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# Modern Temporary Grain Storage

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**Moderne Getreide-Zwischenspeicherung**
**Stockage temporaire moderne de céréales**
**Moderno almacenamiento provisional de cereales**

近代的な一時穀物貯蔵

现代化短期谷物存贮

مخازن الحبوب المؤقتة الحديثة


## Summary

In order to store grain safely at a reasonable storage and handling price, the concept of bunker storage is receiving increased interest. The reasons for the development of the bunker concept by the Victorian Grain Elevators Board are given.


## 1. Introduction

The concept of bunker storage of grain is not new but, until three years ago, bunkers were not widely used in Australia.

In 1978—79, the Victorian Grain Elevators Board constructed six bunkers, followed by 43 in 1979—80, and a further 14 in 1980—81. Their size varies from 8,500 tonnes to 20,000 tonnes, with the majority at 10,000 tonnes. Total capacity has now reached 637,000 tonnes.

The reasons for introducing the bunker concept are many. Permanent storage within the Victorian GEB system, although it might be statistically classed as adequate at 3.8 million tonne capacity, is not always in the right area in high production years.

## 2. Capital Expenditure Costs

Costs are also a major factor. To construct a 10,000 tonne permanent vertical storage would require an expenditure of between $ 800,000 and $1 million. The cost of bunkers, however, is infinitely cheaper at less than $ 50,000 for 10,000 tonne capacity.

Although we have not yet had sufficient experience to properly calculate capital expenditure and operational costs for bunkers, due to the *ad hoc* nature of their development and the experimentation we are conducting, it appears that the capital costs of a 10,000 tonne capacity bunker are about $ 2.50 per tonne, and the operational cost about $ 2.57 tonne, giving an all-up cost of about $ 5 in round figures.

Some extra 'invisible' costs are also involved, such as negotiating the lease of land, generally from the Railways, and the requirement by the lessor that all bunker areas must be left as they were originally if the bunker sites are terminated.

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Apart from cost considerations, there are a number of reasons why we are developing the bunker concept:

1. Bunkers allow the handler to receive grain, store it safely, and retrieve it at a reasonable storage and handling price.
2. Importantly, it allows growers to deliver to a central handling system with minimum hold-up and be paid the guaranteed minimum price.
3. It discourages the provision of extra storage on farms in grain glut periods, thus assisting the grower economically by releasing the pressure on his expenditure, maintaining the grain at its optimum quality, ensuring that maximum market flexibility is maintained.
4. Bunkers can be constructed very quickly once leases have been negotiated, in one week under the most favourable circumstances and two weeks, with difficulties, for a 10,000 tonne storage. Generally, they can be constructed right where the storage is required, thus further assisting the grower.

## 3. Design Criteria

Most bunkers have been constructed with earth walls but, in some cases, it has been more appropriate to use pre-fabricated concrete "T" sections for wall construction and, although these have been more expensive to purchase and transport, they have extra flexibility in that they can be moved at any time and re-constructed at another area. Less land is generally required where concrete walls are used.

The general anatomy of the 10,000 tonne bunker constructed by the Board is a rectangular shape 533 ft long by 104 ft wide, allowing grain to be stacked 20—30 ft high in the centre. Early versions had walls 10 ft high, later ones have 8 ft walls and, recently, we have been experimenting with much shorter walls which require less earth. The most desirable fall is 1 in 100.

Normal black plastic is spread over the earthen or concrete walls and, when the required quantity of grain is stored, a heavy duty "Canvacon" is placed over the top, with careful overlapping, taping the edges, being sure to place the cover well above the walls so as not to encourage depressions which could accumulate water.

If long-term storage is required, we cover the "Canvacon" (which we estimate will last two — five years depending on

quality) with 2—3 ft of earth. Short-term storage does not require the earth cover, thus further reducing the cost (Fig. 1).

Fig. 1: Bunker showing the grain stockpile partly covered by "CANVACON"

It is important that the covering plastic be placed on top of the bunker progressively as grain is delivered as we have found that rain and wind can create real problems if the covering efforts are left to the last minute prior to a thunderstorm.

We are still learning inloading and outloading techniques. Originally, we had trucks tipping on to the backs of augers. Now, we have portable 200 tonne conveyors, triple barrel augers and grain throwers and, this year, have developed a shortbelt conveyor which accepts the grain at ground level from tippers or bottom discharge trucks and lifts it 3 ft on to the main 100 ft conveyor belt (Fig. 2).

The more handling gear we have, of course, the more trucks that can be unloaded at the same time. Our main objective in this area is to be able to utilise the same equipment for both inloading and outloading but we have a little way to go before this can be achieved.

It has been necessary to use portable power generators in most bunker locations because many of them are, by necessity of the site, too far away from the main silo source of power.

Fig. 2: Portable unloading equipment showing the 100 ft, 200 t/h conveyor belt

We are also examining the use of bitumen or concrete floors to cut down dust, consolidate the floor areas and avoid the annual cost of re-grading floors and re-constructing parts of some walls.

Continual modification to the design and nature of inloading and outloading equipment will also be necessary, with particular emphasis on the vulnerability of bunker sites to adverse weather conditions, such as wind and rain, and in recognition of the wide variation in delivery systems and trucks used by farmers.

The Victorian Grain Elevators Board has one bunker still untouched from the 1979—80 harvest and two from the 1980—81 harvest. We have inspected these for damage from vermin after the mice plague last year but found no apparent problems. We are confident that the concept works and, with the assistance of the Australian Wheat Board and C.S.I.R.O., we are hopeful that this temporary form of storage will shortly become a permanent feature of grain handling, not only in Victoria.