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in the Area of Advanced Communications

Project T1003 - TWIN

GUIDELINES

for setting up

TELEWORKING CENTRES

integrating disabled people

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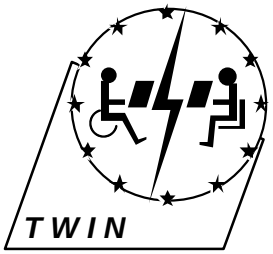

Teleworking for Impaired Persons
Evaluation of Networked Telecentres
Experiences in Europe

GUIDELINES

for setting up

TELEWORKING CENTRES

integrating disabled people

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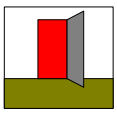
1. Introduction



- **Why these guidelines ?**

Teleworking is a fashionable word today. Terms like "information highways", "telecommuting", "working at a distance" are in the newspaper everyday. But that does not mean necessarily that everybody knows what they can really mean in practice. The issue is raising a lot of interest in the world of disability: the possibility to work at a distance is felt as a new opportunity to access the labour market, by improving flexibility and reducing the need of travelling to a workplace. As a matter of fact, very often rigid working times and stressing daily travels are major obstacles discouraging a disabled person to consider a job offer: teleworking may allow a job to be more compatible with health, personal care, accessibility and assistance need. On the other hand, concern is sometime expressed that teleworking may encourage segregation of disabled workers at their home or in sheltered environment, instead of promoting their integration in the mainstream society. This document stems from the concept that teleworking, when properly implemented, is an integrating opportunity for profitable employment; the following guidelines intend to clarify concepts, and briefly guide to properly planning a teleworking operation that integrates disabled workers.

- **Whom are these Guidelines addressed to ?**

These Guidelines originate from the experience of the European TWIN Project. They are mainly addressed at anybody who is actively involved (or is planning an involvement) in teleworking initiatives, like:

- employers who are considering to set-up a teleworking operation including disabled workers;
- disabled professionals who want to establish a teleworking operation on their own;
- professionals in the field of vocational guidance or rehabilitation, who are considering the teleworking opportunity for improving integration of disabled people in the labour market.

These Guidelines may also be useful, although not specifically addressed, to individual disabled persons who heard of teleworking and wish to get a clearer idea of opportunities, barriers and all aspects involved, so as to be better prepared to discuss with employers whenever teleworking arrangements are proposed.

- **The TWIN Project: what is it ?**

Started in January 1994 and concluded in June 1995, TWIN is one of the 43 projects launched by the European Commission within the DG XIII programme "**Telework Stimulation**". It was the only project specifically focused on disability, with the main aim of investigating how far teleworking centres can improve job opportunities for disabled workers. A substantial part of the project was devoted to monitoring real experiences of teleworking in five Countries (Italy, United Kingdom, Ireland, Greece and Finland), some of them already existing and some other promoted by the TWIN partners (appendix 1). The European Commission is quite active in promoting teleworking, as part of its unemployment fighting strategy outlined by the Delors' White Paper on "Growth, Competitiveness, Employment". The advancements in information and telecommunication (IT&T) technology and the spreading of information highways, supported by enormous investments all over the European Union as recommended by the "Bangeman Report", are easing the path to teleworking and increasing its prevalence at all levels in the labour market. From the point of view of a disabled worker, that means that more and more opportunities of teleworking are being offered in the future; and a teleworking culture will be more widespread among employers than today. The documents produced by the TWIN study (appendix 2) can be helpful for setting up teleworking experiences now, but also for better preparing the disabled workers to such a near future.

- **Can a person with disability telework ?**

Comparing teleworking for able bodied and disabled people shows that there are far fewer differences that might at first appear. In general, disability is never a critical issue for a teleworker: most (estimated 70%) persons with physical or sensory disability can perform the teleworking job without needing any adaptation to the teleworkstation. A number of persons may need minor adaptations; even for severe disabilities technical adaptations (assistive devices) are available to accommodate for much more cases that one could think. In other words, teleworking is accessible to almost any disabled worker; at the same time, by reducing mobility needs, it

is a facilitating opportunity. Setting up a teleworking operation with disabled workers does not differ substantially from the situation where only able-bodied workers are concerned. These synthetic Guidelines help to ensure that a Telework Centre be accessible to disabled as well as able-bodied workers, and identify where specific adaptations, if any, are needed to facilitate the operation by a person with a disability. More information and details can be found in the public TWIN documents and in the material listed in the References.

2. The shapes of Teleworking

- **What is teleworking ?**

This is not a handbook on teleworking. Excellent books are available on this topic (see references, appendix 5). However, some quick quotation may help the reader to better understand these guidelines. Teleworking can be defined as *"...a flexible way of working which covers a wide range of work activities, all of which entail working remotely from an employer, or from a traditional place of work, for a significant proportion of work time. Teleworking may be on either a full-time or a part-time basis. The work often involves electronic processing of information, and always involves using telecommunications to keep the remote employer and employee in contact with each other."* (Gray, et al., 1993). Teleworking is not a job, it is a way of organising the work characterised by the coexistence of the following two factors:

- **distance from the employer**
- **systematic use of IT&T equipment**.

- **How can teleworking be organised ?**

Teleworking does not necessarily means working from home: various types of implementation are possible like:

- **Home Teleworking**
  Working directly from home; often carried out in alternation (telecommuting) with traditional work at the employer site
- **Satellite Branch Offices**
  Remote units within a company; each of them being relatively autonomous and in close contact with the company headquarters through telecommunication link
- **Shared Facilities**

  Centres providing IT&T equipment, shared by workers employed (or contracted) by different companies. "Neighbourhood work centres" and "Telecottages" are examples of shared facilities
- **Mobile Work**
  Travelling workers who regularly link up with the company by IT&T; in most cases professionals whose work requires a lot of travels and a frequent information interchange with the headquarters
- **Distributed Business Systems**
  Distributed networks of offices joined through IT&T links; examples are banks, insurance and travel agencies, spreading their services throughout large areas by inter-connecting many small local offices
- **Distance Work Enterprises**
  Offering services to customers by IT&T; in this case the interaction with the client is performed by means of telecommunication links, like tele-secretariat, tele-translation or tele-renting services

- **Where is the teleworker located ?**

For the purposes of these Guidelines, key features of any teleworking operation are the worker's mobility needs, and the links to be established with the employer and the other workers. From this perspective three types of teleworking can be identified:

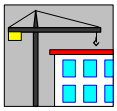
- **Nomadic Telework** (Mobile or Itinerant Work)
- **Home-Based Telework** (Home Teleworking)
- **Centre-Based Telework** (Satellite Offices, Shared Facilities, Distributed Systems, Tele-services, Distance Work Enterprises)

Very seldom a person, disabled or not, carries out pure home-based telework. It may be the case of professionals with long term work experience and sufficient entrepreneurial ability to set up their own telework operation, market themselves and relate with customers in teleworking mode. The same applies for nomadic telework.

Pure home-based or nomadic telework were felt marginal with respect to the scope of the TWIN project. Here the main focus was to address the problems of the larger population of persons with disability seeking better access to job opportunities. TWIN concentrated on **telecentres**, seen at this point in time as the more realistic environment where effective job integration can be implemented, by ensuring proper infrastructure, support services, and in-the-job training. Such support is a key issue in reducing the risk that teleworking be used as a segregating instead of an integrating opportunity.

- **What is a telecentre ?**

The concept of telecentre, traditionally considered as a physical place offering the worksites for centre-based telework, needed to be re-defined within the TWIN project in order to better reflect practical realities and specific needs of the disabled. From this perspective a telecentre must be regarded as a location from where all necessary support (technical, organisational, training, marketing etc..) is provided to a telework operation, being it centre-based at the same location, centre-based at other locations, or distributed throughout individual home-based teleworkers, and which acts as a node for the communication of the individual teleworkers. The telecentre is the core of any teleworking operation. Examples of telecentres are a office in the company supporting one individual home based teleworker and interacting with him; a team at the headquarters supporting a network of home-based teleworker; a centre where teleworkers work together and interact with clients. In the case of a freelancer (self employed) teleworking at home offering services to his customers, although the definition of telecentre is hardly applicable, a telecentre-like thinking is needed: noboby becomes a freelancer teleworker from scratch. In the following a number of guidelines are given that can help the employer to initiate a telecentre in such a way to integrate disabled teleworkers.



3. Establishing a telecentre

- **A telecentre is not primarily a physical place with technical equipment.**

It is an **organisation** capable to initiate and manage a teleworking operation, by providing all the following kinds of support:

- training and guidance to teleworkers
- work flow management
- administration and legal support
- marketing
- technical infrastructure.

Such an organisation may be achieved by:

- adapting the existing organisation of a company, or
- creating a specialised telework organisation, or
- starting a self-employed teleworking operation.

Do not forget that effective work flow inside the telecentre is substantial: the technical and human infrastructure at the headquarters should be prepared to properly interact with teleworkers.

- **Decide the kind of teleworking arrangement**

Before starting you must have already decided the jobs you want to be performed in the teleworking centre. Now, depending on your organisation and on the geographical distribution of the potential teleworkers you may want:

- to establish one or more **satellite branch offices** connected to a headquarters
- to distribute work throughout a number of **home-based** teleworkers
- to **interact** with clients through telematics

Your teleworking centre may involve just **one** of the above types or a **combination** of them. In any case at least one physical office, with some personnel and infrastructures, will be needed as a headquarters aimed to organise, distribute and collect the work to and from the teleworkers.

- **Choose the teleworking support system**

Evaluate the type of human interaction you need and the type of data that will be exchanged through telecommunication facilities. You may need support tools like:

- standard telephone (for voice interactions)
- telefax (for written data, drawings, maps, reservations, etc.)
- video-phone (for improved voice and visual interactions)
- video-conferencing (for improved voice/visual interactions among many persons)
- co-operative work platforms (for collaborative work on PC-based applications)
- electronic mail systems (for frequent medium-sized message exchange)
- bulletin board systems (for delivering information and public advertising)
- access to remote hosts (for accessing large or shared data-bases or special applications)
- access to Internet services (for world-wide information retrieval, mailing, advertising)
- access to other distributed networks (for local or specialised information exchange, retrieval, etc.)

- **Choose the proper telecommunication infrastructure**

Depending on the chosen teleworking support system, the amount of data you need to exchange weekly, and their requirements in terms of quality and speed, select one of the following alternative telecommunication infra-structures:

- **PSTN Dial-Up**[1] (Low Quality, Low Quantity, Low Speed, Low Cost)
- **PSTN Leased-Line**[2] ((High Quality, Medium Quantity, Medium Speed, High Cost)
- **ISDN**[3] (High Quality, High Quantity, Medium Speed, Medium Cost)
- **B-ISDN** [4] (Very High Quality, Very High Quantity, Very High Speed, High Cost)

- **Set the specifications of the teleworkite**

The teleworksite consists of a physical space, a layout of furniture, and a computer equipped with the proper software, hardware, and interfaces to the telecommunication infrastructure (teleworkstation). Depending on the specific job requirements, the teleworkstation may also include other tools like a separate telephone, video phone or telefax, access to remote hosts, electronic mail or Internet services. The teleworkstation may also include, if needed, special equipment or interfaces to allow a severely disabled worker to use it independently and more effectively. Aspects concerning the teleworkstation adaptation are dealt with in Chapter 5.

- **Ensure that the teleworksite is fully accessible to disabled workers**

The physical organisation of the teleworking site and its environmental characteristics (e.g. climate, lighting) have a substantial (sometime critical) importance. Particular care is required when designing it. The teleworksite has to be **accessible** to and fully **usable** by the teleworker (especially if he/she has a disability) in good safety, comfort, and independence conditions for the needed time. Specific **regulations** for environmental accessibility for wheelchair users and blind persons are provided by the legislation of most Countries. For instance, wheelchair accessibility involves space requirements (e.g. doors width, turning spaces) and accessible bathrooms; minor motor impairment (e.g. moving with crutches) benefit of the same wheelchair accessibility requirement. Basic points to consider for accessibility are:

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[1] Public switched telephone network: i.e. a normal phone line and a modem

[2] A normal telephone line dedicated to data transmission

[3] Integrated Services Digital Network

[4] Broadband Integrated Services Digital Network

for wheelchair users:

- **wheelchair accessibility from the outside**, typically from the outside car parking: absence of curbs, slopes less than 5%, ramps with handrails, walking paths and doorways wide enough to independently ride the wheelchair
- **indoor accessibility**: wheelchairs turning spaces where appropriate, accessible furniture both in the working areas and in the socialisation spaces (e.g. office kitchen), environment control equipment (e.g. automatic doors / windows) if needed
- **bathroom accessibility**: appropriate placement of toilet and wash basin, wheelchair turning space, handrails for helping independent or assisted transfer to/from the wheelchair
- **teleworkstation accessibility**: sufficient free space under the table to accommodate the wheelchair, appropriate height and placement of working desk, keyboard, monitor, printers, etc.
- **worksite lay-out**: placing the working tools (telephone, fax machine, etc.) to allow their easy access without any need to manoeuvre the wheelchair.

for workers with visual impairment:

- **orientation elements**: handrails and tactile signals where needed

for workers with hearing impairment:

- **general accessibility**: visual cues for auditory signals (e.g. fire alarms, phone bell)

Appendix 4 provides a quick summary of accessibility recommendations.

4. Matching jobs and abilities: the selection of teleworkers

- **Jobs are evolving: a fixed list can never be defined.**

  In principle any job whose output does not consist of material products is a potential candidate to telework. You should take into account that each job is evolving following the technology advances and the socio-economic developments: jobs that require the physical presence of the worker on site now, may not require it in the future. Also consider the possibility of telecommuting (part of the time on site, part at a distance).

- **Don't start from scratch. Learn from the existing experiences.**

  Many successful examples of teleworking can be found in fields like, for instance:
  - information processing
  - teaching
  - data entry
  - design
  - translation.

  Works that involve:

  - a high degree of cerebral, rather than manual, work
  - work done as an individual, or with clearly defined areas of individual work
  - a fair amount of initiative, with teleworkers given objectives and left to work with little supervision
  - measurable outputs or "deliverables" and measurable success criteria
  - no very bulky or costly items of equipment,

  have widely demonstrated to be suitable to telework. Examples of such kind of jobs are listed in Table 1.

Table 1 : examples of jobs suitable for teleworking		
Computer specialist	Sales	Customer relations
Software programming	Telesales	Client contact and support services
Software support	Sales reps	
Software design	Auctioning	
System analysis	Livestock sales	Marketing
System design	Catalogue ordering	Telemarketing
Software development		Market research
Software advice	Training / open learning	Market analysis
Computer support service	Sales training	Marketing planning
Computer technical assistance	Quality management training	
Provision of backup and disaster recovery	Research	Text production/composition
System conversion tasks	Information processing	Publication editing
	Research consultancy	Text editing
Professions	Research and analysis	Journalism / Writing
Architecture	Operational research	Proof-reading
Legal practice	Information brokerage	Word processing
Physicist	On-line database research	Text processing
Mathematics	Telephone interviewing	Technical authoring
		Videotext editing
Accountancy	Consultancy	DTP
Book keeping	Advertising consultancy	Technical publications
Accounting		Multimedia presentations
	Personnel services	Journal editing
Miscellaneous	Recruitment	Translation
Business programming		
Corrections personnel	Data processing	Design
Public safety	Data entry	Graphic design
Probation officers	Data presentation	CAD / CAM
Costs draughting	Database development	
Directory enquiries	Mailing list construction	Administration
Decision support	Insurance claims processing	Administration consultancy
Photocomposition	Insurance assessment	Pension administration
Airline reservations	Medical transcription	Mail shot administration
Forecasting	Pensions processing	Financial administrative services
Safety Security		
Public relations	Management	Secretarial services
Tachograph analysis	Supervision	Office services
Insurance agency	Project management	Mailing / Fax / Copying / Laser printing
Financial modelling	External affairs management	
Financial advice	Human resources management	Local information service
Inspection	Subscription management	Message-taking service
Employment brokerage	Mailing list management service	Facilities booking
Planning	Database management service	Typing
Production and materials planning	"Social" work	Engineering
	Telephone counselling	Development engineering
Business planning	Career counselling	Field service engineering
		Telecommunication engineering

- **Learning teleworking is not learning to work**

  In recruiting teleworkers a careful analysis of jobs and related abilities is needed, as not all people are suited to working at a distance. Teleworking is not a job in itself, but just a way of organising it: before planning any telework the worker must be qualified and experienced for that job. Before being able to carry out the job

independently, active practice with experienced colleagues may be needed. Before starting telework, consider if it would be the case of having the workers practising their jobs at the headquarters for a certain period of time.

- **The job is the issue, not the disability**

  The pure job qualification certificate may be not enough to ensure that the worker will be smart in teleworking. At this point the disability is not an issue at all: more substantial are the abilities that are really required by that job. Three dimensions should be considered:

  - **Operational abilities** (direct ability to carry out a task)
  - **Task fulfilment abilities** (e.g. self-organisation, task planning, problem solving, etc.)
  - **Behavioural abilities** (e.g. intelligence, perception, learning ability, motivation, etc.).

  When moving from a traditional working mode to teleworking, the required job-related abilities may be:
  - less, since teleworking virtually cancels any mobility need and reduces physical efforts
  - more, since some additional operational, task fulfilment and behavioural ability is needed

  Generally speaking, task fulfilment abilities and behavioural abilities are key issues in a teleworking context, even more than in a conventional (not teleworking) arrangement.

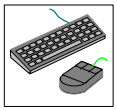
- **Learning to work is not learning to telework**

  It is obvious that teleworking requires a basic knowledge of informatics and a full command of the teleworkstation hardware and software. Where computer interfacing is to be achieved through assistive devices, additional specific training may be required. But this is not enough. The aspect of training (both basic and in-the-job training) must be carefully considered if you want your teleworkers to be really efficient. When developing a training curriculum consider at least the following points:

  - **Operational skills:**
    - Basic concepts (connections, file transfer, networking)
    - Use of telematic systems and services, e.g. Internet, BBS, E-Mail, ...
    - Software (Communication programs mastery)
    - Hardware (IT&T equipment mastery)

  - **Task fulfilment skills:**
    - responsibility
    - actions planning
    - independence

  - **Behavioural skills:**
    - psychological preparation to telework
    - group dynamics within the teleworking team



5. Customising the teleworkstation

- **Identify the critical tasks, if any**

  A job involves a number of practical tasks, like: using a keyboard, handle manual books, communicating on the phone. Most disabled persons can operate computer and telecommunication equipment without any difficulty, provided the worksite is accessible. However, it may happen that a teleworker's disability interferes with one or more tasks, so that it results difficult or even impossible with standard equipment or method. Such "critical tasks" need to be looked at carefully (see examples in table 2). There is no reason for stopping the job placement

process because a critical task is detected: a solution is almost always possible through assistive devices or by carrying out modification in the working method.

Table 2: examples of possible critical tasks

• Read printed matter
• Handle manuals or books
• Usage of speech input
• Insert cards, coins, media (disks, cassettes, etc.)
• Get tactile alerts or signals
• Get visual alerts or signals
• Get acoustic alerts or signals
• Understand speech info
• Get audio info
• Get graphics or video info
• Select objects on screen
• Read text on screen
• Usage of touch-screen
• Handle pointing devices
• Write with Braille keyboard
• Read with Braille bar
• Write on PC keyboard
• Input data and/or commands to a PC
• Use numeric keypad
• Use dial
• Lift and hold devices or handset
• Operate switches
• Identify commands or devices
• Locate commands or devices
• Access equipment
• Locate equipment

To identify the appropriate solution it is not wise for the employer or the teleworker to think alone. A variety of competencies are needed: assessment should be carried out with the help of at least a rehabilitation specialist and an assistive technology expert. Assessment services are available in many rehabilitation centres, with uneven distribution throughout Europe; the best advice on whom to contact in each Country can be obtained by contacting the national Handynet reference Centre (see appendix 3), who run their own counselling service or are networked with regional or local services.

- **Identify the critical disabilities**

The starting point for finding a solution to critical tasks is the assessment of the teleworker's disabilities. The term "disability" encompasses any restriction or lack of ability to perform an activity in the manner or within a range considered normal for a human being: for instance, walking, writing, understanding. It is quite important to analyse the nature of the specific disabilities that is behind a critical task. If the critical task is keyboarding, this may be the result of a dexterity difficulty of just the difficulty in reaching the keyboard in its standard position. It is clear that these two critical disabilities need quite different technical solutions. More in general critical disabilities may be in the area of:

- behaviour (awareness, relation etc.)
- communication (speaking, reading, listening, writing etc.)
- body disposition (retrieval/reaching objects, keeping a seating position etc..)
- dexterity (limbs, hand or fingers control etc.)
- situation (endurance, tolerance to temperature, climate, work stress etc.)

A more detailed list is given in Table 3.

Table 3: list of possible critical disabilities

According to ICIDH (the International Classification of Impairments, Disabilities and Handicaps of the World Health Organisation). Items not relevant with teleworking have been excluded from the list)

	Disabilities Classes	**Clusters**		**Sub classes**
1	Behaviour	Awareness	10	self-awareness
			11	Related to location in time/space
			12	Other identification disabilities
			13	Personal safety
			14	Related to situational behaviour
			15	Knowledge acquisition
			16	Other educational
		Relation	18	Occupational role
			19	Other behaviour
2	Communication	Speaking	20	Understanding speech
			21	Talking
			22	Other
		Listening	23	Listening to speech
			24	Other
		Seeing/reading	25	Gross visual tasks
			26	Detailed visual tasks
			27	Related activities
		Other	28	Writing
			29	Other communication
5	Body disposition	Body movement	52	Retrieval
			53	Reaching
			54	Other in arm function
			57	Other
		Other	58	Postural
			59	Other
		Daily activity	60	Environmental modulation
			61	Other
6	Dexterity	Manual activity	62	Fingering
			63	Gripping
			64	Holding
			65	Handedness
			66	Other
		Other	67	Foot control
			68	Other body control
			69	Other dexterity
		Dependence and endurance	70	Circumstantial dependence
			71	Endurance
7	Situational	Environmental	72	Temperature tolerance
			73	Tolerance to climatic factors
			74	Tolerance of noise
			75	Tolerance in illumination
			76	Tolerance of work stresses
			77	Other

- **Identify the critical impairments**

  After identifying the critical disabilities, it is important to understand the nature of the impairments originating such disability: in other words the critical impairments. The term "impairment" indicates any loss or abnormality of psychological, physiological or anatomical structure or function. Examples of critical impairments are the absence of control of the upper limbs, the blindness, the deafness. More in general, critical impairments that have an impact on teleworking may be:

  - intellectual (e.g. memory, intelligence)

- psychological (e.g. perception, attention, behaviour)
- language (e.g. language understanding, speech)
- aural (e.g. deafness, hard of hearing)
- ocular (e.g. blindness, difficulty in seeing)
- skeletal (e.g. motor impairment of the arms, hands, legs)
- others (e.g. tolerance to temperature or noise)

A more detailed list is shown in Table 4.

Table 4: list of possible critical impairments

According to ICIDH (the International Classification of Impairments, Disabilities and Handicaps of the World Health Organisation). Items not relevant with teleworking have been excluded from the list)

	Impairment Classes		**Clusters**
1	Intellectual	10-14	Intelligence
		15-16	Memory
		17-18	Thinking
		19	Other
2	Psychological	20-22	Consciousness and wakefulness
		23-24	Perception and attention
		25-28	Emotive and volitional functions
		29	Behaviour pattern
3	Language	30-34	Language functions
		35-39	Speech
4	Aural	40-45	Auditory sensitivity
		46-49	Other auditory/aural
5	Ocular	50-55	Visual acuity
		56-58	Other visual/ocular
7	Skeletal	70	Head/Trunk regions
		71-74	Mechanical and motor impairments of limbs
		75-79	Deficiency of limbs
9	Other	90-94	Generalised
		95-98	Sensory
		99	Other

- **Identify the range of possible solutions**

Now a solution to the critical task is to be sought that overcomes the critical disabilities by compensating for the critical impairments. Three strategies can be considered:

- **Accessibility:** finding a different way to perform the same task.
  Example: a voice recognition system overcomes the inability to input data and/or commands to a PC (critical task) allowing the same goal by substituting the keyboard with a different device operated by means of other ability (speech) thus compensating for the dexterity disability to use hands and fingers (critical disability) due to a mechanical and motor impairment of limbs (critical impairment).
- **Supporting device:** amplifying the impaired ability over acceptable threshold.
  Example: a video enlarging software allows to read text on the PC screen (critical task) overcoming the detailed visual task disability (critical disability) due to a visual acuity impairment (critical impairment) by supporting the residual visual ability amplifying the dimension of letters on the screen.
- **Substitution device:** removing the disability by means of a device operated by other abilities.
  Example: an operating helmet-stick allows to type on a PC keyboard (critical task) overcoming the dexterity disability to use hands and fingers (critical disability) due to an upper limb paralysis (critical impairment) by exploiting a different ability (controlling head movements).

Examples of possible solutions are listed in table 5. Appendix 5 provides a framework for accessibility to computer and telecommunication equipment

Table 5: Examples of possible technical aids overcoming critical tasks

Impairments	Accessibility solution	Supporting device	Substituting device
Aural		• amplifiers boosting telephone hearing	• visual cues for auditory signals • dialling, engaged and ring tone indicators • answering machines • telephones with text input and/or output • video-telephone
Ocular	• Braille keyboards • tactile cues on keys, switches and commands • audio or tactile feedback • standardised position for commands	• large monitor • magnifying software • magnifying lenses to read printouts and documents • image-enlarging video systems	• screen navigation through voice synthesis • Braille bars • OCR • Braille printers • acoustic signals and audio recorded info • voice recognition
Skeletal	• wheelchair accessibility • furniture layout • handset holders • book holders • remote control devices • home automation / environmental controls • automatic doors	• keyboard adaptations / improvements • mouse adaptations / improvements • switches with sensors • switch-boards • forearm supports	• keyboard emulation through alternative input devices • mouse emulation through alternative pointing devices • voice recognition • page turners
Language		• voice amplifiers	• speech synthesisers • augmentative communication systems • text telephones • video-telephone

- **Take a decision on the optimal solution**

  Generally a variety of technical solutions are possible. There is not a magic standard recipe for everybody: what is optimal for one individual or situation may be not suitable to another one. Decision should be taken case by case considering aspects like:

  - level of independence provided to the teleworker
  - reliability
  - compatibility with the hardware/software platform
  - cost effectiveness

6. Technical and organisational support

- **Prepare your technical staff to support a teleworking organisation**

  Technical failures in the remote teleworkstations or in the headquarters equipment may seriously hamper the work flow. Your technical staff should be prepared for ensuring prompt equipment maintenance and operational management.

- **Establish a Help-Desk service for teleworkers**

  Teleworkers often need assistance for troubleshooting and problem solving. An efficient help desk (hot line) should be available for them for all the duration of the working time. A log file of help desk calls management may help your organisation to continuously improve.

- **Carefully plan the work flow**

  Teleworking involves a proper work flow management (to and from teleworkers) able to:

  - organise and manage work by setting objectives and measuring results/products
  - define clear protocols so as avoid misunderstanding on the objectives entrusted

- **Establish an appropriate employment contract**

  Consider that a key characteristic of teleworking is flexibility. Standard labour contracts do not always allow the flexibility of teleworking to be fully exploited. Therefore specific agreements may be needed that focus on the results (products) of the work rather than on the working hours.
  For a disabled person this may be a very important issue, since a disability may require a different distribution of working time during the day, so as to comply with specific health and endurance problems.

- **Consider socialisation opportunities for teleworkers and their families**

  One of the major risks of teleworking is isolation; avoid such kind of problems by providing initiatives and opportunities for the teleworkers to meet and know each other and with other colleagues at the headquarters. For instance, you may plan monthly meetings to discuss work related problems or to design future actions. A good idea is also to create opportunities to involve the family of home-based teleworkers to help them to better integrate and accept telework.

- **Plan monitoring instruments**

  It is essential, especially in the initial phase of establishing telework activities, to plan some monitoring instrument, e.g. questionnaires, logs of the amount of processed information or time spent by teleworkers at the PC terminal, both on-line and off-line. A well organised monitoring instrument can help employers to better organise work flow and optimise costs, e.g. by planning data transfer hours and link scheduling, or by adopting technical strategies such as host terminal emulation, local pre-processing of large amount of data, data compression before transfer, etc..

7. Financial aspects

- **Investment costs**

  Without proper planning, equipment, training and counselling, telework projects can lead to productivity dives and confusion. Some investment is required to get it right. All the technical infrastructure needed must work with proper speed and reliability; teleworkers must have full command of their technology, otherwise they loose time and efforts in the technical operation instead of being able to fully concentrate on the contents of their job. It is not possible to define exact figures of the investment cost of a workplace for a disabled teleworker. It depends substantially on the technical / organisational support already available or on the effort needed to reconvert traditional organisation to a telework organisation. Each case is different from the others, as each worker is different from the others. Calculations should be made case by case by considering at least the following elements:

  - **physical worksite**
  - **support services**
  - **computer HW**
  - **computer SW**

- **telecommunication infrastructures**
- **telecommunication equipment**
- **telecommunication operation/management**
- **teleworkstation adaptation for accessibility**
- **assistive technology**
- **training and counselling**

For each investment element, the saving side should be considered, either for the employer (e.g. cost of physical space at the headquarters) or the employee (e.g. adapted car for transport).

- **Running costs**

  As for investment costs, each case is different from the others. Very often running costs can be kept at an optimal level if proper investments have been done so as to ensure optimal technology and optimal usage of it. An key element for minimising costs is the optimisation of the telecommunication links usage, both in terms of time spent and quantity of data exchanged. Long periods of inactivity during link (thinking time, debugging, navigation through large documents) should be avoided or planned in order to minimise the communication costs. However, for the time being it is more and more difficult to make comparison between running costs of traditional and telework organisations. Information technology is rapidly invading traditional jobs, and more and more cost-effective telematic tools are available. Again, for each running element, the saving side should be considered both for the employer and for teleworkers.

- **Pure cost of productivity considerations do not always apply**

  However, in most cases teleworking with disabled persons is not mainly motivated by a investment/running cost considerations. A range of expectations can be applied to disabled people in the workforce. Pure financial considerations should keep into account elements linked to production quality, production costs, value of human resources that would be otherwise locked. The balance with social benefits (established by the legislation of most countries for promoting job integration of disabled people) should be looked at as well, as e.g. reduction in fiscal charges for the employers or financial contributions for technology. Last but not least, there are cases where teleworking is not just an option, it is the only path to have a disabled person integrated in the workforce.

8. Marketing issues and opportunities

- **Evaluate the influence of teleworking on your marketing policy**

  If telework is just a facet of the internal organisation of your company, most probably it will affect in no way your marketing policy with respect to the customers. If you are an individual self-employed teleworker or a specialised teleworking centre, the possibility to find customers and maintain an efficient communication with them highly depends on your ability to re-design your marketing strategy in view of your teleworking.

- **Teleworking helps to put together a skilled team**

  By virtually cancelling distances, skills that are not available in one area can be "purchased" in other areas thus better allowing in principle, to build up a skilled team able to delivering a better product or service to the customer. If this is really the case, it may be worth to use it as an additional argument to qualify your work when advertising yourself.

- **A teleworker is a teleworker: disabled or not, it does not matter**

  This is not only an obvious statement of democracy: it is also an objective production consideration. The customer judges the quality of the product / service offered and not the way to achieve it. Despite cultural barriers of society towards its disabled members are on the way to disappear all over Europe, the concept that "a disabled is less productive" still takes long time to die out: less-informed customers may feel uncomfortable with the idea of committing work to disabled people, especially when quality and timing of the product are critical.

You do not need to specify to the customer that you or other members of your team are disabled. You are a teleworker, and this is enough. If for other reasons (e.g. social awareness) you want to highlight that disabled people take part in your work-force, you may need to include in your marketing policy a specific awareness campaign addressed at the customers.

- **Teleworking ignores distances**

  As for the recruitment of your work-force, teleworking gives tremendous opportunities to geographically expand your operation area. You can seek customers everywhere with a very limited need of face-to-face interaction. Traditional advertisement methods (e.g. brochures, public presentations, etc.) may not be enough for such purpose. Powerful telematic tools, like World Wide Web, are now emerging with a tremendous potential to help to make you and your services known everywhere. However, also information highways are not enough: they are already overloaded with information so that your messages may be unobserved; targeted advertisement (e.g. mailing, faxing, e-mailing, phoning) still remains important. The value of attractive brochures and personal contact, if properly conveyed, is still hard to be replaced by other means.

- **Teleworking ignores national borders**

  Consider that teleworking overcomes national borders. This means that your marketing policy can expand in principle world-wide. Think about increasing your perspectives and opportunities through trans-national telework. This obviously yields advantages (e.g. competitive prices, broader markets) and difficulties (culture and language differences, floating exchange rates, differences in the taxation, invoicing and payment systems). First of all, you have to adapt yourself to an "international" way of thinking. On the other hand the increasing turbulence of the market makes it quite necessary in the future.

9. Conclusions

Teleworking is an emerging opportunity in the labour market that can expand dramatically the possibility of profitable employment of persons with disability.

All those persons with impaired mobility resulting from a wide range of physical or sensory impairment can be considered as potential candidates to telework, in that the possibility to work at a distance can remove or overcome barriers and problems related to health conditions, safety, fatigue and stress, need for personal assistance, inaccessible transportation or architectural barriers. That means in general all the problems associated with moving from home to the workplace or from one town to another for work reasons.

Job integration is considered one of the main objectives of rehabilitation for the persons in working age, as a basis for independence, self empowerment and active participation in society. Various policies and initiatives try to address such objective in the various Countries, but consensus exists everywhere on the idea that the ultimate aim should be equal access to the largest spectrum of work opportunities rather than assisted employment in a limited range of jobs.

For the disabled, telework has to be seen as an integrated opportunity to profitable employment for a very extensive range of jobs:

- **Integrated**, because wherever a telework organisation exists the disabled teleworker can perform the same jobs as a non disabled one, the only difference being sometime in the technology adopted for controlling the teleworkstation

- **Profitable**, in that the investments for telework arrangements make sense in terms of effective (satisfactory for the user), productive (for the employer) and profitable (for both) job placement
- **Extensive range of job**, due to the ever increasing number of computer-based or computer-related jobs offered by the current trends in the Labour market.

A large part of the disabled population, but especially those with the most severe physical disabilities, are expected to get substantial benefits from teleworking, and productive resources (which today are non-productive and have to rely mainly on assistance arrangements) can be unlocked in this way for employers and in general for the benefit of society.

But some caution is required. Without proper planning, equipment, training and counselling, telework projects can lead to productivity dives, confusion and failure. Always consider that:

- **Teleworking is not the "Panacea"**
  It is not THE solution for any worker (disabled or not). It involves human, psychological, social, organisational and economical aspects, and must be carefully approached to avoid errors and frustrations.

- **Teleworking is not a segregating excuse!**
  It is just another interesting way to create new opportunities.

- **Teleworking is just one among many other possible integration opportunities**
  It must not be seen as a substitution for the job integration of disabled people in the traditional labour market. Like any other non-disabled persons, not all disabled people are suitable to telework.

- **Teleworking does not remove all barriers**
  Teleworking must never become an expedient to avoid removal of architectural, social and cultural barriers: work is just only a part of the life.

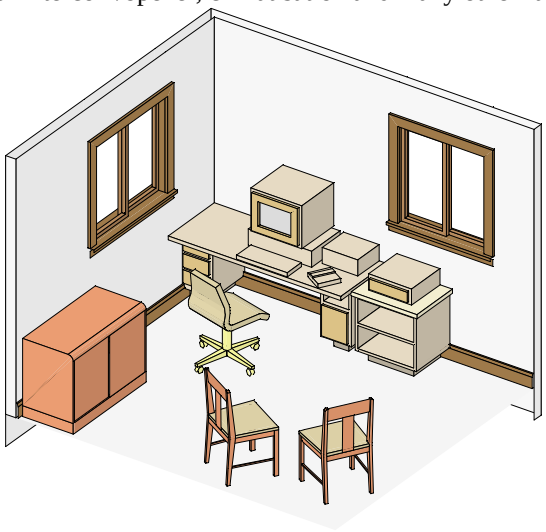
As any business operation, teleworking yields strenghts and weaknesses, threats and opportunities: you are the best judge to identify them in your specific context. A teleworking operation cannot be established in one morning from scratch, but needs a number of conditions to be set. These conditions depict the concept of telecentre. We hope you found these guidelines helpful to better understand how to initiate a telecentre. If you wish further details, most probably you will find the answer to your questions in the other TWIN reports.

Case study: Helen

Helen is an architect who has been working as a freelancer in the field of furniture design since 10 years. Two years ago she suffered a high-level spinal cord injury due to a road accident. She is now quadriplegic with very limited use of upper limbs, and drives her electric wheelchair by means of a chin-controlled joystick.

Before the accident she had already several customers, the major being a furniture factory located 200 km away from her home. She used to travel a lot to the customers, especially to the factory who was in the process to re-organise its production process by using computer aided design and manufacturing technology. Now she feels like to resume to work and started to take again contact with the previous customers. At that time the factory was seeking to outsource the design of a new line and was very willing to offer Helen a contract, since she had the right expertise. At a first glance the problem looked insurmountable and the hypothesis to perform the job in teleworking mode took shape.

Substantial was the help of a technical aids advice centre (a department of the rehabilitation centre who was looking after Helen) who carried out a detailed assessment and recommended a proper interface for controlling the personal computer in MS/Windows environment. The solution consisted of a head-mounted mouse emulator that allowed control of the cursor by lightly moving the head right-left and up-down. The click button was emulated by puffing on a pneumatic switch. With the help of some piece of software (a virtual keyboard on the screen and a mouse facilitator) Helen was able to control most Windows application, like a word processor, a spreadsheet, a CAD (computer aided design) software compatible with the CAD/CAM system of the factory, a telecommunication software. Again with the help of the technical aids centre Helen designed her new home office, equipped with wheelchair-compatible furniture, climatisation, a powerful personal computer with a modem, a telephone line independent on the home line. The office had separate entrance, so as to receive visits by customers without interfering with family life. The computer is equipped with an environmental control system running under Windows, so as to control the telephone, the lights, the curtain openers, the alarm calls, the door intercom/opener, climatisation and many other functions.



Now Helen's daily work consists of designing components and assemblies through the CAD and compiling specifications by means of a word processor and a spreadsheet. The product of the work is sent by modem to the factory according to planned deadlines. After quality checking it is implemented in the CAM system for constructing the piece of furniture. The job involves intensive discussion with other members of the design team and the production line. This is organised through:

* daily exchange of messages, through electronic mail, with the team leader and the other members of the team
* telephone meetings when needed
* exchanging by fax ideas on possible modifications to the drawings
* visiting the factory once a month for attending the team meeting and evaluating the products.

For finding updated information on materials, techniques and products Helen subscribed to some CD-Rom and on-line databases. She also takes part in architecture / design interest groups at international level in Internet.

Checklist of Helen's investment costs for her self-employed operation:

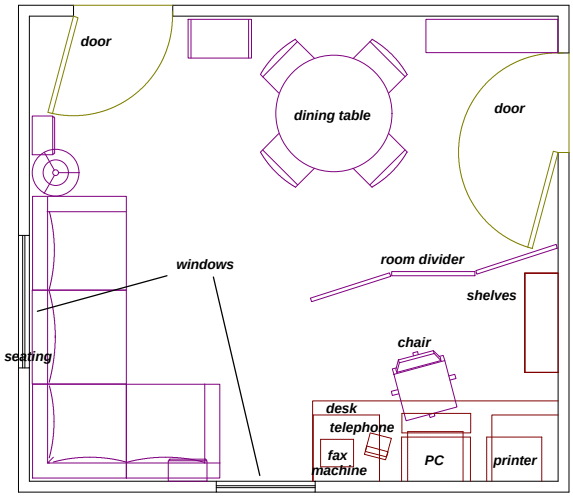
* Refurbishing the room
* building an independent entrance
* working desk with accessible design
* furniture
* personal computer
* telephone (PSTN) line, for both telephone and modem/fax
* laser printer
* assistive devices: head mouse
  virtual keyboard software
  mouse facilitator
  environmental control hardware/software (master unit)

	environmental control appliances
* software	word processor
	spreadsheet
	CAD
	telecommunication software

Checklist or Helen's running cost:
* telecom charges
* computer supplies and maintenance
* travelling to the factory once a month (wheelchair accessible taxi + personal attendant)

• Case study: Robert and Vincent

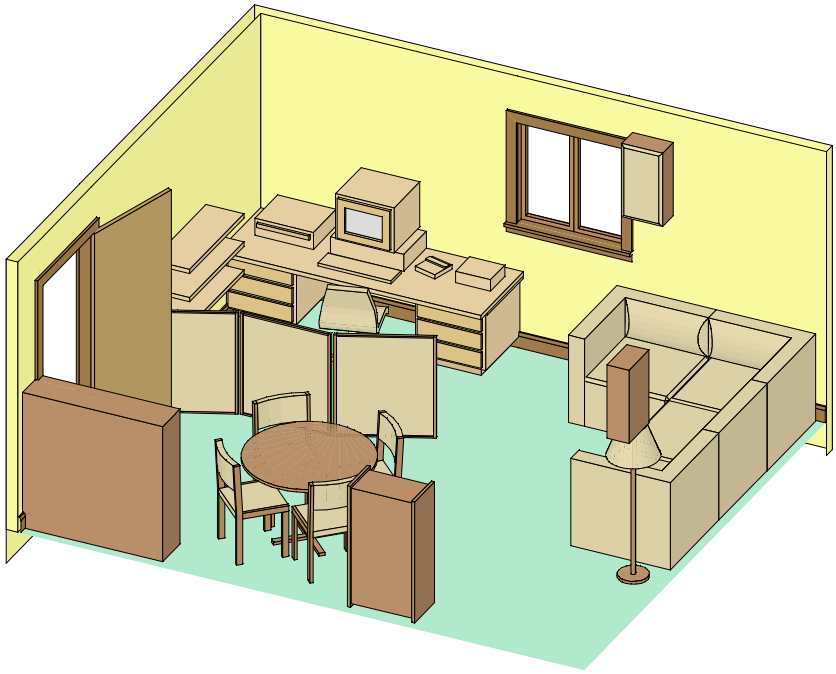
Robert is an entrepreneur who established a little firm producing electronic equipment. He employs engineers, software analysts, programmers, electronic technicians, workmen, accountants, and clerical workers. Vincent is an electronic technician with considerable experience. He leads the design of electronic circuits and the programming of the micro components. Two years ago the onset of multiple sclerosis was detected, and his health has been getting worse since then. Until now travelling to the firm and working according to the factory schedule was still possible. But now the use of a wheelchair became necessary. Robert made whatever necessary to make Vincent's worksite fully accessible for working in a wheelchair: the major intervention was the rebuilding of one bathroom (used also by other workers), the other being just minor adaptations like the substitution of some pieces of office furniture, the substitution of the table of the staff meeting room with a wheelchair accessible table, the enlargement of the office door, a small slope (4%) at the factory entrance, and a reserved parking lot for Vincent's car. Owing to this facilitation Vincent kept working full time in the factory for almost one year. In the last month his health worsened: travelling to the office has become really fatiguing. He also needs to rest at regular intervals, so he would find safer to work in the morning and in the late afternoon, instead of the standard factory timetable 8-16. Vincent's physician and Anne, the therapist, strongly recommend to save any unnecessary physical effort; on the other hand they recognise that it is quite important for Vincent to keep working, both for economical and for self-realisation reasons. Vincent's expertise is so important for the firm that Robert is willing to make any necessary investment, within available resources, to benefit from Vincent's collaboration. A possible solution was identified with teleworking.



Vincent is living with his wife and his three children in a medium-size flat. He has just completed some adaptations (especially in the bathroom and in the bedroom) that allow him to be quite independent in daily life activities. In the home he uses the wheelchair or, more often, a wheeled office chair with a lever brake that he uses by kicking by feet. Vincent decided to organise his worksite in the living room, since he and his wife preferred to leave each child (two attend university, the third high school) his personal room. On the other hand, the living room is pretty quiet for most of the day: the only rule that needed to be agreed in the family is that television can be watched only after Vincent finishes working. Vincent designed the furniture lay out in such a way to make easier the separation between working life and private life: a movable wall was the solution. With the help of a technical aids information centre some device was identified that help to be independent in any

computer and telecommunication operation. For the time being only a arm support and a large -button telephone set was sufficient, but any facilitating device can be implemented in the future to accommodate for possible deterioration of physical abilities. Basically a working space has been gained exploiting one corner of the room, away from the doors and frequently used corridors; the personal computer has been positioned such that windows light does not generate fastidious reflections on the screen or eyes fatigue due to direct light. Power and telephone socket are nearby the desk. A room divider can be used to separate the working area from the rest of the room. In case the teleworker can meet his clients near the working place, by accommodating them in the seating and eventually removing or extending the divider. The room dimensions and the furniture arrangement leave enough space for wheelchair operation and all components of the teleworkstation are easily accessible with short movements.

All the worksite was financed by Robert's firm. The equipment consisted of a ISDN line, a 486 personal computer, a set of software production tools (word processor, database, spreadsheet, e-mail) a hardware software/hardware platform allowing videoconferencing, file transfer, white-board in windows environment, a ISDN telephone/fax. At the firm another workstation was installed in the office of the head of the production unit. Now Vincent works for most of the time at home. A daily videoconferencing meeting is held with Robert and, according to a fixed schedule, with the heads of other units so as to discuss and solve design and production problems. Once a week there is staff meeting at the firm: a wheelchair-accessible cab (paid by the firm) takes Vincent to the firm. For urgent problems, whenever videoconferencing is not enough, it is more practical for Vincent's colleagues to take a car and visit Vincent at home during Vincent's working time. This is another good reason for working in the living room, where a meeting can take place in a comfortable atmosphere.



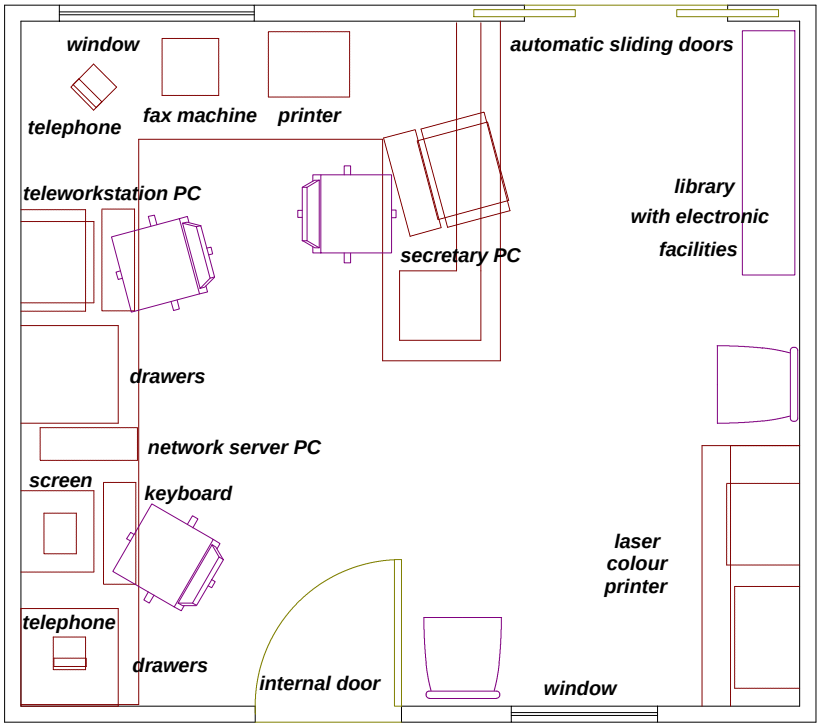
Checklist of the corporate investment cost for setting up Vincent's teleworking:
* ISDN line
* Computer
* co-operative work platform
* software production tools
* assistive devices: arm supports
  keyboard / mouse facilitating software (public domain software)
* ISDN telephone / fax machine

Checklist of the running cost
* telecom charges
* taxi for taking Vincent to the staff meetings
* time for travelling to visit Vincent for extraordinary meetings

- # Case study: John, Janet, Paul, Nigel

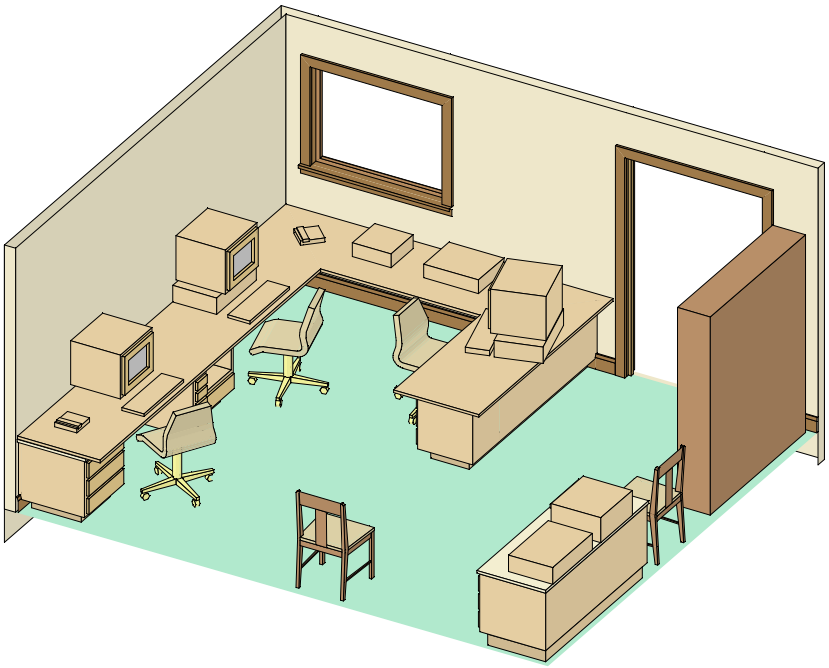
John, Janet, Paul, Nigel were student at a rehabilitation / vocational centre, where they attended rehabilitation treatment and got various kinds of qualifications in the field of office automation, desktop publishing and programming. John has just some locomotion difficulties, but three of them have severe disabilities (Janet due to muscular dystrophy, Paul is paraplegic, Nigel is blind), but have no problem in using standard computers. John and Paul can use standards PCs, Janet needs minor adaptations (a TSR software allowing one-hand keyboard and mouse control), Nigel needs to interface his synthetic-speech screen reader. All wish to find a job, but for many reasons none of them could find it in the area they live: paucity of jobs, incompatibility of jobs with transport and health problems, unsatisfactory offers etc... Since they became friends during the courses and still often meet each other when attending the rehabilitation centre, they started to consider the idea to establish their own firm (a co-operative) for running a telework operation. The legislation of that country allows benefits to co-operatives employing disabled people, like reduction of fiscal charges, financial contributions for equipment; moreover, novice entrepreneurs can benefit of a European fund for regional development to support part of the investment cost. They share this idea with the responsible of the vocational centre, who strongly supports it and convince the management of the centre to cooperate and make available legal / fiscal assistance and one room for three years. That will help a lot the teleworkers, and save a lot of time, efforts, transports. Agreement is taken that after that period the co-operative must find its seat outside because it is supposed to become a self supported enterprise.

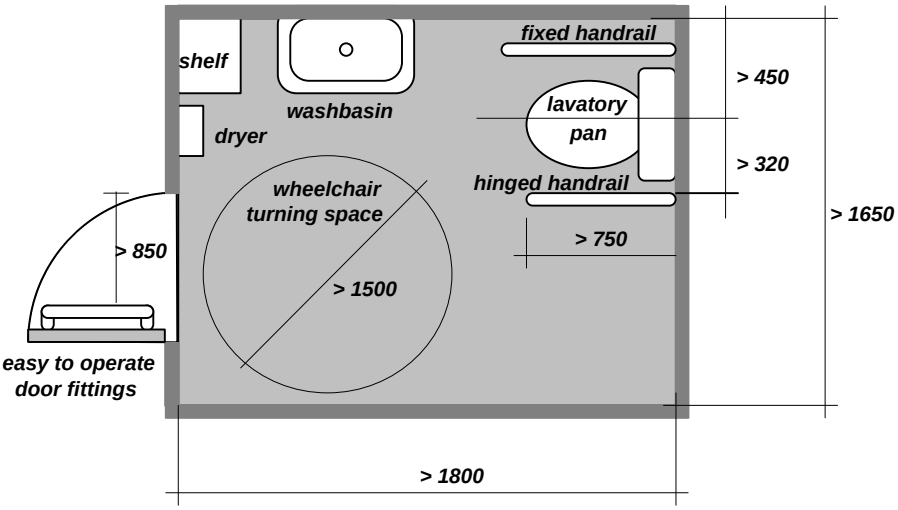
After completing the procedure for creating the co-operative, applying for public contributions, putting together a reasonable financial base, and carrying out some architectural adaptations, the office is organised. It is quite small for four workers, but It is equipped with three PC workstations linked though a local network and a server (a tower pc placed under the desk) so as to share resources (a powerful colour laser printer, a file server, a modem-fax, etc.). The space is organised so as to allow the wheelchair users easy mobility and operation. The glass doors of the outside entrance has automatic electronic control; just outside the office there are parking lots that are easily accessible to wheelchair users and to people using crutches. One of the workstations is turned towards the entrance and represents the secretary working place (Paul). Each workstation is equipped with telephone. To allow wheelchair users to reach higher shelves of the library, an electronic gear makes the upper part of the library to slide up and down. An accessible bathroom is available opposite the internal corridor. All other services available at the Centre (cafeteria, meeting spaces etc. can be reached from the inside.

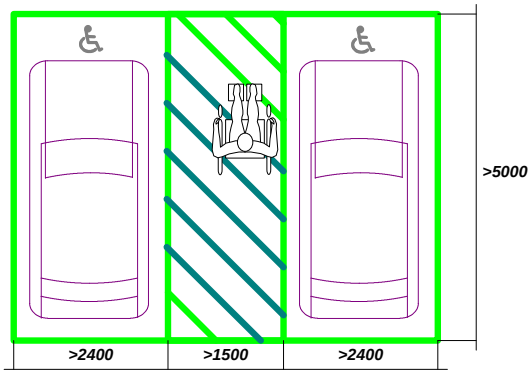


The initial service offered by the co-operative is desktop publishing of administrative forms, leaflets, brochures, announcements of congresses and courses. On request, the service includes the mailing and the maintenance of mailing lists databases. The assignment can be defined by direct interaction with the client, who visits the co-operative, or by receiving the instructions by fax or internet e-mail. Then the client is presented with the proofs and the lay out by fax, mail or transmission of graphic files. If the quality or quantity of copies exceed the possibility of the laser printer, the product is sent electronically to a typography for printing. Marketing of their

services is made through leaflets, newspapers, and more recently on a internet WWW server where they have their home page.







Checklist of investment costs:

* Refurbishing the room
* building an independent entrance with automatic door
* adapting parking lots
* building an accessible path linking the parking lots to the entrance
* adapting the bathroom
* working desks with accessible design
* powered storage cabinet
* furniture
* personal computers
* server & local area network
* colour laser printer
* telephone (PSTN) line with internal switchboard an 4 phone sets
* telephone line for fax and data transmission
* high quality G3 fax
* photocopying machine with automatic loader and sorters
* fax/modem card high speed
* assistive devices: mouse and keyboard facilitator (software TSR)
  screen reader with voice synthesis
* software office production tools
  professional desktop publishing software
  telecommunication software

Checklist of running costs:
* telecom charges
* computer supplies and maintenance
* internet link

Appendix 1: The Partners of the TWIN project

CSELT - Centro Studi e Laboratori Telecomunicazioni — Marco Mercinelli
Telemedicine and Telematics for Disability Research Unit — Tel. (+39) 11 228.6123
Via G. Reiss Romoli 27, I-10148 TORINO (ITALY) — Fax. (+39) 11 228.6190

It is a company of the STET Group (Italian Holding for Telecommunications) with the mission to provide R&D of new telecom architectures and services. One unit is dedicated to the study, research, experimentation and qualification of new services and applications for people with disabilities and the health sector.

Fondazione Pro Juventute Don Carlo Gnocchi — Renzo Andrich
S.I.V.A. - Servizio Informazioni e Valutazione Ausili — Tel. (+39) 2 40090157
Via Capecelatro 66, I-20148 MILANO (ITALY) — Fax. (+39) 2 26861144

It is the largest private organization in the field of rehabilitation, vocational training and job placement of disabled in Italy, running 14 centres throughout Italy. SIVA is its research and information department, running a computerised information system on assistive tecnology, educational activities and an advice service for disabled persons and rehabilitation professionals.

Work Research Center Ltd — Richard Wynne
22 Northumberland Road — Tel. (+353) 1 6683.988
DUBLIN 4 (IRELAND) — Fax. (+353) 1 6683.142

It is a research and consultancy practice which specialise in the areas of social aspects of the "information" society, experiences of disabled and elderly, health and social care. It has a wide ranging expertise in planning and implementation of teleworking, especially for people with disabilities.

National R&D Centre for Welfare and Health (STAKES) — Victor Savtschenko
P.O. BOX 220 — Tel. (+358) 0 3967.2354
SF-00531 HELSINKI (FINLAND) — Fax. (+358) 0 3967.2001

It is an advisory and expert institute under the Finnish Ministry of Social Affairs. The Unit for Independent Living has the duty to promote elderly and disabled persons independent living by assessing, researching and developing services and technical aids, and by providing expertise, training and consultation.

BIOTRAST UETP — Lefteris Leondaridis
111, Mitropoleos Str. — Tel. (+30) 31 277.904
54622 THESSALONIKI (GREECE) — Fax. (+30) 31 277.960

It is an established network of academic and industrial institutions across 10 EU and EFTA countries organised under the EC COMETT II programme. It fosters the initiation and coordination of educational, training, research and application programmes in the biomedical and rehabilitation fields.

HUSAT Research Institute — Anne Clarke
Loughborough University of Technology — Tel. (+44) 1509 611088
The Elms, Elms Grove — Fax. (+44) 1509 234651
LOUGHBOROUGH - Leicestershire LE11 1RG - ENGLAND (UK)

It is the largest University Institute in Europe specialising in the domain of Human Factor Advanced Technology. It undertakes research and consultancy on the human aspects and implications of the design and implementation of advanced technology across a variety of application domains.

LEAD Scotland - Linking Education And Disability — Ken Abraham
Spectrum Centre, Farraline Park — Tel. (+44) 1463 713.979
INVERNESS IV1 1LS - SCOTLAND (UK) — Fax. (+44) 1463 713.325

It is an independent voluntary organization. It's purpose is to provide physically disabled people with educational and training opportunities and home based tuition. It run a computer loan scheme and provides local computer training in accessible areas and distance training to remote areas of the Highlands of Scotland.

Appendix 2: Public Documents of the TWIN project

The TWIN project produced a number of deliverables and publications, describing the project activities and conclusions. A brief description of these documents is reported here. The documents are available from the authors or from the European Commission.

The project deliverable D1 “Technological and socio-economic requirements and opportunities” conceptualises the requirements and opportunities for telework for the disabled. It provides an analysis of the factors which have promoted the establishment of telework for disabled people and of the factors which act as barriers to telework development. A reference framework has been produced to provide an overview of the broader context (telework, technology and disability) within which the particular work of the project can be situated, and to provide the basis for the development of a set of guidelines for establishing telework for the disabled. The final document has been updated with the experience gained from the pilot experiences.

The project deliverable D2 "Description of the networked telework pilot centers" gives a complete description of each of the pilot sites involved in the TWIN project.

The project deliverable D3 “Assessment strategies and methods for pilots evaluation” describes the data collection and analysis methods, evaluation grids, protocols, monitoring instruments and a mechanism and structure for reporting results to ensure a common methodology for monitoring and collecting data from the pilots sites.

The data collected the monitoring of the pilot experiences are reported in the project deliverable D4 “Evaluation of the networked telework pilots centres”.

The results from the evaluation of the collected data are described in the project deliverable D5 “Assessment on networked telework centres for disabled people”. The evaluation takes into account the social impacts, the human factors, the necessary technological infrastructures, the organisational factors, the implications from the rehabilitation point of view and the costs/benefits resulting from the implementation of networked telework centres for people with disabilities.

The TWIN consortium has also published a separate document containing the policy recommendations for actions to support teleworking for the disabled in Europe, and a colour booklet containing a short description andpictures of the TWIN pilot sites.

Appendix 3: National reference centres for information and advice on assistive technology

Austria	Landesinvalideramt für Wien, Nö and Burgenland Zentrale Hilfsmittelbertungsstelle Geigergasse 5-9, A-1050 Wien
Belgium	Funds Communautaire p.Integration Soc.Prof. des personnes handicapées Rue de Meiboom 14, B-1000 Bruxelles
	VLICHT Tervuursevest 101, B-3001 Leuven
Denmark	Danish Centre for Technical Aids for Rehabilitation and Education Gregersenvej, DK-3630 Tåstrup
Finland	National Research and Development Centre for Welfare and Health po box 220, SF-00531 Helsinki
France	Comité National Francaise pour la reàdaptations des personnes handicapées 236 bis Rue de Tolbiac, F-75013 Paris
Germany	Institut der Deutschen Wirtschaft Gustaf Heinemann Ufer 84/88, D-50968 Köln
Great Britain	Disabled living Foundation 380/384 Harrow Road, GB-W9 2HU London
Greece	Institute of Computer Science, Foundation of Research and Technology po box 1385, GR-71110 Heraklion
Ireland	National Rehabilitation Board 44 North Great Georges Street, IRL Dublin 1
Italy	SIVA, Fondazione Pro Juventute Don Carlo Gnocchi via Capecelatro 66, I-20148 Milano
Luxembourg	Centre de Coordination Handynet Rue de Contern 20, L-5955 Itzig
Netherlands	Handynet Nederland IRV, Zandbergsweg 111, NL-6432 Hoensbroek
Portugal	Centro de coordinação Handynet, Secretariado Nacional de Reabilitação Quinta da Malvazia Unhos, P-2685 Sacavém
Spain	Centro de Autonomia Personal y de Ayudas Tecnicas Los extremeños 1, E-28038 Madrid
Sweden	The Swedish Handicap Institute po box 510, S-16215 Vällingby

Appendix 4: Overview of accessibility recommendations

A treatise on physical accessibility applied to a teleworksite is far beyond the scope of these guidelines. General concepts on accessibility apply to a teleworksite as to any other office. They are described by many handbooks of architecture available in each Country and national language, and in most national legislation. Since the subject is continuously evolving, no specific reference is given to literature: the national centres listed in appendix 3 are the best source to find proper information tailored to the context of each Country. Here a short summary of the most important concept is given, quoted from the "European Manual for an accessible built environment" (CCPT, Rijswik 1990)

In general, the so called "integral accessibility" principle considers the following environments:

- public transport
- outdoor environment
- indoor environment
- specific areas

The last two environments are directly related with the teleworsite, although some aspects of the outdoors environment (eg. the path between the parking place and the worksite) may also be important. The indoor environments embraces elements like:

- building entrances
- doors / internal entrances
- stairs and lifts
- halls and corridors
- handrails and handles

Specific areas are dedicated spaces such as:

- toilet / bathrooms
- kitchens and dining rooms
- service rooms (dressing rooms, storage spaces, etc...)
- work areas (workplace, meeting settings etc...)
- garages
- terraces and balconies

In the following a list of general recommendations is given for the most common architectural elements. They are sorted starting from outdoors.

Car parking:

- provide car parking areas 2400 mm x 5000 mm
- leave a free area wide > 1500 mm along each parking place; optimise space using overlapping exit areas
- locate parking places as near as possible to the most likely destination; use clear sign posting

Slopes:

- keep slopes < 1:10 for rises < 100 mm
- keep slopes < 1:12 for rises < 250 mm
- keep slopes < 1:16 for rises < 500 mm
- keep slopes < 1:12 for rises >500 mm
- locate one landing every 5 m for slopes 1:12, or one every 10 m for slopes 1:16
- ensure landings length > 1500 mm

Handrails:

- mount handrails on both sides of ramps when rises > 250 mm
- extend handrails > 300 mm beyond the first and last riser
- handrails should continue on landings

Entrance doors:

- prefer, if possible, double automatic sliding doors electronically operated
- clear opening width > 850 mm
- unobstructed headroom > 2100 mm

- leave free space before and after the door > 1500 mm
- leave free space next to the lock side > 550 mm
- avoid thresholds; if necessary, keep height < 20 mm and use rounded thresholds
- avoid revolving doors or provide alternative hinged or automatic doors
- make glass doors visible with contrasting colour markings
- hinged doors opening at > 90°

Corridors:

- keep frequently used corridors width > 1800 mm (> 1200 mm for infrequently used ones)
- keep minimal narrow > 1200 mm for frequently used corridors (> 900 mm for infrequently used ones)
- avoid thresholds and sudden height differences
- avoid doors opening onto corridors; if not possible, leave an unobstructed space > 900 mm (> 600 mm)
- leave turning spaces with diameter > 1500 mm
- provide appropriate sign posting to help people to easily find their destination

Inside doors:

- clear opening width > 850 mm
- unobstructed headroom > 2200 mm
- leave free space next to the lock side > 550 mm
- avoid doors opening onto corridors
- hinged doors opening at > 90°
- mount easy-grip doorknobs
- clearly identify glass areas within doors
- distinguish glazed doors from adjacent fixed glass panels
- avoid spring closures or use delayed action, preferably electronic
- set automatic doors speed at 0.5 m/s, maximum resistance of closures at 30 N
- install operating instruments between 850 mm and 1100 mm above the surface

Signpost and information:

- use clear and unambiguous symbols or pictograms appropriate to context
- use colours (green = safety, red = emergency, yellow = risk)
- use contrasted colours to increase visibility of signposts
- place information that must be visible from a distance > 2200 mm above surface
- place information that must be visible from nearby 1500 mm above surface
- provide accessibility symbol to identify:
  - accessible entrance to buildings
  - accessible lifts
  - accessible lavatory accommodations
  - reserved car parking spaces
  - special services in buildings.

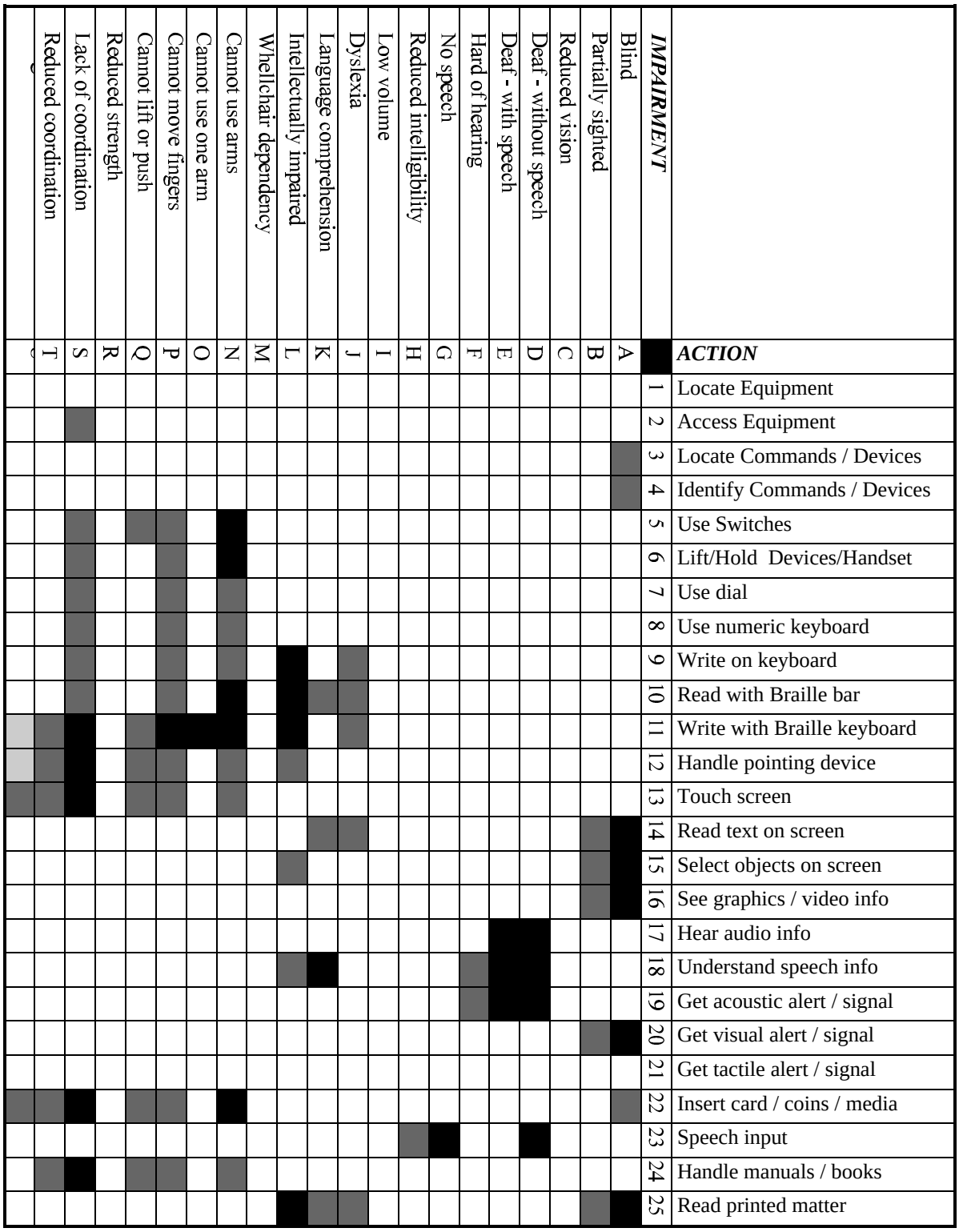
Toilet and bathrooms:

- minimum measurements of an integral accessible toilet: 1650 mm x 1800 mm
- minimum measurements of a moderately accessible toilet: 900 mm x 1500 mm
- locate at least one integrally accessible toilet on every floor accessible to public
- always leave sufficient turning space for wheelchairs (a 1500 mm diameter circle)
- use washbasins and shelves with sufficient space (> 700 mm) below them for wheelchair operation
- use preferably washbasins and shower heads variable in height
- keep anyway top of washbasins and operation shelves < 900 mm
- use taps that can be easily operated with one hand only, preferably a mixing thermostat tap
- provide tip-up seat with hinged handrails near showers
- have doors opening outwards and easy to operate door fittings
- keep operating height of instruments between 850 mm and 1100 mm
- mount operating instruments within reach of the lavatory pan at operating height
- provide fixed or hinged support handrails near lavatory pan, washbasin, shower, bath
- provide firmly mounted easy-grip handrails
- optionally provide alarm pull cord switch near lavatory pan, shower or bath
- avoid as much as possible external pipes and drains and space wasting furniture
- use non-slip floor finish

Interior design:

- letterboxes and bell-panels height >850 and <1100 mm; leave >900 mm free behind them for operation
- clothes hook in cloakrooms at height <1300 mm; shelves at height >400 mm and <1300 mm
- windows operating area at height >850 mm and <1100 mm
- tables and desks must have sufficient space underneath (>600 mm depth, >700 mm height)
- electricity switches should be easy-to-operate and located in the operating zone (>850 mm <1100 mm)
- provide adequate lighting near stairs and obstacles
- alarm signals must be clearly visible and audible from all directions
- locate alarm buttons and fire extinguishers within the operating zone (>850 mm <1100 mm)

Appendix 5: COST-219 Framework for accessibility to computer and telecommunication equipment



Examples of solutions to access the barriers highlighted by the COST 219 scheme

Possible solutions	
Public equipment in 'logical' places	
Directional signs for orientation in public places and offices	• Printed in large letters • Use contrasted and standardised colours • Also printed in Braille • Easy to spot • Use standardised icons or words • Also use audio recorded information
Accessibility of the equipment	• Equipment should be reachable by users with reduced mobility • Standardised dimensions of public booths and kiosks • Use of automatic doors • Possibility to adjust the height of equipment • Provide space under the equipment for wheelchairs • Ergonomic design of the environment
Equipment operations	• Accessible, standardised position for command, buttons, switches, knobs, slots, keys etc. • Standardised marking of commands (icons, colours, tactile cues) • Use large well defined commands whenever possible • Use standardised feedback from commands - visual, acoustic, tactile • Possibility of free hands operation • Avoid EMI emission that disturb rehabilitation aids
Audio devices	• Provide adjustable signal level and tone • Provide inductive coupling amplification
Keyboard input	• Standardised keyboard and keypad layouts • Standardised key markings (icons, colours, tactile cues) • Provide audio/tactile feedback for pressing a key • Avoid multiple key pressing • Use large well defined keys whenever possible • Provide for adjustable sensitivity of keys • Provide possibilities for using alternative keyboards (e.g. chord, Braille) • Provide hooks in applications for the integration of adaptations (e.g. eye gaze, scanning tools) • Provide for speech input where possible • Provide intelligent word prediction where possible
Speech input devices	• Place the equipment in a low noise environment • Possibility to control the intensity of the signal sent
Alerting signals	• Provide multiple alerting signals (acoustic, visual, tactile) • Standardise the use of alerting signals
Textual/numeric output	• Possible selection of large letters for text output • Possible speech synthesised output
Screen operations	• Possible selection of colours and contrast used in applications • Possible magnification of screen objects and cursor • (Research area: alternative use of GUI by blind people) • Provide alternative for selecting screen objects (e.g. pointing devices, touch screen, keyboard, speech input)
Help systems	• Provide visual examples using icons and designs • Speech synthesised help
Visual communication	• Provide adjustable temporal and spatial resolution (especially for videophone communications used for sign and lip reading)
Text communication	• Standardised text telephones • Compatibility of Smart Phones and text telephones

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