

# final report

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Date published: January 2009

PUBLISHED BY  
Meat & Livestock Australia Limited  
Locked Bag 991  
NORTH SYDNEY NSW 2059

## Frozen beef preliminary consignment

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government and contributions from the Australian Meat Processor Corporation to support the research and development detailed in this publication.

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## Abstract

This project is effectively the first stage of a planned program to innovate the way beef for manufacturing purposes is frozen, handled, and packaged for distribution, namely the preparation of one-tonne shipping units of frozen blocks rather than the conventional 27.2 kg cartons.

A document that described the manual process, the envisaged mechanised process, and suggested alternative ways for USDA re-inspection to occur was submitted to AQIS and FSIS and discussed with those organisations during visits to Washington DC and also to Vineland, New Jersey where re-inspection of a consignment was undertaken by FSIS.

Two consignments were prepared by manual means for evaluation by Australian and US regulators and grinders. For both consignments, 54 frozen blocks were stacked to give a shipping unit weight of almost one tonne, wrapped with stretch film and enclosed in a two-layer fabric of woven polypropylene coated on the inside with a polythene/polypropylene co-polymer. The first consignment (4.9 tonnes) was received by AFC, Coominya and evaluated there at intervals over 13 weeks. There was minor discolouration of some blocks where the polyethylene combo bag used as secondary protection beneath the woven polypropylene outer had not been in close contact with them, but the outturn was acceptable in appearance, and functional and sensory properties.

The larger (19.4-tonne) consignment was re-inspected in New Jersey on 3rd December 2008 and some of the shipping units were opened and ground at Keystone Foods, North Baltimore Ohio on 5th December. It is anticipated that the re-inspection may lead to USDA agreeing to amendments to the re-inspection procedure proposed by AQIS; senior FSIS and AQIS personnel were present for the re-inspection.

However, the existing inspection procedure proved to be practicable for the consignment, would be for the additional trial consignments planned and is likely to be suitable for ongoing consignments, albeit less convenient and perhaps more prone to contamination of the meat than the alternatives proposed. Sensory assessments of ground beef and patties at Keystone Foods have gone well to date; assessments will continue for some months.

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## **1 Project objectives**

1. Submission by November 2008, with AQIS input, to FSIS of a protocol for re-inspection.
2. Technical input to domestic shipment by Teys Bros of 5 tonnes of meat frozen blocks (according to specifications) to AFC Coominya to test product integrity.
3. Technical input to initial consignment by Teys Bros of unitised frozen blocks for Keystone Foods LLC.
4. With the stakeholders, review the learning from the consignment.
5. Revision, as appropriate, of the protocol for the through-chain trial and preparation of a final report including all the lessons learned and assessment of issues encountered in the process, together with potential solutions.

## **2 Milestones**

Consignment planning: participation in planning meetings, including advice concerning block preparation, unitisation and packaging in unique polypropylene container. Submission, with AQIS input, of draft submission to FSIS regarding re-inspection of initial and subsequent consignments. Participation in FSIS inspection at US port of entry.

## **3 Success in achieving milestones**

### **3.1 Preparation of frozen blocks**

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Two consignments of frozen meat blocks were prepared by Teys Bros over consecutive October weekends, 18/19<sup>th</sup>, 25/26<sup>th</sup>. The first – five units each weighing 972 kg (54 blocks, each 18 kg) – was trucked to AFC at Coominya. Two units were assessed there one day after delivery. The others were assessed at intervals to 13 weeks.

The second consignment – twenty shipping units each weighing (net) 972 kg – was despatched from Teys Bros Beenleigh on Monday 27<sup>th</sup> October. The preparation of the beef for freezing as 18 kg blocks, and the stacking and packaging of the frozen blocks, was watched by people with previous experience of preparing and handling frozen blocks, and by potential commercialisers.

Details of the procedure for preparing and packaging the frozen blocks for shipping are appended (Appendix 1). The appendix includes photographs.

### **3.2 FSIS port-of-entry re-inspection**

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An application was submitted to AQIS and FSIS and discussed with senior FSIS personnel in Washington D C. One senior FSIS officer was present at the re-inspection of the consignment in New Jersey on 3rd December. The Agency had reservations about some aspects of the proposed re-inspection process and chose to undertake the re-inspection according to the current official procedure. However FSIS has stated that it considers seeing and working through the trial shipments to be beneficial to all.

Despite some reservations expressed by FSIS officers in Washington D C that the new packaging format would involve FSIS inspection staff in more work, the reservations proved unfounded.

Given that neither freezer store staff nor FSIS inspection staff had previously seen the shipping units or the frozen blocks therein, the removal of the packaging, accessing the blocks that were randomly selected using the FSIS automated import information system for sampling, and

reassembling and resealing the shipping units proceeded smoothly. FSIS inspection staff and freezer store staff all commented enthusiastically about the ease of sampling the consignment.

An outline of the re-inspection procedure actually followed appears in Appendix 1.

### **3.3 Grinding of frozen blocks**

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Of the five shipping units trucked to AFC at Coominya, two units were assessed there one day after delivery. The other three were assessed at intervals to 13 weeks for evidence of freezer burn or other changes in appearance. They were ground at 13 weeks and found to have acceptable functional and sensory properties.

Immediately after blocks in Ohio had been ground (after 6 weeks storage), patties of blended chilled and frozen beef from the trial consignment were cooked in the Keystone test kitchen. The flavour was determined by Keystone staff to be good with no off flavour. The flavour of meat shaved from the surfaces of some blocks that were discoloured (due to possible minor freezer burn) and cooked in a manner similar to the patties was also good.

During the week commencing 8<sup>th</sup> December, 2008, Keystone staff thawed some representative blocks from the trial consignment and assessed the beef trimmings against McDonald's specifications. In their opinion, not all the pieces were identifiable as required by McDonald's. Frozen blocks from the trial will be used by Keystone Foods at intervals up to nine months.

## **4 Overall progress of the project**

The first objective of engaging AQIS and FSIS at a senior level in discussion about of the re-inspection process has been achieved. The re-inspection and discussions took place in early December. FSIS staff showed great interest in the trial and several had clearly considered the submission.

The objectives have also been achieved of preparing: 2) a consignment for AFC, Coominya and 3) a shipping container load of frozen blocks for export to Keystone Foods LLC in the US. Many findings from the trial have been discussed between project team members and are documented in this progress report and will be reviewed with other stakeholders at the task group meeting scheduled for 16<sup>th</sup> February 2009.

At the New Jersey inspection, McDonald's noted that the naked block approach offered improved sustainability for the McDonald's supply chain (reduced labour and materials requirements). The approach also offered improved OHS outcomes and would eliminate plastic entrapment in frozen meat.

### **4.1 Block preparation**

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Whilst the block preparation, freezing, and frozen block handling processes were very labour-intensive, and they differed markedly from the mechanised purpose-designed process envisaged, blocks were produced which were successfully bulk-packed and loaded into a container for export to the US. At some key stages – notably size reduction, handling of naked frozen blocks and applying protective packaging over stacks of the blocks – information has been generated that will be valuable for the successful operation of the mechanised process.

The grinder and plate sourced by Teys Bros for the trial operated well. The piece size of individual pieces was discussed with Keystone Foods, and McDonald's LLC. The 40 mm kidney plate, used in the grinder to effect reduction in meat piece size, resulted in pieces smaller than had earlier been negotiated with Keystone Foods and McDonald's. The feedback from Keystone Foods however, after QA staff there had assessed some thawed blocks, was that the meat was acceptable, although larger pieces are preferable in order to better comply with the McDonald's requirement for individual pieces to be identifiable.

The trial highlighted that it will be critical to develop a process that minimises the time interval between the individual blocks exiting the plate freezer and the consolidated and covered shipping units entering a holding freezer. A frame to facilitate better alignment of the blocks as they were stacked would have resulted in easier and quicker fitting of the polypropylene tops and earlier placement of the finished shipping units in the freezer store. Such an aid should be considered for the next stage. The trial also highlighted the implications for various stakeholders of block size and size of shipping units.

## **4.2 Packaging**

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Apart from the difficulty of fitting them over poorly stacked blocks, fitting the polypropylene covers worked well. The reactions of inspectors and handlers in New Jersey and Ohio to the packaging were favourable.

Some modifications to the design are necessary. A modification is needed to the pouch to which the labels were applied because freezer conditions caused the labels to detach from the material of which the pouch was constructed. As FSIS noted, a space has to be provided so the FSIS mark of inspection can be applied. The slip-sheet proved to be brittle under frozen conditions and was sewn to the polypropylene base incorrectly. For one shipping unit, this defect led to a fork of a forklift truck puncturing the polypropylene base. Fortunately, once the affected frozen block had been trimmed, all the frozen blocks were deemed acceptable for use. Some side seams were poorly finished and had opened, slightly exposing some frozen meat. A better means of securing the polypropylene tops to the bases is needed and it needs to be tamper-evident. Secondary packaging should be within the bas. With these modifications, all stakeholders agreed that the trial could proceed with this form of packaging. The cost of this packaging will range from AUD18 to 21 (USD12 to 15) per tonne, depending on the size of the shipping unit. The cost of a secondary liner (around AUD 4) is included. This compares with around AUD35 to 45 per tonne when cartons and liners are used. There will also be a saving on labels because far fewer are required.

For the mechanised stage of the trial it is important that the capacity of the plate freezer(s) be such that partly-stacked shipping units are avoided in order to prevent part shipping units standing away from freezing conditions longer than absolutely necessary.

The trial consignment was exported with all 20 shipping units sitting on the floor of a 40-foot container. Because there is a likelihood of shipping units being stowed two high in 20-foot containers, aspects of the package design, including placement of the shipping labels require further consideration.

## **4.3 Regulatory aspects**

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FSIS officers at the inspection facility in New Jersey and at the Keystone facility in Ohio were supportive of the naked block approach because of the convenience and the likelihood of superior hygiene performance.

AQIS is seeking an agreement with FSIS on a more appropriate definition of transport damage for the shipping units because the current FSIS inspection instruction which is based around 60 lb cartons as the package size could potentially result in the rejection of the whole shipping unit (2000 lb) even if only one 30 lb block had been exposed by the damage to packaging.

AQIS is pursuing with USDA alternatives to the current reinspection procedure. Some alternatives were nominated in the submission to FSIS (Appendix 2). The current procedure at import inspection facilities involves the random selection of a pre-determined number of cartons to sample, or of positions in shipping units such as combos. The number of samples varies with

consignment size. For consignments up to 24,000 lb, the number of (Step 1) samples to be taken is nine. For consignments of more than 24,000 lb (10.9 tonnes) up to 60,000 lb (27.2 tonnes), the number of (Step 1) samples to be taken is 15.

For the re-inspection in December, all 20 shipping units of the two consignment lots were transferred to the inspection room before random selection of the lot, shipping units and position (of individual blocks) occurred. This resulted in the whole room having to be devoted to this consignment.

It is likely that USDA will agree to selection of the positions of the sample blocks, and the shipping units from which they are to be taken, beforehand so that only the required shipping units have to be moved into the inspection room. Although not as convenient an option as the ones AQIS is negotiating with FSIS (upwards of 100 individual blocks had to be handled in order to retrieve the nine blocks identified for examination from the one selected lot), the inspection house handling charge is likely to increase little and it would probably be tolerable to Mac on an ongoing basis and would certainly be practicable for the next stage of the proposed trial. The proposed trial consignments will provide the opportunity to obtain useful information about the handling costs and also a better indication of the hygiene implications of handling individual naked blocks in order to retrieve sample blocks.

FSIS voiced a concern about traceability of individual blocks if, once shipping units of product entered US commerce, the units were split up before they reached the final user. This concern doesn't arise if our proposed shipping units are supplied intact to grinder end users. It is felt that this concern could be used as an argument in favour of conducting the import re-inspection at the premises of the end-user.

## 5 Recommendations

1. AQIS to be encouraged to continue negotiations with USDA for a more relevant definition of transport damage, and for alternative inspection procedures to the current ones;
2. The project team persevere with the current packaging approach and that Bag Corp be encouraged to resolve some deficiencies that were identified;
3. Because of the implications for further evaluation of the packaging, a decision should be made on whether there is a likelihood of naked blocks be exported in 20-foot shipping containers with shipping units stacked two high;
4. Subject to the outcome of the planned trial by Keystone Foods, the block size for the next stage of the trial should be 13.6 kg (30 lb);
5. Through its consortium members, Mac gauge whether the opinions formed from this trial with Keystone are likely to be shared by the other member companies;
6. Possible commercial models that underpin further development of block preparation systems be evaluated.

In addition to the ones above, discussion of the outcomes with the project task group may result in further recommendations that relate to the mechanisation project to follow this one.

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## 6 Appendices

### **Appendix 1: Outline of procedure for freezing, handling, and packaging blocks**

Blocks were prepared by Teys Bros staff and employees at the Company's Beenleigh facility over two consecutive weekends in October – 18/19<sup>th</sup> and 25/26<sup>th</sup>. The first lot – five 972 kg shipping units – was prepared for evaluation at AFC at Coominya. The second – twenty shipping units, each 972 kg – was prepared, stowed in a forty-foot container, and despatched to Philadelphia.

### **Method of preparation of blocks**

On each of the two occasions 85 CL product was selected from normal boning room output two days prior to the block production. CL estimates at the Eagle analyser were used to select the cartons. Sufficient cartons to produce the required numbers of shipping units were transferred to a freezer store and the meat was cooled to approximately 2°C.

When the meat was required for size reduction and repacking, groups of cartons were moved to the offal handling and freezing facility. The cartons were opened in groups of three and the meat was emptied into a wheeled stainless bin. Great care was taken to separate all polyethylene liner material from the meat. The bin was elevated, the meat was emptied into the holding chamber of a 200 mm grinder fitted with a 25 mm hole plate and cutter for part of the first run and with a 40 mm kidney plate and a four-bladed cutter for the remainder of the first run and for all the second run.

The size-reduced meat was packed manually into 100 mm deep cartons. The cartons – of base and lid construction – were of liner-less design, coated internally to make them impervious. The cartons were filled to a net weight of 18.0 kg, lidded and strapped. For the first (5-tonne) lot, two straps were applied, each 80-100 mm from the ends. On the second occasion a third strap was applied around the centre to provide additional support and reduce carton bulging.

For the first lot, the lidded and strapped cartons were transferred in pallet-loads of 54 cartons to the boning room and re-screened through the Eagle analyser for metal contamination. They were then brought back to the offal freezing facility and loaded into a plate freezer. Upon closure, the plates were prevented from squashing the cartons by the use of spacers between the plates. According to temperature loggers placed in selected cartons, meat froze to below -18°C within 7 hours. Cartons were removed from the freezer after approximately 24 hours at which time the meat temperature was colder than -30°C. The cartons were held in a freezer store for a further 24 hours until required for stripping and unitising.

For the second (19.4-tonne) lot, after the cartons had been re-screened they were strapped in pairs, one on another, and loaded into designated stations in a large plate freezer that is routinely used for freezing beef TRMG for manufacturing. Meat froze to below -18°C within 18 hours and when the cartons were removed from the freezer – after around 24 hours – the meat temperature had fallen to -30°C.

Discussions with freezer operators during the re-inspection visit to New Jersey suggested that block size should be compatible with carton size in order to maximise the utility of the naked block distribution process. For this reason it appears that the preferred block size is 30 lb – half the thickness of standard 60 lb blocks. Such thinner blocks may, however, pose difficulties for grinders. This is referred to later.



### **Unitising and packaging procedure**

The carton lids and bases were stripped from the frozen blocks manually. The blocks were unitised as shown in the photographs on page 7. The base of the containment package was from woven polypropylene with an internal coating of polyethylene/polypropylene to ensure it was impervious. The base had a slip-sheet sewn on.

For the first consignment, at the request of AFC, a combo-sized bag of blue polyethylene was inverted over the unit and tucked into the polypropylene base. The combo bags proved to be too large so for some units a flat sheet of blue polythene was placed over the top blocks before the combo bag in order to better exclude air. The top, like the base, of coated woven polypropylene, was pulled over the unit and tied to the base.

Labels bearing necessary details were placed within pouches sewn to the tops.

For the second consignment, flat sheets of blue polythene were placed over the top blocks and stretch plastic (blue) was liberally wound around the stack down to and including the top 150 mm of the base. The tops were pulled over the unit and tied as for the first consignment. At first, the stacks of blocks were assembled with blocks of successive layers perpendicular to those immediately below (brick stacked) in order to maximise the stability of the shipping unit. Because the polypropylene tops proved very difficult to pull down however, later stacks were assembled with only the top and bottom layers oriented perpendicularly to the other layers which were column-stacked. This practice made it easier to pull on the tops, yet did not noticeably affect the stability of the units.

Difficulty was experienced with the pouches for labels in that once the labelled shipping units had been placed in a holding freezer, the labels detached. Special measures had to be adopted under the supervision of AQIS officers to secure the documentation required by AQIS and FSIS. During the US visits, the supplier of the polypropylene packaging was shown the deficiency and possible alternatives were discussed.

During the handling of the trial consignment in New Jersey and Ohio, other deficiencies of the packaging became apparent. The slip-sheets sewn to the bases proved to be very brittle when frozen; the fracture of one resulted in a fork of a forklift piercing the polypropylene base and coming into contact with the meat. Also, some side seams of the bases (within which there was no secondary protective covering – unlike the upper parts of the stacks) parted slightly, exposing small areas of frozen blocks. Photographs of examples of the defects are shown below. The project team is confident that the defects can be corrected.

Keystone Foods would like secondary protection – probably via a bag similar to the combo bag – to protect all blocks, including the bottom ones. In order to avoid the inconvenience of packing blocks into a tall bag, it has been suggested that the inner protection be of two pieces – like the polypropylene outer. Keystone Foods also expressed a preference for blocks with rounded corners to minimise abrasion and puncture.

At the time of re-inspection the polypropylene tops proved relatively easy to remove and replace, and at the grinding facility they were found very convenient to remove and stow for disposal.



Kidney plate used in grinder – 40 mm holes



Examples of individual meat pieces from 40mm plate. Scale lying on surface is 150mm



Carton base (left) and lid



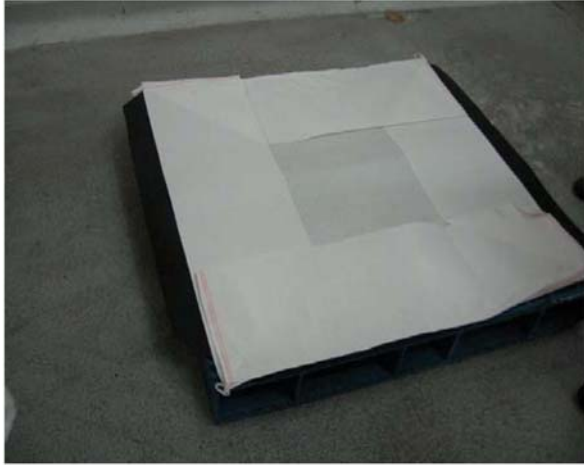
Cartons being levelled, filled to weight and lidded



Lidded and strapped cartons



Frozen blocks removed from cartons and stacked into polypropylene base



Base before addition of blocks



Polypropylene top being secured to base



Shipping units ready to be loaded into shipping container



Shipping label affixed within pouch sewn to polypropylene top



Shipping units (20) loaded into container with dunnage strips of polystyrene

### **Re-inspection - procedure followed**

As stated in the main report, AQIS is pursuing with USDA alternatives to the current reinspection procedure at the inspection houses. For the trial consignment inspected by FSIS on 3<sup>rd</sup> December 2008 however, current procedure was followed.

The 20 shipping units were exported as two lots of 10 units (A and B marks). For the re-inspection on 3<sup>rd</sup> December, all 20 shipping units of the two consignment lots were transferred to the inspection room before the random selection of the lot, shipping units and position (of individual blocks) occurred. This resulted in the whole room having to be devoted to this consignment.

The FSIS automated import inspection system (AIIS) did not generate a requirement for either lot to be subjected to physical examination. FSIS randomly selected Lot A for the inspection.

The current procedure involves the random selection of a pre-determined number of cartons to sample, or of positions in shipping units such as combos. The number of samples varies with consignment size. For consignments up to 24,000 lb, the number of samples to be taken is 12 – nine for Step 1, three for Step 2 if the Step 1 samples fail the examination criteria. For consignments of more than 24,000 lb (10.9 tonnes) up to 60,000 lb (27.2 tonnes), the numbers of Step 1 and Step 2 samples to be taken are, respectively, 15 and 15 – 30 in total.

For lot A, the AIIS identified blocks in nine positions in a total of eight shipping units, meaning that two of the shipping units were not opened while two blocks were selected from one of those opened, with one block selected from each of the other seven.

Under FSIS supervision, and with onlookers from at least 12 US, Australian and New Zealand organisations, handling staff at Atlantic Coast Freezers opened a shipping unit, retrieved a block from the position nominated by AIIS, and replaced the packaging before moving to the next shipping units in turn. They removed the top cover, the stretch wrap and the blue plastic sheet from the blocks. The top cover and blue sheet were folded and placed on a stainless steel table. To retrieve the block required, overlying blocks were manually placed on the blocks at the side opposite to where the required block was located. By following this practice, there was no need to move the overlying blocks to a nearby table as intended. The procedure was particularly convenient for the units in which successive layers were column stacked. For one unit, the block chosen was near the bottom of the stack; it was retrieved without difficulty. Overlying blocks were then replaced, stretch wrap applied and the cover replaced.

Although some blocks were bonded together, personnel had little difficulty breaking the bonds, either with a small tool or simply by gently lifting and dropping them.

As the nine blocks for examination were removed, they were carried to a stainless steel table near a bandsaw. Two samples, each approximately 6 lb, were sawn from the blocks. Each of the samples was placed in a plastic bag and a second bag was pulled over the first to provide greater confidence that there would not be water ingress during the water thawing process (water 125F) that followed. In accordance with the normal policy of Mac, the nine blocks – including the thawed sub-samples – were discarded.

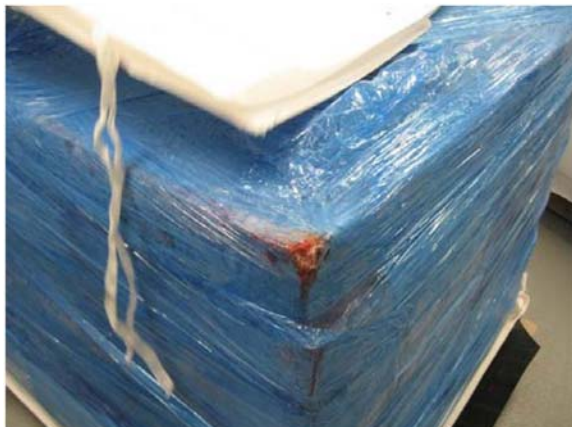
The blocks were thicker than those normally removed from 60 lb blocks and took longer than anticipated to thaw. The physical examination of the samples took place after the visitors had left the freezer facility. The lot met the acceptance criteria.



Shipping units set out in inspection room for FSIS physical examination



Packaging removed from a unit selected for sampling by FSIS



Evidence of abrasion of stretch wrap.



Outer Removal of selected frozen block packaging intact so acceptable to FSIS



Nine selected frozen blocks awaiting sampling



12 lb sample (2two 6 lb pieces)0  
sawn from block awaiting thawing

### **Use of frozen blocks at Keystone Foods Equity Group, Ohio**

To the initial concern of some observers, the 20 shipping units were found to have been trucked from New Jersey two abreast without restraint in a truck rather longer and wider than the consignment. No damage as a result of movement during the journey was evident, however. As indicated earlier, some evidence of deficiencies in the polypropylene packaging became evident upon close examination at the grinding facility.

Several shipping units of product were transferred to the grinding room. Others were moved to a freezer store for later use. No difficulty was experienced by the handling personnel in removing the packaging. Apart from the aforementioned puncture of one polypropylene base by a forklift truck and some initial concern about the presence of blue plastic within blocks in the first unit opened (plastic deliberately inserted around temperature loggers by Teys Bros staff), the reaction to the units of frozen blocks was very favourable.

Although some blocks were found to be bonded together, after a brief period of familiarisation, personnel had no difficulty breaking the bonds, either with a small tool or simply by gently bumping them.

The incline conveyor to the No. 1 grinder was designed for thicker 60 lb blocks; it had non-return barriers at intervals which proved to be inadequate if the thinner trial blocks were fed onto the conveyor at the incorrect time and during the short period trial blocks were fed to the grinder, two blocks fell to the floor. It appears that it will be quite simple to make a modification to the conveyor to prevent this loss.

The vertical elevator to the No. 2 grinder will also need modification. Being thinner than normal, the trial blocks tended to tilt away from the elevator mechanism, and jammed without manual intervention.

The in-feed mechanisms to both grinders handled the blocks without difficulty. Individual blocks being thinner and lighter than the 60 lb blocks normally taken from cartons meant that at the in-feed rates at the speeds at which the conveyor and in-feed mechanisms were set, were too low. It was foreshadowed that if subsequent consignments of blocks were thinner and lighter as intended, the throughput rate would be even lower unless appropriate modifications were possible. After discussion, it was agreed that Mac would arrange with Atlantic Coast Freezers and Keystone Foods for one or more pallet quantities of 60 lb blocks from cartons to be split and evaluated by Keystone for the convenience and rate at which they could be fed to the grinders.



Shipping units as trucked from New Jersey to Keystone Foods, Ohio



Example of poor stitching of polypropylene base



Unit to be opened for grinding. Inclined conveyor to No. 1 grinder in background



Blocks being fed onto inclined conveyor



Evidence of fork puncture of polypropylene base



Blocks fed via metal detector to vertical elevator for No. 2 grinder