

THE INFLUENCE OF ELEVATOR CONSTRUCTION PRACTICES ON INSECT CONTROL

J.B. Van Loon

Canadian International Grains Institute and Canadian Grain Commission

Introduction

With the loss of a large number of grain fumigants and increased restrictions on the use of insecticides the reality of a world without the crutch of chemical insect control seems to loom nearer. This is an incentive to look for alternate methods. One of these is the use of construction methods to exclude the various pests thriving on our stored grain.

While inspecting elevators and flour mills the managers or millers often complained to us about the lack of foresight by the engineers that designed the plant. There was little effort in trying to build insects out. To illustrate this I have, over the last few years, collected a series of slides on common reoccurring problems in elevators and also some solutions that can be found in the recent elevator constructions.

Light Sources

Since elevators quite often operate 24 hours a day, internal and external light sources are required. On the outside far too often, the light is placed directly over the entrance doors. Insects by the thousands are attracted by this light during the dark hours, facilitating penetration of the building as soon as the doors are opened. A more efficient approach would be to place the light at least 10 meters from the building so that insects stay well away from doors and windows.

Electric Wiring and Boxes

A modern elevator can not be run without electricity. With the advent of automation and computer control the amount of wiring used has multiplied considerably. The big problem is where to go with all that wire. The resulting cable boxes and harnesses can also form a haven for insects. Originally the trend was to place these cables in closed boxes. It is however difficult to make these boxes dust tight. The better approach is to use some kind of an open framing sturdy enough to support the wiring. This should be structured in such a way that it reduces the chance of dust settling on it, and facilitates regular cleaning. A different approach is to incorporate the wiring in the concrete at the

time of construction thus eliminating the cable boxes completely. However, if there is some movement in the building these lines could be cut off.

Windows

Windows form the most common means of access into an elevator for insects, rodents and birds. For some reasons windows do not survive long, leaving large openings for all kinds of pests to enter at will. Where daylight and ventilation is needed inside a plant, alternate ways can be provided. Glass bricks which are much stronger than windows still allow light to penetrate in the work place. Fibre glass panels of various sizes and colours are replacing glass in some plants. A different approach is the use of wire screens either on the outside or inside the windows. A combination of steel louvres and wire screening is also becoming more popular. This type will provide the light and keep the birds and rodents out, but will not stop insects from flying in.

Pits and Elevator Boots

In the older elevators the boot of the bucket elevator was in a pit, which was narrow and difficult to access. Any grain spill had to be cleaned out with a shovel and pail, but grain was sometimes left in there for long periods. In the newer elevators these pits have become more shallow or have been completely eliminated. This is an improvement since the area is much easier to keep clean. A better approach is to have the boot elevated to facilitate cleaning underneath and inside.

The standard design of the boot is square, leaving a large space between the two halves where grain can lodge. If no regular cleaning is carried out, infestations can develop which are passed on to the rest of the system. Newer designs have rounded the bottom of the boots to reduce the free space. Some elevators have retro-fitted the slides in the boot with doors which can be opened quickly for fast cleaning and spraying.

Transportation Belts and Supports

Belts are used to transport grain horizontal through an elevator and grain can easily spill on the ground from them. These spills are relatively easy to clean in the open work houses. In the older annexes however, where space is at a premium, the clean up is quite often broom and shovel work. Adequate space should be provided to work in those areas. In the newer elevators the construction is more open making cleaning easier.

The supports of these belts can also cause problems. In the older design short "I" beams were used. Dust and grain could collect in the back part where it is hard to see and clean. Insect infestation has been found in those areas. Some supports had bolt holes through them probably designed to hold some sort of equipment. These holes also filled with old dust and large numbers of moth larvae were found in some elevators.

Concrete supports as found in the newer elevators are easier to clean and maintain.

The structure of some of the end pulleys also allows excessive residues to build up. The supporting structure should be designed in such a way as to allow easy cleaning.

Downspouts connecting bins with the belts should be as short as possible. In the long spouts, in areas that are not scoured by the grain, heavy grain moth infestations can build up, especially in warmer climates. The spouting had to be opened up and the webbing scraped of the sides in Canadian elevators to control the infestation.

In modern elevators, all the belts are covered to control the dust movement through the plant. These covers are also a good haven for moth and other insect infestations. Dust and other grain residues lodge on internal ledges which are hard to clean. Inspection openings should be placed at regular intervals, especially around the bin bottoms for inspection and cleaning.

Drag Conveyors

With increased use of automation in our elevators more drag conveyors will be used. They also provide better dust control as it is a totally enclosed environment.

Two problems have already become apparent with this type of equipment. One is too much open space left behind the end pulley of some types. This allows grain residues to build up in that area. Inside ledges have also been found where residues and infestations can start. The severity of the problem depends on the geographic location of the elevator with a greater chance of problems developing in the warmer part of the country or in warmer climates. One elevator in Montreal had inspection hatches and cleaning doors at the end of the conveyor which will facilitate a regular clean up in that area.

Another potential problem area could be the transfer point from conveyor into the bin. At the slide area is a depression where grain lodges and since it is internal no cleaning is possible. Fumigating with an automatic dispenser would also allow some of the fumigant pellets to lodge on top of this slide which could result in gas development in the bin top area.

Ledges

Any horizontal ledge in an elevator with dust flying around is an invitation for this dust to settle. There is not always time to clean so the result is residues left where insects can develop. There are two main types of ledges. First, the concrete walls supporting other structures and second, steel framing within an elevator. The concrete ledges instead of

being built square, should be provided with a sloping top to allow residues to slide off.

Structural steel is a different proposition. In elevator construction "I" beams are used frequently throughout the structure, especially with the modern steel clad structures where they form the frame work around which the work house is constructed. These I beams when horizontal, form ledges on two sides. When these are in clear view, they can be checked regularly. However, quite a few are in locations where it is impossible to detect nor clean residues on a regular basis. One way to prevent this condition is to use an alternate type of steel framing like round and square pipes. I am not familiar with the difference in strength and cost of this type of framing but do know that the maintenance would be quite a bit easier. The other possibility is to cover these ledges with sloping steel to prevent lodging of dust. This in itself is a costly proposition, and also of relative value. A real tight fit is needed to shut out dust and/or insect infestations. The better the fit, the higher the cost.

A third possibility is to place the steel cladding on the inside of the framing. This would leave the ledges outside and make the maintenance inside the workhouse much simpler. However, under our moderate climatic conditions, dust collected outside could also form a base for insects to develop who will then readily invade the elevator from the outside.

Pillars and columns are part of an elevator structure. If they are made from concrete and more or less rounded there is no problem. When they are again I beams, pockets are formed where they go through a floor, forming areas for residue to settle in. These should be filled with sloping concrete to facilitate cleaning.

Motor and equipment mounts can be constructed in various ways. The old method of building a cage-like support caused residue problems. Some of them were used as garbage cans with all kinds of refuse being thrown in. An open structure under these motors is simpler, and when they are kept slightly above ground, level cleaning is also much easier. The design of the cleaning equipment should be simplified to reduce the internal ledges that can give support to insects developing there.

The use of automation in modern elevators is on the increase. Cleaning of these plants is often still done with a broom and dust pan. Although compressed air can be used to clean the premises, its use is discouraged or prohibited as being dangerous. It usually moves a problem or infestation from one part of the elevator to another. A better approach is the use of vacuum cleaners. The residues are sucked into a container, the contents of which can be easily disposed of without contaminating other parts of the plant.

In some of the modern plants, a steel grating is used instead of solid floors. These minimize the amount of residues that will settle on the various floors. However, at points of support of these grating small pockets are formed where, over a longer period, residues and infestations can build up. These pockets should be eliminated by filling them with

mortar or other material that will not break down under normal working conditions.

I have made a short tour through an elevator and shown some of the problems inherent in their structure. Some solutions were provided but it will take a cooperative effort between engineers and biologists to come up with economical alternatives. Some will be an economical trade-off where reduction in cleaning cost will pay for the improvements. However, if by writing this paper I have opened another avenue for engineers to approach elevator design it has served its purpose.