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INTERPRETATION OF THE RELEVANT CONSTRUCTION CODES AND REGULATIONS, AND THEIR IMPLEMENTATION ON AN ERGONOMIC AND SAFE WORK ENVIRONMENT

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ABSTRACT:
This paper reflects on the ergonomic criteria for a humane working atmosphere in industrial buildings while respecting and paying close attention to the physical, mental, and stressful demands of the work environment. It describes effective construction codes and standards of practice and their importance in ensuring a safe environment for working people. Also addressed are the objectives for a productive work environment and its organization. The paper considers the significance of a proper working environment, the use of dangerous working materials, the use of proper ventilation, climate, and lighting to ensure that the productivity of the enterprise is met with common goals shared between employer and employee. The connection between the legal foundation and the design of industrial construction is the focus of this paper. It shows that the planning and executive persons are obliged to observe the relevant construction laws and regulations including standards and codes of practice. Additionally discussed are the possible solutions and consequences for development in the productional, constructional, and ergonomic fields of design.

KEYWORDS:
Ergonomic criteria, implementation humane working environment, safety in workplace

1. INTRODUCTION

The society in which we live has requirements on industrial buildings and industrial plants according to the standards of a conscientious society.

The technological and social factors exert an influence on the organization of the working atmosphere. The concern of humanity for its self-preservation is necessary, and while members of the society strive for work, the need for satisfaction is constant.

Therefore, organization of the working atmosphere takes a high value, in order to achieve humane conditions of work.

The result becomes an optimal satisfaction for both the working humans and the enterprise itself.

In construction, the goal of Management is to achieve productivity in a humane working atmosphere for the building industry.

The value of the working atmosphere organization in a humane society is an important factor, for which one must find the means and ways to improve the future of industry. Since the industry also needs active human working places that are consciously planned, qualified future-oriented industrial planners should consider the value of work quality and the working environment with increasing measure.

It is important to recognize that the tasks of business premises do not only lie in the production of goods and services, but also in the human being's appreciation of the organization of the industrialized places.

The fulfillment of operational requirements and humane formative are tasks which affect the industrial building design.

2. LOADS AND DEMANDS OF THE INDUSTRIAL JOB

Most humans spend about 35 to 45 years in a more or less freely selected occupation. Frequently it is only after years on the job that a person can determine whether the choice was correct and whether a certain satisfaction or self-fulfillment was achieved.

One spends much time on a job, where control of the workload by the worker is limited. Therefore, an individual should pay special attention to the optimal conditions of the job adopted, as well as to the possibility of health damages by the working atmosphere. These fall under three categories:

1. physical load due to various muscular activities.
2. physical and chemical factors, such as heat, noise, gases, dust, etc.
3. psycho sociological factors. Whereas physical and chemical factors are objectively detectable, psycho-social factors are subjective. Therefore, in order to achieve a reasonable work environment, a balance must exist between the loads of the job and human demands. If a discrepancy between these two exists, reconciliation is necessary by organizational and/or technical measures on the one hand and by appropriate training of workers on the other. In addition to the three ranges of stress, which were mentioned above, the following specific factors are important:
   - repetitive work
   - low qualification
   - Monotonies
   - shift work
   - conflicts on the job
   - responsibility demands
   - job uncertainty

2.1. Value of the work organization in the society

The society, in which we live, has requirements on industrial buildings and industrial plants according to the standards of a liberal, democratic and culture-conscious social order. The technological and social factors exert an influence on the organization of the working atmosphere.

The concern of humanity for its self-preservation is necessary, and while members of the society strive for work, the need for satisfaction is constant. Therefore, organization of the working atmosphere takes a high value, in order to achieve humane conditions of work. The final result becomes an optimal satisfaction for both the working humans and the enterprise.

2.2. Personality-promoting job

A job should promote and be the least damaging to a workers personality. There are subjective and objective work-related conditions that are involved in this issue:

- the complexity of the work affects the intelligence and its development
- the possibility to control the working process; the absence of which can lead to a learned helplessness;
- planning strategies
- content related training
- the capabilities of the worker's capability for making joint decisions
- qualification processes must serve the Optimization of cognitive regularization bases and thus promote in particular the steered, mental learning activity of the working individual
- Criteria of this kind must, in the context of a prospective work organization affect the process of technological development, which is to take place by means of the formulation of minimal standards and organizational criteria.

- Thus, for instance, penetrance brings changes of the work and living conditions which show up particularly in the work area. In order to promote the personality on the job, the human strengths must be protected and promoted.
- These lie in the cognitive range, in the ability of the Human for equivalent learning and evaluation by feel of certain situations, in its physical aspects and in its communicative orientation with other humans, etc. In addition, in this regard, criteria of the work organization can be applied. All those who are actively involved in work organization, must clearly carry a large responsibility for the development of the personality of working humans.

2.3. Work moral and work motivation

The moral aspects of work and the positive attitude of all involved are unbelievably important for their satisfaction and for the personality of workers. Differences in industrial achievement are often, and to a considerable degree, due to differences in the motivation of workers.

In order to achieve possible positive affects of work actions, such as personality development and work motivation, it is advisable that the task content for individual coworkers be coordinated with their specific conditions.

3. ERGONOMIC CRITERIA FOR A HUMANE WORKING ATMOSPHERE IN THE INDUSTRIAL BUILDING

The personality of humans, as the entire range of characteristics and abilities unfolds during a complex process of development and growth of physical-sensual, emotional-psychological and mental moments, participation and arrangement are handled in social situations and relations. Since the human body is the central focus of the individual's collective life and experience, there are no thoughts or feelings which exist alone; rather both coexist with the physical. Physical processes are equally important to our intellectual capacity, feelings, behavior and activities. The working atmosphere must meet the physical and mental requirements. If one sees humanization as a goal for the organization and working atmosphere, where the health and well-being of employees can be increased and made suitable, then it must be a central element apart from the economic and technical objectives.

3.1. Psychological false demands

Psychological demand is to understand the proper psychological conditions required to be achieved when implementing work activities. The consequences of psychological false demands are fatigue, saturation and stress.

3.2. Stress

Stress is understood as a reaction to unacceptable or threatening experiences as well as conflicting false demands, imposed above the conditions for achievement that questions substantial goals including social roles.

Environmental exposure, such as noise, bad lighting and vibration, as well as time, pressure, constant interruptions, unclear achievement feedback, and conflicting aims can release emotional loads, characterized by undesired conditions of stressed excitation and fears. Feeling stress depends on the subjective process of the person's evaluation:

3.3. Fatigues

A term used to describe a condition of temporary impairment of conditions for achievement by continuous activity requirements, which exceed the possibilities of the currently established conditions for achievement. With humans, this impairment expresses itself in reactive and anticipative counter measures and concerns.

It therefore includes different conscious and unconscious levels of behavior regularization. Implementing several hours of activities can lead to a sinking of the quality

and speed to changes in the achievement, psychological fatigue is predominantly psychological, i.e. by information intake and processing stressing activities.

It is revealed that high strain increases physical fatigue with resumed manual labor also leading to psychological fatigue. Psychological fatigue is distinguished by a feeling of tiredness, monotonous condition, psychological saturation and stress. Fatigue leads to decreased ability to function and impaired achievement. The recovery is affected by more psychological and physical fatigue which is time-consuming.

4. VALUE OF THE ERGONOMIC ORGANIZATION IN SOCIETY

The working atmosphere as part of our entire area of life is affected and controlled by the rising measure of technical and scientific innovations. The working atmosphere repeatedly tries to subordinate working humans to the technical-organizational objectives and procedures instead of adapting to the workers needs. The constant striving of humans for improvement of the quality of life and their constantly rising needs have various consequences.

The straight fulfillment of the demand for quality of life at the job is the basic goal of a humane working atmosphere, with suitable organization of the work environment.

- the inhumane job is not a job
- protection of the employees from dangers on the job
- protection of their health and protection from other physical and psychological loads
- suitable for human work organization
- self instead of imposed regulation
- rich work contents and self development within the work
- participation and cooperation, of the employees

4.1. The term suitable for human work organization

The term, "suitable for human work organization" encompasses the following qualities:

- feasibility
- bearableness
- reasonableness
- well-being

Feasibility and bearableness can be achieved with the help of the ergonomic realizations. The adjustment of the work on humans is generally misunderstood.

As for "reasonableness", psychological and sociological process engineering must be consulted. Mental well-being includes both physical and social well-being.

Feasibility of the work: A work is executable if it can be performed without endangering health while taking into consideration the mental and physical conditions of humans.

Bearableness of the work depends on the achievement possibilities of humans, which they can furnish in the long run, without arriving into a range, where their health is endangered or impaired. These achievement possibilities are dependent on age, sex and state of health and surely the training.

Reasonableness of the work: Whether a work is regarded as reasonable, depends on the social balance of power, the strength of the protections of interests and the level of awareness of the employee concerned.

Thus it cannot occur that a work is called executable and bearable, unless it is considered to be reasonable. Monotonous work forms are a typical example. Well-being with the work: Humans have a high measure of well-being, if he/she is healthy. The World Health Organization defines health as "a condition of the complete mental, physical and social well-being". This definition goes clearly beyond the freedom from diseases and includes work satisfaction and is today generally recognized. Humans, who probably feel superior on the job and in the enterprise, have achieved.

4.2. Ranges for the organization of the work seen from a human perspective:

- moving
- reaction
- perception
- relating

4.2.1. Moving

The adjustment of the work to human needs requires the knowledge of the Body mass. This body mass is based on an abundance of scientific work and is standardized both in the Federal Republic of Germany and in Austria. (OENORM A. 8060)

4.2.2. Body mass and area for humans

Work height and work seats must be adaptable to the Body mass and to the kind of work and are for great importance in industrial safety.

Humans need a certain effect area for the execution of their respective activity. This must be considered a minimum motion travel of the body and its member masses - as a function of body mass. Beyond the effect area, humans need an area for well-being; this is larger than the effect area. The extent of this comfort range is subjectively very differently judged. This comfort area was calculated to be approximately 20 to 30 % over the effect area.

Height of work surfaces and seat faces: The height of the work surfaces and/or seat faces depends not only on the body size, but also on the kind of the implemented work.

Seat and legroom height: The correct height of the seat face is particularly important. *Effective area for humans when sitting is illustrated in figure 1.* For example, if the body size amounts to 175 cm, then the seat level is to be stopped to approximately 43 cm. The legroom height should be somewhat more than 63 cm. The optimal organization of the job in the sitting position is different than in standing and should be possible; because, a continuous body attitude during long periods is to be avoided.

Point of view with the work: A further criterion during the work organization is the point of view, under which the work is performed. When sitting, work under a point of view of 38° and when standing, under a point of view of 30° is to have to be possible to perform. *Point of view hile working is illustrated in figure 2.*

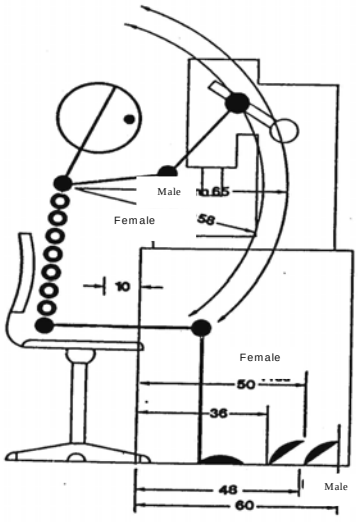

Figure: 1. Effective area for humans when sitting

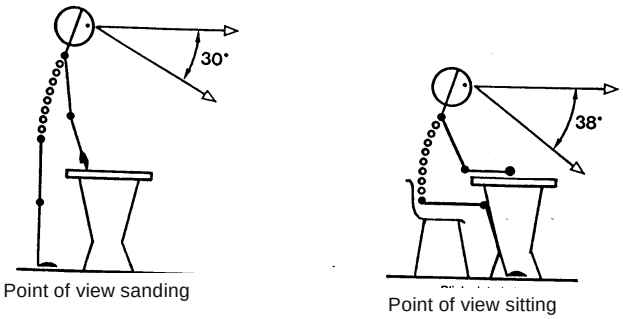

Figure: 2. Point of view while working

4.3. Body forces age and sex

Muscles are the force engines of the human body. One differentiates between small and large groups of muscles. Small groups of muscles, like in fingers or hands, develop small forces; large, like in the thigh, develop large forces.

A condition for muscles to work is a sufficient supply with nutrients and oxygen. Movement work (dynamic load) is characterized by the fact that muscles contract and relax alternatively. In this case sufficient blood supply to the muscle is ensured. Retaining work (static load) is characterized by the fact that the muscle is continuously strained and thus the blood circulation is impaired.

Lifting and carrying: When lifting and carrying loads, not only the form, weight and dimensions of a load and the general physical efficiency play a substantial role, but, more important is the attitude of the body when lifting and carrying the same load.

The appropriate and incorrect method of lifting and the effects this has on the back of the human being while lifting is illustrated in figure 3. Age and sex: Muscle power depends on age and sex. A man reaches his maximum strength approximately around the age of 30 years. A woman reaches her maximum strength approximately around the age of 25 years. However, a woman's maximum strength is a little more than 65 % of that of a man.

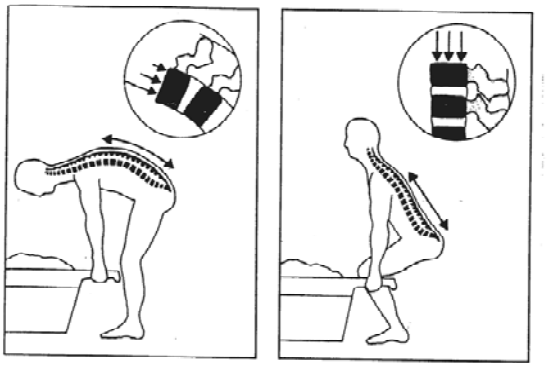

Figure: 3. *The appropriate and incorrect method of lifting and the effects this has on the back of the human being while lifting.*

4.3.1. Feeling is the basis of perception.

This means that pain is felt and noticed. Well-being is defined as both physical and mental and is intended for achievement contribution and readiness.

4.3.2. Noticing

Noticing is obtaining information with the help of the human senses.

4.3.3. Sense of vision

Seeing is noticing information by the sense of vision. Visual acuity and ability is a condition of any work, in which the eyes are used. It refers to seeing a close, and/or far object, different colors and space.

With increasing age, visual acuity changes and increases the need for light. From this the necessity follows to offer apart from a general lighting, particularly for the older employees, an individual auxiliary lighting whereby the color of light should be equal to that of natural light.

4.3.4. Sense of hearing/noise

The sense of hearing serves noticing acoustic information. The sound/noise acoustic waves are "oscillations". The human ear can notice oscillations to the extent of 16 to 20,000 cycles per second. An oscillation per second = 1 cycle per second. There is a distinction between sound pressure and sound intensity. The cause of the sound is the oscillation produced in the acoustic source. Pressure waves hitting the ear produce the power of sound. It is called loudness or intensity. The effects of the same sound pressure and the same oscillations can be felt differently by different individuals. The excess of a certain volume is experienced as pain.

Noise is a disturbing sound, unpleasant to humans. Sound pressure plays a role in the sense of hearing. The time of reaction to it is subject to the height of the tones and the temporal arrangement of the sound.

The unit of sound/noise is the decibel. *Volumes, frequency, hearing border and pain thresholds are illustrated in figure 4.* It demonstrates that an increase in the volume corresponds to a duplication of the volume of approximately 10 decibels subjectively.

The estimated volume of certain types of work is as follows:

- Mental work.....max 50 decibels
- Normal work.....max 70 decibels
- Other work.....max 85 decibels

A sound volume beyond the 85 decibels maximum endangers aural acuity. Noise protection measures:

1. Diffraction: when planning new factories, noise protection must be included in the planning process. Therefore it is not necessary (only) to choose the plan appropriate building material and taking into consideration not only to include the noise generated within the factory, but also the noise coming from the outside (e.g. traffic noise).
2. Stopping the noise at the source is the most effective and most rational measure. As an example, often metal gear wheels can be replaced by plastic gear wheels. Deflected storage causes often-avoidable noise. Also noise is reduced when machines are placed on floors covered with materials such as felt, rubber or cork.
3. Stopping sound propagation is a further effective measure for noise reduction. It is achieved with sound-absorbing shrouds at the source of noise and lining the workspace with sound-swallowing material.
4. Personal ear protection is to be paid primary attention in regards to the dominant noise. Thus, employees must be provided with ear protective devices and instructed in that matter.

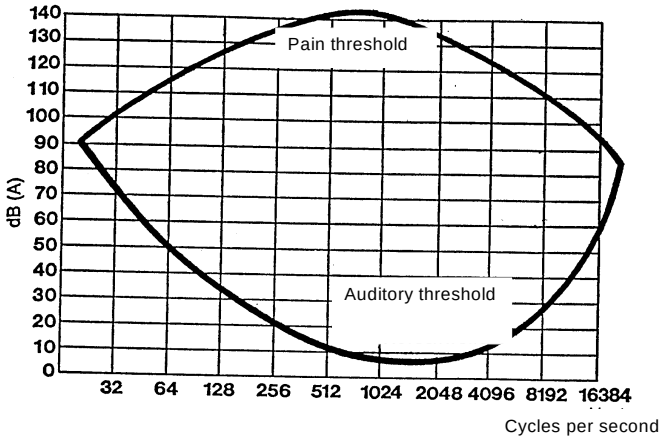

Figure: 4. Volume, frequency, hearing, and pain threshold

5. THE ORGANIZATION OF LABOUR

One of the conditions for the acquisition and strengthening of the worker's abilities should be through measures of the work organization. Also a progressive gain of experience is obtained by such measures. Nevertheless, varied work activities and the possibility for the practice of planning and control of such activities are of crucial importance.

Therefore, the Organization of Labor should be flexible in order to be adaptable to changes of requirements on the part of the employees.

This is particularly important in order to achieve a progressive development of the worker's abilities and interests and to ensure quality acquisition through working activity. In this sense, work-organizational measures can contribute crucially to arrange a working situation suitable to the motives and needs of both the employer and employees. Motivation is not only limited to the organization of work activities, but to be sufficient it must involve the use of protection devices and safety measures.

Additionally, the organization must be so constituted that users of protection devices are not subject to disadvantages, such as income losses to cover the cost of a device or missing important danger signals when using noise-protection methods. If the learned and acquired abilities of the employees in operational practice were either not used or are not allowed to develop, they would be considered as a social waste.

Therefore, they should be given special attention in the organization of work. According to the definition of the World Health Organization (WHO), Health is a condition of complete mental, physical and social well-being and not only the freedom from diseases and physical defects. When the work environment is not suitable to humans, various conditions of health damage can develop. This could be the result of various attitudes to be assumed by the body during prolonged uninterrupted work periods.

Thus, prolonged sitting may lead to difficulties in breathing, while varicose veins may be the result of prolonged standing.

Excessive stretching or lifting movements often lead to damage of muscles and joints such as tears as well as back pain due to the deterioration of vertebral cartilages discs and joints.

Visual damage and headaches are consequences of insufficient indoor lighting, while lack of direct contact with daylight often leads to psychological disturbances, hearing difficulties and sleeplessness.

5.1. Dangerous working materials and legal measures

The harmful effects of working with hazardous materials can vary from mild, such as catarrhal lesions, to severe, such as cancer.

Also included are poisonous materials that can lead to death. Therefore, in handling these materials, the highest degree of care and relevant protection regulations should be considered in great detail. Other materials are also dangerous if they explode or cause fire.

Biologically they can be carcinogenic, or endangering to human reproduction and causing hereditary changes. Dangerous working materials should always be marked correctly. Dangerous working materials, if possible, should be processed in closed equipment or in separate work spaces. Gases, steams or suspended matters at the place of their opening should be sucked off and/or the appropriate protection equipment used.

The use of certain materials should be revealed to the Work Inspector. Working procedure restrictions for the protection of employees usually have ranges for the use of materials that are regulated in every detail and assigned categories. According to the risks outgoing from them the following partitioning in three groups of risks applies:

1. Materials that is improbable to cause illness.
2. Materials that may be cause illness to humans and represent a danger for employees.
3. Materials of this group can cause a serious illness and are dangerous to the employees.
4. The danger of spreading in the population can exist, but effective protection or treatment is normally possible.

5.2. Limit values of the dangerous working materials MWC-value and TAC value:

(1) According to the law for the protection of employees, the MWC-value (Maximum Work Concentration) is the average value within a certain evaluation period that indicates the maximum concentration of working materials such as gas, steam or suspended matter in the air, which does not affect the health of employees after repeated long-term exposures.

(2) the TAC value (technically acceptable concentration) is the average value in a certain evaluation period, which indicates that the concentration of a dangerous working material, as gas, steam and suspended matter in the air, below which prevention measures to determine those after the state can be met its effects are treatable.

(3) Once the MWC value of a working material is determined employers, must ensure that such value is not exceeded.

(4) Employers must also ensure that materials with known TAC values are used at their lowest possible concentration.

(5) Employers must establish measures to be used whenever the MWC or the TAC- values of a health endangering working material are exceeded due to accidents.

(6) When limit values exceeded due to accidents the employers must further ensure that, as long as excess is not eliminated 1- employees needed for the repairs are the only ones on site, 2- the duration of the exposure of these employees should be limited to what is absolutely necessary and 3- That appropriate (personal) protection equipment is used.

(7) When health- endangering working material is in use for which no MWC or TAC values are fixed, employers must ensure that the concentration of such material as gas, steam or suspended matter in the air is always as low as possible.

6. HEALTH RISKS IN COLD TEMPERATURE ON CONSTRUCTION SITES

Cold stress or hypothermia can affect construction workers who are not protected against cold. Cold is a physical hazard in many construction workplaces.

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, leading to permanent tissue damage and even death.

There are certain risk factors and various medical conditions which can increase the risk of cold injury, such as: heart disease, asthma/bronchitis, diabetes, circulatory problems and vibration/white finger disease. The body tries to maintain an internal core temperature of approximately 37º C (98.6º F).

This is done by reducing heat loss and increasing heat production. Under cold conditions, blood vessels in skin, arms and legs constrict hence decreasing blood flow to extremities.

This minimizes cooling of the blood and keeps critical internal organs warm. At very low temperatures, however, reducing blood flow to the extremities can result in lower skin temperature and higher risk of frostbite.

6.1. Wind-chill

Wind-chill involves the combined effect of air temperature and air movement.

Wind-chill cooling rate is defined as heat loss (expressed in watts per meter squared) resulting from the effects of air temperature and wind velocity upon exposed skin. The higher the wind speed and the lower the temperature in the work environment, the greater the insulation value of the protective clothing required.

Figure 1 compares the effects of air temperatures with and without wind. For example, when the air temperature is -28.9º C (-20º F) there is little danger of flesh freezing with no wind, increased danger with a wind of 8 km/h, and extreme danger with a wind of 32 km/h or more.

When air speed and temperature produce a chill temperature of -32º C (-25.6º F), continuous skin exposure should not be permitted. Unprotected skin will freeze only at temperatures below -1º C (30.2º F), regardless of wind speed. When weather information is not available, the following signs may help to estimate wind speeds in the field: at 8 km/h (5 mph) a light flag just moves, at 16 km/h (10 mph) a light flag is fully extended by the wind, at 24 km/h (15 mph) a newspaper sheet raises off the ground and at 32 km/h (20 mph) the wind is capable of blowing snow. Wind speed and air temperatures are illustrated in figure 5.

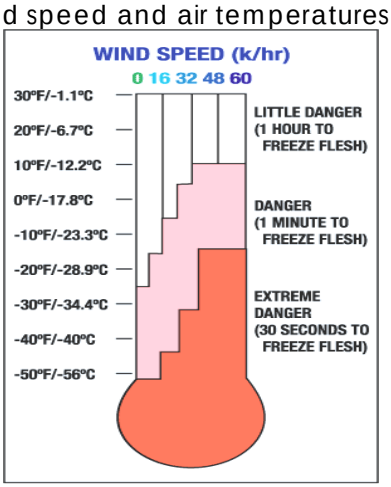

Figure: 5. Wind speed dangers in cold temperatures

6.2. Hypothermia and frostbite

When the body can no longer maintain core temperature by constricting blood vessels, it shivers to increase heat production. Maximum severe shivering develops when the body temperature has fallen to 35º C (95º F). The most critical aspect of hypothermia is the body's failure to maintain its deep core temperature. Lower body temperatures present the following signs and symptoms:

1. persistent shivering--usually starts when core temperature reaches 35ºC(95º F)
2. irrational or confused behavior
3. reduced mental alertness

4. poor coordination, with obvious effects on safety
5. reduction in rational decision-making

In addition, acute exertion in cold can constrict blood vessels in the heart. This is particularly important for elders and workers with coronary disease, who may have an increased risk of heart attack.

6.3. Hypothermia

Signs of hypothermia include:

a) Mild**-** shivering, blue lips and fingers, poor coordination

b) Moderate**-** mental impairment, confusion, disorientation, inability to take precautions from the cold, slow heart rate, shallow breathing

c) Severe**-** In severe cases, hypothermia can resemble death. Patients must be treated as though they are alive. Severe hypothermia can be indicated by: unconsciousness, low heart-rate to the point where pulse is irregular or difficult to find, no shivering, no detectable breathing

6.3.1. Hypothermia Treatment– first aid

The following steps should be taken to stop further cooling of the body and provide heat to begin re-warming.

1. Carefully and gently remove casualty to shelter, sudden movement or rough handling can upset heart rhythm.
2. Keep casualty awake, through talking, asking questions etc.
3. Remove any wet clothing and wrap casualty in warm covers.
4. Re-warm neck, chest, abdomen, and groin--but not extremities.
5. Apply direct body heat (skin to skin), or use safe heating devices.
6. Give warm, sweet drinks, but only if casualty is conscious.
7. Monitor breathing. Administer artificial respiration if necessary.
8. Call for medical help or transport casualty carefully to nearest medical facility.

6.3.2. Ensuring workers awareness and compliance

The wind-chill factor should be explained so that it is understood by workers, especially those working on bridges or out in the open on high buildings. An effort should be taken to ensure that workers are medically fit to work in excessive cold, especially those subject to the risk factors which were mentioned previously. Workers should also be informed in regards to the importance of high-caloric foods when working in cold environments. Warm sweet drinks and soups should be available at the work site to maintain caloric intake and fluid volume. Coffee should be discouraged because it increases water loss and blood flow to extremities. There should be a back-up crew for personnel working in isolated cold environments. Hot drinks and regular breaks should be encouraged and provided under extremely cold working conditions.

6.4. Clothing

Several layers of clothing rather than one thick layer should be worn; the air captured between layers acts as an insulator.

Synthetic fabrics such as polypropylene should be worn next to the skin because these materials whisk away sweat. Additionally, the clothing should not restrict flexibility.

If conditions are wet as well as cold, the outer clothing worn should be waterproof or at least water-repellent. Wind-resistant fabrics may also be required under some conditions.

At air temperatures of 2º C (35.6º F) or less, workers whose clothing gets wet for any reason must be immediately given a change of clothing and be treated for hypothermia.

The use of hats and hoods to prevent heat loss from the head and to protect ears should be encouraged. Balaclavas or other face covers may also be necessary under certain conditions.

Footwear should be large enough to allow wearing either one thick or two thin pairs of socks. Wearing too many socks can tighten the fit and harm rather than help, tight-fitting footwear restricts blood flow. Workers who get hot while working should open their jackets but keep hats and gloves on. Select protective clothing to suit the cold, the job, and the level of physical activity, as demonstrated in Figure 6.

Figure: 6. Select protective clothing to suit the cold, the job, and the level of physical activity.

6.4.1. Shelter, Exposure limits and Training

For work performed continuously in the cold, allow rest and warm-up breaks.

Heated shelters such as trailers should be available nearby. Encourage workers to use these shelters at regular intervals depending on wind-chill factor. Workers showing signs of shivering, frostbite, fatigue, drowsiness, irritability, or euphoria should immediately return to the shelter.

Workers entering the shelter should remove their outer layer of clothing and loosen other clothing to let sweat evaporate. In some cases, a change of clothing may be necessary.

Table 1 was developed in order to indicate the Threshold Limit Values (TLVs) for properly clothed personnel working at temperatures below freezing. Before working in extreme cold, workers should be instructed in safety and health procedures. Training should thoroughly cover the following criteria:

1. Proper clothing and equipment
2. Safe work practices and guidelines for nourishment
3. Risk factors that increase the health effects of cold exposure
4. How to recognize signs and symptoms of frostbite, on oneself and others
5. How to recognize signs and symptoms of hypothermia, on oneself and others
6. Appropriate first aid treatment, including re-warming procedures

6.5. TLVs Work/warm-up schedule for four-hour shift

a) This schedule applies to any 4-hour work period of moderate-to-heavy work with warm-up periods of ten minutes each and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work, (limited physical movement) apply the schedule one step lower. For example, at -35º C (-30º F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4 -hour period (Step 5).

b) TLVs apply only for workers in dry clothing. As illustrated in Table 1.

Table: 1. TLVs Work/warm-up schedule for four-hour shift

Table 1: **TLVs Work/Warm-up Schedule for Four-Hour Shift**

Air temperature - sunny sky		No noticeable wind		8 k/hr wind (5 mph)		16 k/hr wind (10 mph)		24 k/hr wind (15 mph)		32 k/hr wind (20 mph)	
°C(approx.)	°F(approx.)	Max work period	Number of breaks	Max work period	Number of breaks	Max work period	Number of breaks	Max work period	Number of breaks	Max work period	Number of breaks
-26° to -28°	-15° to -19°	normal breaks	1	normal breaks	1	75 min	2	55 min	3	40 min	4
-29° to -30°	-20° to -24°	normal breaks	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

7. CONCLUSION

In Conclusion, this paper presented the importance of implementing the relevant construction laws in order to fulfill the humane and operational requirements of a human working environment. Particular attention was placed on the human body, and how the work organization, must correspond to the workers.

The demands of the environment on the human body, and the way in which they impair and impede the conditions necessary to achieve the body's desired goals, were discussed. It was shown that teamwork is needed in order to produce an environment that ensures human productivity, in accordance with the construction rights of the owner.

The use of the correct lighting, freedom from falling objects overhead, correct ventilation, and climate have been shown to affect productivity within the human enterprise. Therefore, the implementation of the construction liberty in design management must ensure that a functional human working environment is met.

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