (or 'advanced IT', as they understand it).

Armed with this knowledge of the industry, the Construction Sector Group was confident that it would best achieve its purpose by targeting those sub-sectors where solutions from the HPCN-TTN Network could be demonstrated. The next step was to enable discussions to take place between technology providers and SMEs that could help them to acquire the solutions they wanted at a price they could afford.

## 1.2 Group Overview

ESCALATE (UK) was the Construction Sector Group co-ordinator. Four other TTNs were active participants in the group. A fifth, CEPBA-TTN (Spain), provided details of their coastal management project, PARAWAS, but declined to participate in the six-monthly meetings or activities. In this report, therefore, they are excluded from descriptions of the Group.

### 1.2.1 TTNs, related projects and industry areas covered

Five TTNs brought a total of seven projects to the group. Each project had a demonstrator suitable for presentation at seminars and exhibitions, and each project produced its own flyer.

TTN	Country	Projects	Industry area
DANHIT	Denmark	DVMFLOW	Bridge design/aerodynamics
DUTCH-TTN	The Netherlands	CAT	Architecture/building design
ENTICE	Scotland, UK	visCity	Urban design/planning/architecture
ESCALATE (co-ordinator)	UK	none	n/a
HIPERTTN-UPV	Spain	HIPERBUILD HIPERWATER	Structural engineering/building construction Water engineering/analysis
PDC-TTN	Sweden	3DEMO IDASTAR	Architecture/building design Indoor climate/building design

## 1.3 Market Overview

Information and communication technologies are changing society and creating new client requirements for products, processes and services. This has presented a huge challenge to the European construction industry, which is cautious and cost-conscious. Its resistance to change has afforded opportunities for non-European companies to infiltrate its traditional strongholds.

Over the last three years or more there have been several parallel initiatives in different countries, many of them government-led, aimed at raising awareness in the construction industry of the need to use IT to improve communication and processes. In some ways this helped the cause of the HPCN-TTN Network by raising awareness of the need to wake up to IT. However, while the manager of a construction site may have been considering using a PC for the first time, the HPCN-TTN Network was promoting technology that he wasn't yet ready to use.

In view of this it is not surprising that the projects in the Construction Sector Group were applicable not so much on the construction site as at the design stage. A staggering percentage of the cost of any construction is spent on design, or on work to put right defects after the construction is complete. The design stage is where the biggest savings in cost can be made.

## 1.4 Strategy

The Construction Sector Group held meetings of its members every six months. At the first meeting (November '97) the Group agreed to promote the benefits and enable take-up of HPCN in the construction industry by the following three methods:

### 1.4.1 Identification of industry's advanced computing needs

100 European organisations in the construction industry were interviewed in a survey. They were asked about existing use of IT, existing understanding of HPCN and its applications, and readiness for new take-up. While it gave us insight into the readiness of the industry for HPCN, at the same time it raised awareness of our campaign. It also provided us with a database of 100 new contacts.

### 1.4.2 Awareness creation

We used several strategies to raise awareness of the possibilities HPCN technology enables. Most focussed on the Group's projects and involved presentation of the business benefits obtained.

#### 1.4.2.1 Events

At our first meeting we agreed to present project demonstrations at the following events:

- International Symposium on Bridge Aerodynamics, Copenhagen, May 1998 (DANHIT);
- Construmat, Barcelona, April 1998 (HIPERTTN-UPV);
- Scotbuild, Glasgow, November 1998 (ENTICE).

More events were added to our list later.

#### 1.4.2.2 Website

ESCALATE hosted a website for the Construction Sector Group which provided links to project information on other members' websites. The other TTNs provided links to this from their own TTN websites.

#### 1.4.2.3 Press Campaign

In the final months of the project, each TTN participated in a press campaign with the aim to produce as many articles as possible describing the projects and the benefits enjoyed by new users of HPCN in the construction industry.

### 1.4.3 Bringing together key players

Having raised awareness, it was important to create the right conditions in which technology transfer could take place. This was achieved at events like Scotbuild, Construmat and the UK workshops, which brought together technology providers and potential end-users to view presentations of HPCN solutions and discuss routes to take-up.

In addition, in the context of the Construction Sector Group each TTN offered its services as a broker, being a first contact point for enquiries through whatever medium, including websites. In this role the TTNs ensured that interested persons/businesses met with others appropriate to their requirements whether in their own country or one of the other countries represented by TTNs in the Group.

## 2 Actions carried out

### 2.1 Dissemination material

#### 2.1.1 Demonstrators /videos

As stated earlier, each project had a demonstrator suitable for presentation at an exhibition stand or seminar. In some cases this was a video. The demonstration material was as follows:

TTN	Project	Material
DANHIT	DVMFLOW	Video (no sound) with English explanatory text
ENTICE	visCity	Video (available with English, Spanish or French voiceover)  [At workshops the end-user, Edinburgh World Heritage Trust, demonstrated from his laptop PC a number of 3D navigable models that were produced as part of a larger project to create a 3D model of the whole of Edinburgh's city centre. VisCity had a small part in this project].
HIPERTTN-UPV	HIPERBUILD	Linked PCs demonstrator
HIPERTTN-UPV	HIPERWATER	Linked PCs demonstrator
PDC-TTN	3DEMO	Video  Digitised video/film clips (suitable for use in PowerPoint presentations)  3D navigable model suitable for demonstration in visualisation environment - e.g. their own 3D Cube, a 'CAVE' or a Reality Centre
PDC-TTN	IDASTAR	Demonstration from laptop PC

#### 2.1.2 Flyers and other printed material

The TTNs produced a large amount of material (flyers, press releases, posters for exhibition stands, invitations to events, etc.), much of it for use in their own countries. This material included the following:

- At least one flyer for each project (plus some translated into Spanish);
- Posters at Scotbuild and Construmat stands;
- Press releases allied to TTN presence at Scotbuild and Construmat;
- Flyers for the events we organised;
- General press release for Sector Group press campaign;
- Swedish press releases for press campaign;

- Delegates' packs for all participants in the four UK workshops;
- TTNs' official reports of Scotbuild, Construmat and UK workshops;
- Academic paper (about HIPERWATER) for CCWI'99 conference; and
- Web pages describing projects and workshops.

### 2.1.3 Web pages

In addition to the main website for the Construction Sector Group (described in 2.3 below), each of the TTNs had a Construction section on their own website, with a link to the main site and, in some cases, links to construction projects on the respective TTNs' websites.

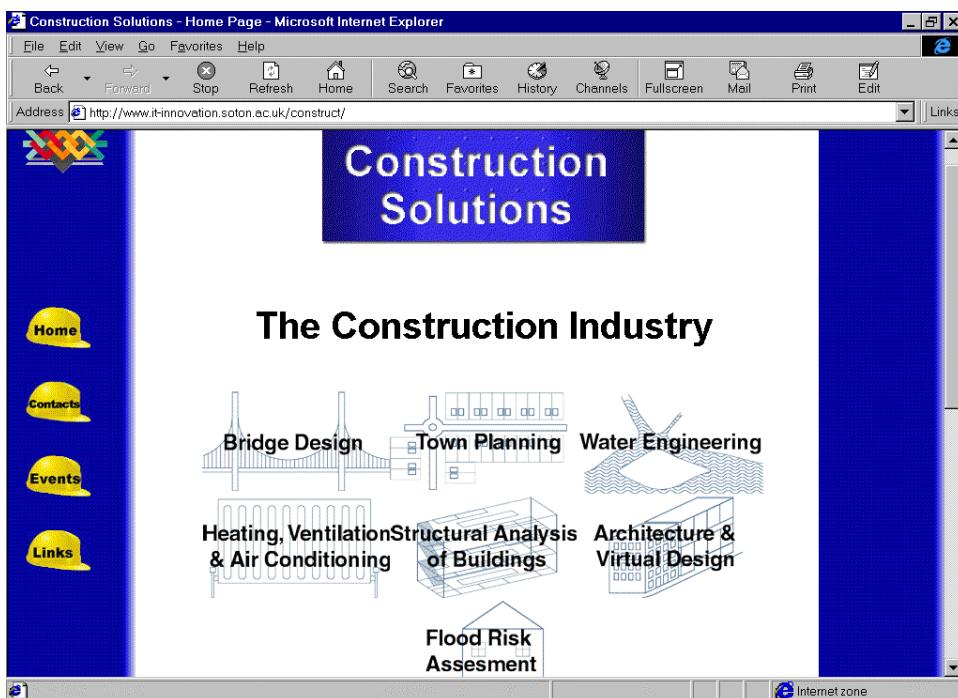
## 2.2 Events

Event + date	Country	Projects demonstrated	TTNs involved
International Bridge Symposium <b>May '98</b> Major three-day event, 288 delegates from bridge engineering/ construction/ maintenance industry, of whom 80 were non-Europeans.	Denmark	DVMFLOW HIPERBUILD	DANHIT ESCALATE HIPERTTN-UPV
Workshop: 'Simulation Methods for Aerodynamics and Wind Loading in Bridge Design' <b>November '98</b> Hosted by the Institution of Civil Engineers, in London. Rated as a CPD (Continuing Professional Development) course. Capacity audience (70).	UK	DVMFLOW	DANHIT ESCALATE
Scotbuild (Exhibition stand and private seminar) <b>November '98</b> UK's major construction event for 1998, covering three days and attracting around 5,000 people.	UK	VisCity IDASTAR DVMFLOW HPCN-WOOD	ENTICE PDC-TTN DANHIT ESCALATE
MICAD (Exhibition) <b>February '99</b> Four-day show, Paris, included more than 600 companies and attracted 29,298 professional visitors.	France	HIPERBUILD visCity	HIPERTTN-UPV ENTICE

Event + date	Country	Projects demonstrated	TTNs involved
<p>Construmat (Exhibition stand and private seminar)</p> <p style="text-align: center;"><b>April '99</b></p> <p>Greatest fair in Spanish construction sector, lasts a week. More than 3,000 exhibitors and 216,000 visitors. 201 useful contacts..</p>	Spain	3DEMO IDASTAR CAT HIPERBUILD visCity	PDC-TTN DUTCH-TTN HIPERTTN-UPV ENTICE
<p>Workshop: 'Versatile Visualisation - virtual models for building design and functionality'</p> <p style="text-align: center;"><b>April '99</b></p> <p>One-day event in University College London's VR Centre for the Built Environment. Near-capacity audience; delegates represented architects, design consultants, consultant engineers, software developers, academics with an interest in visualisation and client organisations.</p>	UK	visCity 3DEMO CAT Supermarket Airflow MOB3D	ESCALATE ENTICE PDCTTN DUTCH-TTN ICETACT
<p>CCWI'99 (International conference for the water industry)</p> <p style="text-align: center;"><b>September '99</b></p> <p>HIPERTTN-UPV presented a paper about HIPERWATER and had exhibition stand. More than 100 delegates.</p>	UK	HIPERWATER (conference paper + demo)	HIPERTTN-UPV ESCALATE
<p>IST'99 (Architecture stand at this event)</p> <p style="text-align: center;"><b>November '99</b></p> <p>Showcase for EC project successes. Construction Sector Group press campaign launched with press release.</p>	Finland	visCity 3DEMO HiPEC MOB3D	ENTICE PDCTTN ESCALATE
<p>Workshop: 'Riding the Tide of Computational Technology - technology and tools for problem solving in the water environment'</p> <p style="text-align: center;"><b>December '99</b></p> <p>Hosted by HR Wallingford, a leading UK water research organisation. Rated as CPD (Continuing Professional Development) course. Delegates represented water supply companies, consultants, civil engineers, software providers, academics with an interest in water engineering and client organisations.</p>	UK	HIPERWATER DESIREE	HIPERTTN-UPV NOTSOMAD ESCALATE

Event + date	Country	Projects demonstrated	TTNs involved
<p>Workshop: 'Visualising the Future - advanced computing in building design'</p> <p style="text-align: center;"><b>March '00</b></p> <p>Hosted by SGI, with parallel sessions in conference room and Reality Centre. Co-organised by BEPAC. Capacity audience (50). Delegates: architects, design consultants, consultant engineers, software developers, academics with an interest in visualisation and client organisations.</p>		visCity  3DEMO IDASTAR  CAT  Parallel PHOENICS	ESCALATE  ENTICE  PDCTTN  DUTCH-TTN  TTN@GMD

## 2.3 Web site



ESCALATE hosted and maintained the website. The home page invited visitors to go straight to the pages relevant to their own area of the industry. These pages described the TTNs' projects in detail and gave general information about events and useful links relevant to that sector. Buttons at the side took visitors to a comprehensive international events page covering all areas of construction, or to a page giving links to websites with useful information for the industry.

Web statistics showed that peaks of visitor activity took place after mailshots had gone out advertising our UK workshops.

## 2.4 Direct mail actions

The following are the mailings sent out to 50 people or more in connection with Construction Sector Group activities:

Sent by + date	What was mailed	Recipients	No. sent
ENTICE October '98	Invitation to their stand at Scotbuild	Architects	350
ENTICE October '98	Invitation to their stand at Scotbuild	HVAC consultants	70
CIBSE October '98	Invitation to ENTICE's stand at Scotbuild	Scottish members of CIBSE	800
HIPERTTN-UPV March '99	Invitation to Construmat stand and seminar; project flyers; seminars timetable	Spanish enterprises in construction	375
University College London March '99	Flyer/registration form for Workshop: 'Versatile Visualisation'	UCL 'built environment' mailing list; VR special interest groups	500
HR Wallingford October '99	Flyer/registration form for Workshop: 'Riding the Tide of Computational Technology'	HR Wallingford's mailing list	1,300
BEPAC February '00	Flyer/registration form, programme and speakers' list for 'Visualising the Future'	BEPAC members and associates in the area of building design	850
ESCALATE March '00	Invitation to 'Visualising the Future'; flyer/registration form; prog and list of speakers	Various, carefully targeted from previous contacts .	50

## 2.5 Synergy with other TTNs

Where appropriate, the Construction Sector Group promoted projects belonging to TTNs that were not members of the Construction Group.

TTN	Project	Project Description and Circumstances used
ATTN Austria	HiPEC	Visualisation System Supporting Networked Electronic Commerce <ul style="list-style-type: none"> <li>• Flyer distributed to all delegates at 'Versatile Visualisation' workshop in London, April '99</li> </ul>
ATTN Austria	HPCN-WOOD	Digital Image Processing for Grading in Wood Industry <ul style="list-style-type: none"> <li>• Was demonstrated, and flyer distributed at ENTICE's stand at Scotbuild</li> </ul>
CEPBA-TTN Spain	PARAWAS	Computational analysis/simulation for coastal management <ul style="list-style-type: none"> <li>• Flyer distributed at 'Riding the Tide' workshop, UK, December '99</li> </ul>

TTN	Project	Project Description and Circumstances used
		<ul style="list-style-type: none"> <li>• Flyer made available to all TTNs in the Construction Sector Group for distribution in press campaign</li> </ul>
ICeTACT Ireland	Supermarket Airflow	<p>CFD application for retailers to assess best location for refrigerators</p> <ul style="list-style-type: none"> <li>• Dublin technology developer, ESI, presented results at the 'Versatile Visualisation' workshop in London, April '99</li> </ul>
NOTSOMAD Italy	CAPP	<p>Simulation of percolation processes - e.g. for coffee or soil contamination</p> <ul style="list-style-type: none"> <li>• Mentioned, with URL, in article published in Sweden as part of Construction Sector Group's press campaign</li> </ul>
NOTSOMAD Italy	DESIREE	<p>Flood risk evaluation system</p> <ul style="list-style-type: none"> <li>• Presented by technology developer at water engineering workshop, UK, December '99, and flyer distributed to all delegates</li> </ul>
PROHPC France	MOB3D	<p>Web based 3D interior design for furniture retailers</p> <ul style="list-style-type: none"> <li>• Flyer distributed to all delegates at 'Visualising the Future' workshop in London, April '99</li> <li>• Sponsored by ESCALATE to attend/exhibit at IST'99</li> </ul>
TTN@GMD Germany/UK	Parallel PHOENICS	<p>A CFD application developed as part of the DOWNPORT project, for simulating airflow in rooms</p> <ul style="list-style-type: none"> <li>• One of the technology developers, CHAM, presented this at the 'Visualising the Future' workshop, UK, March '00. Flyer distributed to all delegates.</li> </ul>

## 2.6 Listening to industry

### 2.6.1 Meetings with industry

In the first year of the project, ESCALATE had meetings with leading organisations in the UK construction industry, to identify their understanding and potential use of HPCN and to advertise the fact that we were part of a major campaign to promote its use.

- Inner City Enterprises
- Gardiner & Theobald
- MACE (Management & Construction Engineering)
- Prudential Portfolio Managers
- BICC

We also talked to the following, existing contacts who provided input to the work of the Construction Sector Group

- David Leonard, Taywood Engineering - accepted our invitation to attend the TTN Network meeting in Lyon, in May '98. He provided useful input and advice to the Construction Sector Group meeting about current use of advanced IT by the industry.

- George Stevenson, Advanced Visual Technology - manager of the Building Information Warehouse, a web site for the construction industry. Also on the board of Construct IT, an influential body within the industry. George Stevenson chaired the 'Versatile Visualisation' workshop for ESCALATE in April '99

### 2.6.2 Industry survey

In the first year of the project, ESCALATE commissioned a survey by IFF Research. The aim was to generate a database of 100 contacts, and to obtain information on use of HPCN by the construction industry, views on its performance and barriers to take-up. We also used it to identify issues that the SG could address with workshops or seminars. The survey was done in two parts: the first part interviewed organisations involved in EC projects, current or recent; the second part interviewed 50 SMEs in the UK selected from the New Civil Engineer's Annual Consultants' file.

While we learned about the needs and expectations of the construction industry, the survey raised awareness in the interviewees that a major project was underway to encourage take-up of HPCN for the benefit of the European construction industry at large.

### 2.7 Press campaign

Our European press campaign was launched at IST'99, Helsinki, in November '99.

ESCALATE produced an illustrated, four-page flyer/press release detailing the objectives of the HPCN-TTN Network and the Construction Sector Group, and describing the projects within it. Contact details were provided.

The TTNs exchanged flyers of their projects and each TTN (except ENTICE, whose commitment to this group was complete) had a plan to approach the press in their own country.

## 3 Achievements and Outcomes

The overall aim of the Construction Sector Group was to improve the competitiveness of SMEs in the European construction industry by promoting new take-up of HPCN applications. By working together as a pan-European team we achieved far more than we could have done as individual TTNs, demonstrating the benefits of HPCN (as exemplified by our projects) to a wide cross-section of the European construction industry.

Although technology transfer was our ultimate aim, we did not have products that end-users could buy. Instead we had demonstrations of applications that could be developed into products through collaboration between end-users and technology developers. Through contacts made in our activities we have helped to create a new interest in HPCN that will undoubtedly result in many of these applications - or systems like them - becoming mainstream within a year or two.

### 3.1 Industry feedback

We received many positive comments from industry regarding our activities. Perhaps the greatest compliment came from Richard Lonsdale, AEA Technology, one of the speakers at the water industry workshop in the UK. He said our workshop was more useful in terms of contacts than the recent IWEX Exhibition, the UK's leading event for the water industry.

For the PSTs, the most encouraging comment came from Per Sahlin, of BrisData, partner in the Swedish IDASTAR project. After the building design workshop in the UK, he said, *"By sheer luck I met somebody from the 'other' track that was an extremely interesting contact and I will most likely follow this up with another visit. So the trip was definitively worthwhile."*

At all four UK workshops more than 50% of participants completed questionnaires and feedback overall was very positive. Although the participants had different levels of technical knowledge, nearly all found the presentations were pitched at the right level. All reported that the event was useful, and many had made new business contacts that they intended to follow up afterwards.

### 3.2 Publications

At the time of writing we are still obtaining results from the press campaign. The following publications are the ones we are aware of which came about through Construction Sector Group activities.

TTN and date	Name of publication	Description of feature	Projects featured
ENTICE August '98	Project Scotland	Article - 'How to deal with an Image Problem'	visCity
ENTICE September '98	New Civil Engineer	Article - 'Visual Aid'	visCity
ENTICE November '98	Scotbuild exhibition catalogue	Description of ENTICE's stand	visCity
ENTICE Winter '98	Building Matters (magazine)	'The Edinburgh Old-Town Anew'	visCity
ENTICE December '98	Edinburgh Evening News (daily newspaper)	'The Amazing Software...'	visCity
ENTICE October '99	Technology Ventures (Scottish science & technology journal)	Article - 'Past Points Way to the Future'	visCity
HIPERTTN-UPV February '99	Conference paper for MICAD'99, Paris	'Parallel Computing & 3D Structural Analysis of Buildings'	HIPERBUILD
HIPERTTN-UPV April '99	CIC Información	Article	HPCN-TTN Network + Construction PSTs
HIPERTTN-UPV September '99	Conference paper for CCWI'99		HIPERWATER
ESCALATE February '00	AlphaGalileo website <a href="http://www.alphagalileo.org">www.alphagalileo.org</a>	Press release about Construction Sector Group	all
PDC-TTN February '00	Aktuell Fou (popular scientific magazine)	2-page illustrated article, focussing on individual projects in Construction Sector Group	3DEMO HIPERWATER HIPERBUILD IDASTAR CAT CAPP

### 3.3 European dimension

Through our activities we have advertised the benefits of construction-related HPCN projects to clients, potential end-users and technology providers in their own countries and outside. Due to lack of commitment from the Dutch-TTN, we cannot report that anything was achieved for non-Dutch projects in the Netherlands, although their project, CAT, received coverage in Spain, Sweden and the UK.

[Construction Sector Group projects in bold]

Project	Denmark	Finland	France	Spain	Sweden	UK
<b>3DEMO</b> (Sweden)		✓		✓		vv
CAPP (Italy)					✓	
<b>CAT</b> (Netherlands)				✓	✓	vv
DESIREE (Italy)						✓
<b>DVMFLOW</b> (Denmark)	✓					✓
HiPEC (Austria)		✓				✓
<b>HIPERBUILD</b> (Spain)	✓		✓	✓	✓	
<b>HIPERWATER</b> (Spain)					✓	✓
HPCN-WOOD (Austria)						✓
<b>IDASTAR</b> (Sweden)				✓		vv
MOB3D (France)		✓				✓
Parallel PHOENICS (Germany)						✓
Supermarket Airflow (Ireland)						✓
<b>VisCity</b> (UK)		✓	✓	✓		✓

### 3.4 Lessons learned

Because we worked as a group, we learned from each others' experience, avoiding the need to repeat the same mistakes. The most useful lessons learned were:

### 3.4.1 Having a stand at large exhibitions

- Opportunity for press release and almost certain press coverage;
- Own seminar within the event can identify those with real interest.

### 3.4.2 Organising a workshop

- Requires at least three months and 30 person days to set up;
- Must target on specific area of industry, with clear reasons for doing so;
- Best done in collaboration with recognised industry organisation that has established credibility with audience and large database of suitable contacts;
- Delegates will be attracted to hear speakers from leading companies; these will set HPCN projects in context of industry as a whole;
- Targeted mailshot with personal letter of invitation and clear information about the programme has higher success rate than mass mailing. [Although ESCALATE sent fewer workshop invitations than the industry hosts, our percentage success rate was around 10% higher - although in each case this only produced around 5 participants - not enough on their own.]

### 3.4.3 Press campaign

- Working alone without professional support has no guarantees of success;
- Journalists/publications don't acknowledge receipt of press releases;
- Material might be used, but unless you buy the journal you won't know;
- PR agency/journalist costs money but they are experts and they will achieve results.

## 3.5 Added value of the Sector Group

The Construction Sector Group provided

- A pan-European audience for our projects;
- A portfolio of projects for each member TTN, attracting a greater interest than one or two alone;
- Opportunity for TTNs to learn strategies from each other and improve their methods;
- A larger database of contacts for each TTN;
- Through exposure to work in similar projects to their own (especially those involving visualisation) TTNs gained additional knowledge of industry's main interests;
- Opportunity for synergy between partners in different projects, when they met at events;
- Better credence with industry;
- New contacts and markets in other countries.

## 4 Future

The Construction Sector Group ceased its activities at the end of the HPCN-TTN project on 31 March 2000. The website will remain live but unmaintained for six months before closure.

Most of the TTNs with projects in the Construction Sector Group (i.e. all except ESCALATE) are expected to continue their work in the areas defined by their projects in the HPCN-TTN Network. Their aspirations for the future are described in the Appendix in Section 6.

Through leadership of this group, ESCALATE has gained an important insight into the construction industry, raising our credibility in the sector and making some very useful contacts. Already, we have started a new construction-related project, funded in the Framework 5 IST Programme (ROBOSENSE, producing a robot to place sensors on dams at risk from earthquakes) and we look forward to further work in this sector.

## 5 Conclusion

The HPCN applications we have been promoting, or very similar ones, will be mainstream in a couple of years or more. The Construction Sector Group has helped pave the way for this to happen by promoting the benefits across a wide cross-section of the industry, in some cases (e.g. bridge design and water engineering) reaching right into the heart of the international community where these issues will continue to be discussed.

After three years of being drip-fed with information from different sources (including the efforts of the other Industry Sector Groups and the Network press campaign), the construction industry has a greater awareness of what HPCN is achieving. The conditions will soon be right for take-up on a large scale.

The Construction Sector Group as it exists now will not be around when this take-up is apparent. Moreover, the European construction industry has a continuing need to be informed and enabled to take up HPCN solutions. Further dialogue between TTNs and industry will be crucial to continued technology transfer, especially if SMEs are not to be left behind. This work needs financial support. We hope that all the lessons learned in the HPCN-TTN Network may be put to good use, perhaps through a similar network of technology transfer experts, to see this work through to a satisfactory conclusion.

## 6 Contact points

### 6.1 Sector Group Leader

ESCALATE (UK)  
 Margaret Cecil-Wright  
 Tel: +44 23 8076 0834  
 Fax: +44 23 8076 0833  
 E-mail: [ttn@it-innovation.soton.ac.uk](mailto:ttn@it-innovation.soton.ac.uk)

### 6.2 Participants

DANHIT (Denmark)  
 Jorgen Moth  
 Tel: +45-358-78889  
 Fax: +45-358-78990  
 Email: [danhit@uni-c.dk](mailto:danhit@uni-c.dk)

DUTCH-TTN (Netherlands)  
 Jan Willem Tellegen  
 Tel: +31-33-422-0230  
 Fax: +31-33-422-0231  
 Email: [platform@hpcn.nl](mailto:platform@hpcn.nl)

PDCTTN (Sweden)  
 Marina Backer Skaar  
 Tel: +46 8 790 9778  
 Fax : +46 8 24 77 84  
 Email: [pdcttn@pdc.kth.se](mailto:pdcttn@pdc.kth.se)

ENTICE (UK)  
 Mark Sawyer  
 Tel: +44 131 650 5030  
 FAX: +44 131 650 6555  
 Email: [ttn@epcc.ed.ac.uk](mailto:ttn@epcc.ed.ac.uk)

HIPERTTN-UPV (Spain)  
 Tel: +34 94 4892400  
 Fax: +34 94 4892460  
 Email: [jose@labein.es](mailto:jose@labein.es)

## Appendix: Individual contributions of TTNs

### 6.3 DANHIT (Denmark)

DANHIT was a full member of the Construction Sector Group for just a year, from its first meeting in November '97 until November '98. Their project, DVMFLOW, did not meet its technical objectives, but its aims were of interest to the international bridge design community. The Construction Sector Group used this to advantage when they organised an international workshop in the UK presenting the status of HPCN in aerodynamics simulations to bridge designers.

#### 6.3.1 Actions carried out

In May '98, DANHIT contributed global services funding and administrative effort which enabled the Sector Group to attend an International Bridge Symposium in Copenhagen. The Sector Group had an exhibition stand and demonstrations (HIPERBUILD and DVMFLOW) and made itself known to bridge design engineers.

#### 6.3.2 Achievements and outcomes

*This TTN has not supplied details of achievements and outcomes. They ceased membership of this Sector Group eighteen months earlier.*

#### 6.3.3 Conclusion

## 6.4 DUTCH-TTN (The Netherlands)

DUTCH-TTN was a full member of the Construction Sector Group for the whole duration, from its first meeting in November '97 until March '00. They participated with the CAT ('Cave' Application Trials) activity and attended all five of the six-monthly meetings.

### 6.4.1 Actions carried out

The Dutch-TTN's 'CAVE' applications, particularly those with the end-user Dutch company Zegelaar & Onnekes, were of interest to the building design community. Albert Zegelaar was a keen participant/speaker in two of the UK workshops: 'Versatile Visualisation' and 'Visualising the Future'.

The Dutch-TTN helped in the organisation of the 'Versatile Visualisation' workshop. They paid for two of their end-users to attend as speakers. Their technical expert came over to the UK in advance to ensure that the demos were compatible with UCL's equipment.

### 6.4.2 Achievements and outcomes

*This TTN has not supplied details of achievements and outcomes. Their final review was on 13 January, before this report was prepared.*

### 6.4.3 Conclusion

## 6.5 ENTICE (Scotland)

ENTICE was a full member of the Construction Sector Group for the whole duration, from its first meeting in November '97 until March '00. They participated with the visCity PST activity (originally named VISAGE) and attended all five of the six-monthly meetings.

### 6.5.1 Actions carried out

ENTICE carried out the following actions:

- **ScotBUILD** - Organisation of the Sector Group presentation at ScotBUILD 98 exhibition. This featured demonstrations from visCity, IDASTAR, DVMFLOW and Europort (European Porting Project). Two seminars (visCity and IDASTAR) were held to coincide with ScotBUILD. There were 43 contacts generated at the exhibition and the seminar. The seminar had 14 participants of which 10 returned a questionnaire.
- **MICAD** - This Paris event was attended by ENTICE with their visCity demonstrator [HIPERBUILD from HIPERTTN-UPV, also attended from the Construction Sector Group]
- **Construmat** - ENTICE supplied a demonstration of visCity. A Spanish version of the flyer was produced.
- **Workshops** - Jon Mengham of the Edinburgh World Heritage Trust (end-user in the visCity project) has given two talks at UK workshops organised by the Sector Group leader.

### 6.5.2 Achievements and outcomes

As a result of involvement in this Sector Group ENTICE generated new contacts (around 20 genuinely interested contacts) and expanded their total database of contacts in this area to approximately 450.

They gained useful knowledge of the visualisation requirements of the industry, which has been put to use in preparing a major IST proposal.

Requests about the service offered by visCity are being followed up.

### 6.5.3 Conclusion and assessment

ENTICE viewed its involvement in the Construction Sector Group as more likely to have results in the long term than in the short term. Their only PST was quite specific for the end-user concerned, and a very small project (costing less than 60,000 Euros). For small projects such as this, where the local dissemination budget is very small, the Sector Group added a lot of value.

EPCC (manager of the ENTICE TTN) is interested in continuing work in the construction sector, initially concentrating on visualisation technology. EPCC has submitted a proposal under the Framework V IST programme to continue technology transfer in the area of visualising the urban landscape.

## 6.6 ESCALATE (UK)

ESCALATE, based at the IT Innovation Centre in Southampton, UK, was the leader of this group. They had no projects of their own in the HPCN-TTN Network applicable to the construction industry, but through leadership of this group gained credibility and insight into the sector.

## 6.7 Actions carried out

- Hosted and maintained main website 'Construction Solutions'
- Organised five six-monthly meetings
- Produced reports
- Enabled dissemination of projects outside the Construction Sector Group
- Surveyed the construction industry for views on HPCN
- Organised and manned exhibition stand at International Bridge Symposium, Denmark
- Organised series of four industry workshops in the UK
- Assisted ARTTIC in presenting 'architecture' demos at IST99, Helsinki
- Masterminded Construction Sector Group press campaign

### 6.7.1 Achievements and outcomes

- Construction industry database augmented by at least 600 new contacts
- Through workshop hosts and co-organisers, new working relationship with industry organisations:
  - Institution of Civil Engineers
  - UK Wind Engineering Society
  - UCL's VR Centre for the Built Environment
  - HR Wallingford
  - SGI
  - BEPAC
- In depth understanding of current use of computational technology by the construction industry, offering scope to apply this knowledge in future projects

#### *Invitation to contribute to UK government future strategies plan*

- In January '00, through an industry contact made in the Construction Sector Group, ESCALATE was invited to participate in a sub-group discussing information and communications technologies for a consultation document being prepared by the Construction Associate Programme (CAP) of the UK Government's Foresight Initiative. The CAP programme was also providing the 'futures' element of the work of CRISP (Construction Research & Innovation Strategy Panel), one of the main standing committees of the Construction Industry Board.

### 6.7.2 Conclusion

Through our leadership of this Sector Group and the successes we have enjoyed, we have earned the respect of certain sectors of the construction industry, especially in the UK. We believe that similar respect has been earned by the other TTNs in their own countries, through the activities this Sector Group has enabled them to undertake.

The European construction industry still has a need to be informed and enabled to take up HPCN solutions. This will require more work from TTNs to maintain the dialogue with industry that is so crucial to technology transfer. For SMEs to benefit, this needs financial support. We hope that all the lessons learned may be put to good use through funding to continue this process.

## 6.8 HIPERTTN-UPV (Spain)

HIPERTTN-UPV (the University of Valencia partners in the HIPERTTN project) were full members of the Construction Sector Group from its first meeting in November '97 until March '00. They had two projects relevant to the sector, HIPERBUILD and HIPERWATER, and were the most active of the TTNs attached to this Sector Group. They attended all five of the six-monthly meetings.

### 6.8.1 Actions carried out

- **International Bridge Symposium** - HIPERTTN-UPV attended in person with their HIPERBUILD demonstrator
- **CIB W78** - HIPERTTN-UPV attended this Stockholm event with their HIPERBUILD demonstrator
- **MICAD** - This Paris event was attended by HIPERTTN-UPV with their HIPERBUILD demonstrator [visCity, from ENTICE, also attended from the Construction Sector Group]
- **Construmat** - HIPERTTN-UPV were sole organisers of a TTN presence at this major Spanish event, with an exhibition stand and presentations of construction demos from four countries. They also held a seminar and, in all, made 201 useful contacts
- **CCWI** - At this international conference in Exeter, HIPERTTN-UPV presented a paper and demonstrated HIPERWATER in the exhibition area. At least three useful technical contacts were made with whom discussions are continuing regarding collaboration on improvements to the HIPERWATER system
- **Water Engineering Workshop** - HIPERTTN-UPV attended this UK workshop as speakers to present their HIPERWATER demonstrator

### 6.8.2 Achievements and outcomes

*This TTN has not supplied details of achievements and outcomes. Their final review was on 30 March.*

### 6.8.3 Conclusion

HIPERTTN-UPV reported that they had experienced added value from being part of the Construction Sector Group, in the following ways:

- The Sector Group provided support for them to attend events in other countries;
- The Sector Group provided them with a complete portfolio of different solutions, enabling them to attract a wider audience at events;
- The definition of a common methodology and sharing of information had led them to improve their capabilities.

## 6.9 PDC-TTN (Sweden)

The following is an edited version of material provided by PDC-TTN for this section. Activities that were outside the workplan of the Construction Sector Group have been removed. PDC-TTN had, in its own right, a strong interest and growing involvement in the Scandinavian construction industry.

### 6.9.1 Actions carried out

PDCTTN has been a full member of the Construction Sector Group since its beginning in November 1997 until March 2000, participating with IDASTAR and 3DEMO PST activities and participating and/or contributing to all the six-monthly meetings.

#### 6.9.1.1 Web pages

PDCTTN has links to the Sector Group web site from [www.pdc.kth.se/pdcttn](http://www.pdc.kth.se/pdcttn)

Internet update of IDASTAR demonstrator IDA indoor climate and Energy (ICE) - spring 1999

3DEMO flyer and special web page - [www.pdc.kth.se/pdcttn](http://www.pdc.kth.se/pdcttn)

#### 6.9.1.2 Participation in Sector Group events

PDCTTN has contributed to:

- Scotbuild, Glasgow, November 1998
- Construmat, Barcelona, April 1999
- 'Versatile Visualisation' workshop, London, April 1999
- 'Visualising the Future' workshop near Reading, UK, late March 2000.

In addition, PDCTTN's (delayed) VR seminar is due to take place 13 April '00. Projects from other member TTNs of the Sector Group will be demonstrated and a press conference is also planned for the event.

#### 6.9.1.3 Press releases and articles

PDCTTN has assisted in the distribution of releases for the following:

- Scotbuild (Nov 98) - IDASTAR press release
- Construction Sector Group Press Campaign - Swedish versions of press releases for their own projects IDASTAR and 3DEMO, and for other TTNs' projects in the Sector Group: CAT, visCity, Hiperwater and Hiperbuild. These have been distributed with the Construction Sector Group release as follows:

*Building & Construction* - 1 release each for IDASTAR, HIPERWATER & HIPERBUILD has been forwarded to 30 trade magazines.

Published in 'Aktuell FoU 1/00', 'Byggforskning nr 3'.

Most likely to be published in 8 more - contact and discussion is established:

- IDASTAR - 'Energy & Miljö', 'VVS Forum', 'V-Byggare', 'Aktuella Byggen'
- HIPERWATER - Stadsbyggnad, VA Aktuellt, Aktuella Byggen
- HIPERBUILD - Aktuella Byggen

*Visualisation* - 3 releases, one each for 3DEMO, VisCity and CAT to be forwarded to 15 trade magazines. Will be co-ordinated with the VR seminar in middle of April.

Will definitely be published in 'Byggforskning 3/2000' and most likely in another 4 magazines - 'Aktuella Byggen', 'Arktiekten', 'Byggindustrin' och 'Rit-nytt'.

Other magazines likely to be interested:

'Allt för Fastigheten', 'Bofast', 'Borätt', 'Bygg&Teknik', 'Byggfakta-projektnytt', 'Byggkontakt', 'Byggnadsvärlden', 'Din Fastighet', 'Fastighetsförvaltaren', 'Fastighetstidningen', 'Form' (designmagazine), 'Forum för inredning, design och arkitektur', 'Husbyggaren', 'Offentliga Rum', 'Plan Planera,bygga,bo'

IT magazines: 'Autodesk Designer', 'CAD guiden', 'Computer Sweden', 'Dagens IT', 'Ny Teknik', 'Veteskap'.

### 6.9.2 Achievements and outcomes

The overall aims for PDCTTN in the Construction sector were to:

- Disseminate benefits of HPCN technology in Scandinavian Building Construction Industry through IDASTAR and 3DEMO results;
- Have a supportive role in Construction Sector Group.

PDC identified HPCN issues in the Scandinavian building industry - to be addressed further. The topic is 'Man Machine Interface - primarily visualisation', based on results from an industry sector wide programme 'IT Construction & Real Estate 2002', implementing IT in construction and facilities management.

Two new projects have been spun off from PDCTTN activities in the construction industry. A 'sister' project to 3DEMO started in 1999. The project name is 'Virtual CAD' - linking VR and CAD. The other is a commercial project in the VR cube. The latter to be linked to 3DEMO press activities in Sweden.

From an article interest was created which later ended in formulating a commercial VR project.

### 6.9.3 Conclusion

Being a member of the HPCNTTN Network PDC-TTN has been given important support to perform technology transfer, as well as acceptance by industry. By acting as a member in a European wide network, impact in industry has been much higher than working alone. The Network has therefore provided PDC-TTN a means to enforce industrial project co-operation. The participation in a European network has further enabled new contacts and markets for the Swedish industrial partners of PDC-TTN, successful examples of this can be found in the building and construction sector.