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Performance Requirements for Building Structures in Post Terminals

Conditions de fonctionnement des structures de centres de tri postaux

Betriebsbedingungen für Gebäudekonstruktionen von Post-Teminals

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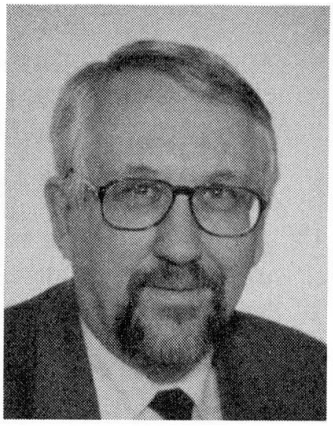

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SUMMARY

This article gives a general description of the requirements for building structures in post terminals, considered both from current user needs and also the longer perspective of real estate development. The philosophy is that post terminals should be considered as designed for light industry yet be able to facilitate a certain amount of change during their life span. The examples have been selected from existing Sweden post terminals.

RESUME

Cet article présente une description des exigences techniques pour la construction des structures de centres de tri postaux. Ont été pris en considération le point de vue du client usager et celui des proprétaires afin d'optimiser l'investissement. Ces centres de tri doivent être conçus comme des bâtiments d'industrie légère et pouvoir être adaptés à de nouveaux besoins. Les exemples cités ont été pris parmi les centres de tri existants de la Poste Suédoise.

ZUSAMMENFASSUNG

Dieser Artikel vermittelt eine allgemeine Beschreibung der Bedingungen für Gebäudekonstruktionen von Post-Terminals im Hinblick auf die Erfordernisse für die derzeitige Nutzung sowie aus der Sicht einer längerfristigen Nutzung. Grundgedanke hierbei ist die Gleichsetzung der Post-Terminals mit Gewerbegebäuden für Kleinindustrien, die während ihrer Lebensdauer einer Reihe von Umbauten und Änderungen ausgesetzt werden können. Die Beispiele stammen von Terminals der Schwedischen Post.

1. THE FUNCTION OF POST-TERMINALS

This paper deals mostly with the demands on building structures when handling mail in post-terminals. Many of the demands are similar to those placed by light industry with assembly lines. This is because of the frequent use of mechanisation in the mail-sorting process.

The sorting of letters in large terminals is a process involving automated sorting machines, manual sorting, various forms of conveyors and even traffic with fork-lift trucks. This constitutes a combination putting specific demands on the properties of the load-bearing structure.

The sorting of parcels is a heavier process and demands larger installations able to accommodate larger parcel-sorting equipment, often 200 metres long, combined with the use of fork-lifts and other equipment for the transportation of parcels to and from the loading-bays for road and ramps for rail transport.

As with any other industrial activity, mail-sorting is often subject to changes in methods, and equipment used. The flow of mail varies in itself, changes regarding types of product and volume of letters or parcels. The layout of the machinery and the manual work-stations is not permanent and regular redeployment occurs.

Postal operations are very much time-restricted. The mail must be processed within a given period to meet the time schedules of road, rail and air transport. The sorting terminals must not, in any way, impede the flow but rather enhance it by virtue of rational planning and effective structuring.

It is preferable not having to transport mail to different levels within the building for processing. A single-storey construction is ideal when considering internal logistics. However the constaints on the deployment of sorting-centers within the infrastructure of cities prevents such optimal solutions.Available sites are too small when the need for good connections with rail junctions, major highways and yet close proximity to city centres are necessary parameters. Therefore, multi-storey constructions for postal terminals are common. The dimensions of main sorting-terminals in Sweden vary between 20,000 sq.m. - 100,000 sq. m.

Parcel-sorting operations are usually located on the ground floor while letter-sorting can take place on first or second floors. On floors above the "production" levels, are the office areas and convenience facilities - locker-rooms, canteens and rooms for physical fitness etc. The terminals are equipped with loading-bays for road and ramps for rail transport, both of which may be open or covered areas.

The existing and future sorting equipment, conveyors and overhead-rail conveyors have determined room dimensions and ceiling heights. Between storeys in large terminals, the floor to floor measurement is 4.5 - 7 metres. Halls with high ceilings are needed for parcel-sorting.

Therefore one talks about "hall solutions" of the sorting areas. Sorting activities go on almost continuously round the clock, with peaks during the evening, night-time and early morning. Very few moments are free from postal-processing, which means that very little time is available in which to carry out repairs that disturb the sorting operations.

2. LOAD-BEARING CAPACITY

Demanded load-bearing capacity varies according to the type of postal activities. In Sweden Post we deal with the following range of load characteristics which can be a combination:

A. Pallets stacked in 3 layers, paths for fork-lifts, load from installed machinery.
B. Post-containers handled with fork-lift, load from installed machinery.
C. Point loads from equipment installed in a 3m. x 3m. pattern, load from installed machinery.

D. Point loads from machine platforms, load from post-containers and other installed machinery.
E. Pallets stacked in 2 layers with paths for fork-lift, load from installed machinery.
F. Pallets in single layer with paths for fork-lift, load from installed machinery.
G. Manual handling of post-containers, load from installed machinery.

3 .EVENNESS OF FLOORS

Level floors in postal terminals is a must as the mail-containers must stand still and not roll away. The maximum permissible slope, at any point, is 1/200, otherwise there is a risk of runaway containers. This can be especially dangerous on loading-docks where uncontrolled containers could roll over bay limits or otherwise constitute a hazard.

Evenness is also a prerequisite for the successful installation of post-handling equipment such as automatic letter-sorting machines.

4. EXPANSION JOINTS

Expansion joints are usually a problem due to the difficulty of making perfectly level joints in floor surfaces. Uneven joints cause vibration with fork-lift equipment.

5. CRACKS IN CONCRETE FLOORS

Wear and tear on floors during post-handling is considerable, especially from fork-lifts and mail containers. Floors should be made as durable as possible during construction as it is practically impossible to make repairs during round-the-clock postal activities.

The floor surface should be hard in itself or treated in such a way that it does not emit dust which can disturb the function of finely-adjusted sorting equipment. The surface should consist of hard concrete, preferably vacuum-concrete and can be given an epoxi coating. There must be no filling in the concrete, as filling materials would not stand up to the pressure and cracks will appear. Single-course floors with vacuum treatment have proven to be the best for this type of activities. In zones where manual sorting is predominant, it is necessary to have a softer material on top of the concrete, but the construction of the floor slab should be the same as in zones with harder wear as one never knows how the layout will be in the future.

6. DEFORMATIONS

Floor surfaces in halls designed for postal production should always conform to the following specifications:
The limit of decline is fixed as the floor-slope should, at no point over the entire length of the floor, exceed1/200. The incline tends to increase at the end of the supporting beams, especially when slabs of pre-stressed concrete are used.
Therefore the total deformation is limited to L/600.

7. SPAN

The span of the bays must be determined on the basis of layouts. Columns should interfere neither with the machinery nor with the work-positions with manual handling. Certain layouts are often subject to revision, especially with letter-sorting, this due to new techniques and the varying types of post being handled.

To facilitate good layouts, not impeded by columns and to ensure good flexibility for future layouts, the spans should be large.

The minimum span-width is 9 metres. For letter-sorting, 12 - 15 metres are often required. Even larger spans are necessary with parcel-sorting, between 20 - 25 metres. Sorting-halls of this type are ideally single-storey constructions, which can be combined with multi-storey building containing personnel facilities and office areas. Solutions with extremely large spans for parcel-sorting halls do exist, e.g. a single span of 30 - 40 metres instead of two or three bays as in other cases.

8. FLEXIBILITY

The larger spans meet the need for alternative use of the premises. The real estate agency of Sweden Post must have as a principle, that all post-sorting spaces should be able to be used in an alternative way, preferably for light industry or distribution purposes. This is due to the necessity of retaining and even increasing the market value of the property.

The structures should normally be built in such a way that horizontal and even vertical extensions are possible. This is to cater for a demand for increased space for postal activities on the one hand, and to maximise the use of development rights on the other.

On prime sites, where development rights are usually a restriction regarding height, it is, for economical reasons, necessary to reduce the height of the floor structures. This in combination with larger spans tends to result in weak floor constructions that might easily vibrate when using fork-lifts, machinery etc.

Extremely restricted sites in city centres can necessitate the use of steel columns instead of concrete, in order to reduce the area of the columns and utilize existing space effectively.

9. STIFFNESS OF FLOOR STRUCTURES

In some "first generation" post terminals, e.g. in the 100,000sq.m. Tomteboda Terminal in the Stockholm area, the structure of the upper floors are relatively weak. In this case this is due to the following reasons: long spans of 12 x 16.8 metres, and the combined steel and filigree-concrete construction of the floors. The weakness has the effect that fork-lift traffic causes vibrations in the floor that spread through the floors to working positions with manual post sorting, work-stations with automatic sorting machines, video-coding desks and to traditional office areas. In some areas the vibrations felt by personnel are certainly above an acceptable level, especially in areas where fork-lifts drive over uneven expansion joints. This feeling of insecurity experienced by personnel due to the vibrations transmitted via the floor structure is to be avoided. Therefore efforts must be made to erect structures more rigidly, and do not vibrate yet still meet the requirements regarding span and other desired properties, such as height of floor structure, decline etc.In this field there is a demand for still more research in order to attain criteria regarding vibration and its effects on the well-being of those employed in industrial environments.

10. HOLES IN FLOORS

In earlier projects for post terminals, one assumed the future would call for holes in the floors for the installation of various equipment etc. This has not really been the case, at least not to the extent anticipated. Still, it does occur that holes of considerable dimensions have to be made. This should be possible to accomplish without damaging the surrounding structure and can in fact be carried out successfully with the aid of e.g. lintels and need not be accommodated in any way causing increased investment costs in the eary stages.

11. ECONOMIC LIFE-SPAN OF STRUCTURES

In modern buildings, the cost of load-bearing structures does not represent a major investment. Still it is the properties of the structure that constitutes the current value of the building and the future value of the property while even determining the possible future uses of the structure. The structure is also the most durable part and should be possible to use to the fullest extent, even following a major conversion of the building for some purpose other than the original.

12. QUALITY ASSURANCE

The properties of structures should be considered with great care and it is also necessary to verify if any of these properties are lost during the building process. Therefore we work with quality control on these types of projects, during the whole process from programming to planning, design and the actual construction of the project. This has meant that a large number of mistakes and even some serious faults in the structures have been detected and rectified.

The effort and money spent on quality-management has been worthwhile indeed . Especially worth mentioning is the effect quality-management has on the clarity in programming and planning, also the verification of the qualities of building materials, prior to their being installed - thus making them impossible to inspect -.This type of successive inspection and verification of quality is necessary to ensure that a structure will meet the demands that may be placed on it at some time in the future.

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