Visit to Irvin & Johnson Ltd Trawling Division, Cape Town, South Africa

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SEA FISH INDUSTRY AUTHORITY

Seafish Technology

Visit to Irvin & Johnson Limited
Trawling Division, Cape Town, South Africa

Provision of Technical Advice on the Implementations of Improved Technical Conservation Measures

In April 1992 Seafish were contacted by Rob Whitehead, Operations Manager, for Irvin & Johnson, for advice on the use of square mesh panels as a means of improving selectivity in trawl gear.

As a result of the initial contact a visit was made to Cape Town where my services were employed by Irvin & Johnson in an advisory capacity.

I was asked to brief senior management on current research generally regarding the use of square mesh, as well as making recommendations and observations on the probable effects of square mesh on catch rates, fish quality, selectivity etc., in the South African Hake Fishery.

Additionally I was directly involved in assisting and advising fishing department personnel including the Fishing Manager (Amir Ovadia), shore skippers (Noel Less) and Netting Superintendents etc., on the design, and production of square mesh panels and other modifications to existing trawl designs.

The main aim was to improve the selectivity of demersal trawl gear aimed at catching Hake.

Hake is one of the principle fish species exploited by Irvin & Johnson's deep sea trawling fleet. It is the only species subject to quota. The five main Trawling Companies in South Africa account for over 80% of this quota.

Recently there have been pressures exerted from certain sectors of the Industry requiring the deep sea trawling sectors to demonstrate that their methods of exploitation are not adversely affecting the stocks of Hake.

Since there has been no significant improvement in the state of the Hake stocks over recent years (reflected by minimal increases in CPUE) despite a number of increases in minimum mesh size, Irvin & Johnson have decided that some different approaches to conserving stocks should be investigated.

Currently the Hake quota stands at 140,000T. This is a static quota.

Irvin & Johnson Limited operate a fleet of twenty four stern trawlers, eleven of which operate as 'Wet Fishers', boxing fish in 30 kilo units and the rest operating as 'Freezer Trawlers'.

The size classes of the vessels range from 50m to 90m. Four of the vessels are ex. Polish, German and Spanish, the rest were purpose built for Irvin & Johnson.

The fleets principle areas of operation are divided by the 20° longitude line. Grounds to the east of the line have a current legal minimum mesh size of 75mm. Grounds to the west have a minimum of 110mm. Waters off the coast of Namibia are also subject to 110mm.

Approximately 40% of the Irvin & Johnson fleet operate to the east of 20°long. The minimum mesh size of 75mm was imposed to take into account the inshore fishing fleets which exploit other species including Sole. (Mixed species fisheries).

Irvin & Johnson have a company policy whereby the minimum mesh size used by their vessels in the easterly sectors is 90mm. Vessels in the western sectors use a minimum of 112mm and more commonly 120mm to allow for shrinkage when using mixed PA/PE twines for cod end construction.

The remaining 60% of the fleet operate to the west of the 20° longitude line. Water depths on the grounds fished range from 100m - 600m with average operational depths of around 300/350m. Deep sea vessels are restricted to fishing waters of 110m minimum - (Government regulation).

Other species taken in the shallow water areas include Horse Mackerel, Mackerel and Snook.

Hake is the species causing most concern. At present there is no minimum landing size (MLS) for Hake but the market dictates a minimum grade size (6) headed and gutted of between 80 and 220g or 18-25cms. This equates to an overall live length of approximately 23-25cms.

The species of Hake caught in South African waters (*Merluccius capensis*) is similar in morphology to the Hake species caught in European waters (*Merluccius merluccius*).

Irvin & Johnson as a company employ over 5,000 people, 1,100 of which are at sea operating their vessels and 1,300 shore based in post-catch processing.

It is apparent that they have forward looking policies including a commendable conservation minded attitude to their catching sector's activities.

Fishing Gear

The fishing gears used by the Irvin & Johnson fleet are of three principle types;

- German design - approximately 80ft on the ground gear which can be either a hard ground bobbin or Rockhopper rig or a fine ground rubber disc footrope.

- French 4-panel net - approximately 43m headline principally rigged for fine ground.

- Polish design - built in a number of sizes to suit vessel horsepower, the two principle sizes being 25m and 33m headlines.

Netting is supplied by local company Cape Netting as cut panels specified by Irvin & Johnson. Nets are put together at Irvin & Johnson's net loft or onboard vessel under skippers supervision, after liaison with shore-based fishing skippers.

Trawls are constructed in PE Twine for the main component sections with cod end constructed of mixed PE/PA. Main panels are single braid PE with cod ends and sometimes extensions in double braid 5mm twine. Twine diameter for the rest of the net is a minimum of 3mm but preferably 4mm.

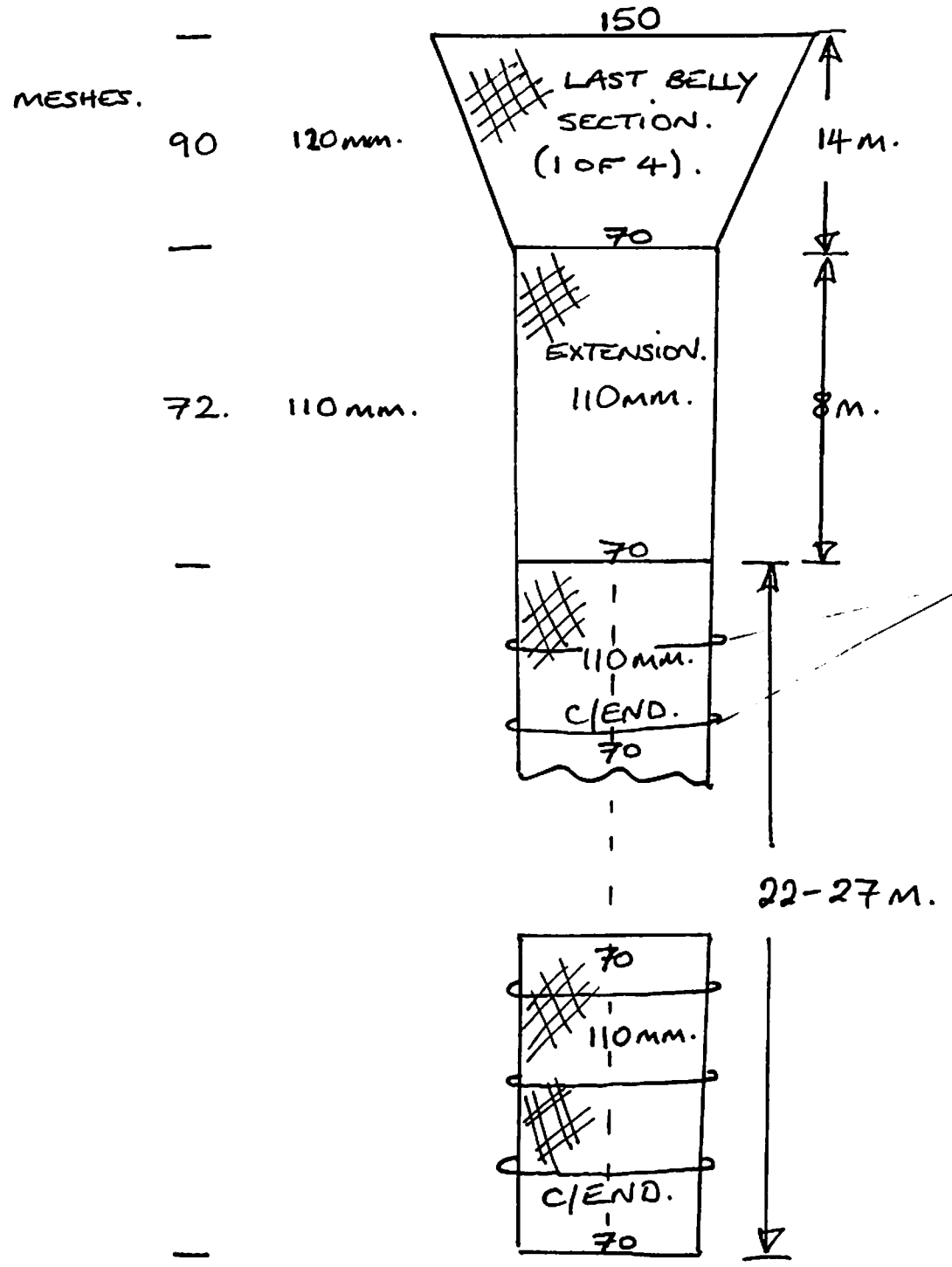
Some of the trawl designs do not incorporate parallel extensions but cod ends are usually a minimum of 22m in length.

A typical trawl used by Irvin & Johnson would have the following dimensions in the aft sections of the net as shown in the diagram.

Vessels operating with a minimum mesh size of 110mm would not be able to use square mesh panels of this size.

110mm square mesh would produce disastrous effects on catch retention.

Typical dimensions of aft section of trawls used by I + J vessels.



Codends are rigged with 14 beckets x 5·5m long at approx. 1·5m. spacings. (Average catch 6-8 rings/2 hour tow.).

Codends have 4 full meshes in side selvege + 2 full meshes in central/mid line "dummy" selveges.

Bellies + c/ends carry "belly lines" side selvege of c/ends have heavy plaited ropes, mid lines have twisted ropes. All rigged length for length.

In order to adopt the square mesh panel idea a more sensible mesh size would have to be allowed. Bearing in mind the species being dealt with, it was recommended that a 75mm square mesh be used as a starting point.

There would be no problems of using this in the area where 75mm is the current legal minimum mesh size.

If 75mm square mesh does not provide the desired reduction in discard levels then the mesh size should be increased in 5mm increments where material availability allows.

If this was not possible or not thought to be practical a jump to 90mm square mesh would give indications as to the possible changes in selectivity achievable this may also be more acceptable to fisheries departments.

Recommendations

It was recommended that the material used for the construction of the square mesh panel be of the following specification:

NICHIMO (Japan), Knotless PE netting of "ultra-cross" (U/C) construction in 240 ply, 4.9mm Ø

75mm mesh size (inside mesh)
or 90mm mesh size (inside mesh)

Top and bottom horizontal edges of the panel to be strengthened by lacing two bars (1 full mesh) together.
Side selvedges to contain 2 full meshes (3 bars) for 2:1 (◇:□) joining rates.

Strengthening "belly lines" to be incorporated on side selvedges and mid line "dummy" selvedges to be compatible with existing ropes on nets. It was recommended that these ropes be shorter than the netting panels to which they are attached. The criterium being the length of the square mesh panel itself. This would ensure the strain is taken off the netting panel and taken on the selvedges. A length of 98% of the panel length was recommended as a minimum.

e.g. 6m square mesh panel, selvedges ropes would be 5.9m i.e. equivalent to approximately 4inches short. 6inches may be a more practical rigging consideration.

If Knotless U/C netting is not available then it was recommended that if standard diamond

mesh PE[1] is to be used it should preferably be heat-set "on the square". As with Knotless netting, the tope and bottom horizontal edges should be strengthened by lacing two bars together. This has the additional advantage of helping the panel maintain a square shape.

Whether using U/C netting or standard netting the square mesh panel once cut-out should be pre-stretched prior to rigging.

The square-mesh selector panel should be constructed as a complete netting section i.e. top and bottom panel complete, fully rigged with selvedge ropes. This enables the section to be interchanged or moved easily if required. This gives greater flexibility in positioning the panel for optimising the effectiveness.

A square-mesh panel length of 6m was recommended initially. This could be adjusted if required. The positioning of the panel within the net may be varied but initially it was recommended that it should be sited between the last belly section and the parallel extension (if fitted) or the cod end (if not fitted).

If a build-up of fish was to occur with the panel in this position (usually indicated by the presence of "stickers" in the top sheet of the last belly section) it may be necessary to move the position of the panel further towards the cod end or place a short section of parallel extension between the last belly section and the square mesh panel.

A joining rate of 2:1 has initially been proposed based on experience gained in UK fisheries. This assumes a towing width of the extension determined by a fractional mesh opening (FMO) of 0.2x the stretched mesh length of meshes in the extension.

Since the trawling operation under consideration involves hauling the cod end up a stern ramp, then there may be a problem in that the square mesh panel section may have insufficient netting in the top panel to cope with this mode of hauling. This can only be established by trial and error. However, panel details involving a joining rate of 1.5:1 were also offered. It is envisaged that this extra netting resulting from this joining rate would alleviate any potential problems without affecting the performance of the panel.

Recommended Procedures for Undertaking Evaluation of Square-mesh panels.

It is Irvin & Johnson's intension to carry out an experimental exercise using four identical sister ships. The vessels are wet fish trawlers of 1,500 BHP catching approximately 10

[1] It may be advisable to increase twine diameter of this type of panel to 5 or 6mm.

tons/day of which 80% would be Hake.

Bearing in mind no specific staff will be available to monitor catches, all catch sampling will have to be conducted by the vessel's crew.

In order to gain any valid data regarding this exercise it was recommended that comparative fishing trials be conducted over a period of six months using two matched pairs of vessels. One vessel from each pair using a net fitted with a square mesh panel. Otherwise both sets of gear, including doors and sweeps, bridles and warp: depth ratios etc. must be identical.

The vessels from each matched pair would alternate nets on a regular basis to reduce effects of any bias towards one vessel or another.

With this type of exercise it is difficult to conduct comparative tows with 100% confidence that the tows are statistically comparable. In order to produce data that can be utilised with confidence a relatively long period of time is required.

Due to the limitations of commercial fishing the most acceptable method of comparative fishing would be using the parallel tow procedure. Even this type of exercise may not be practical and therefore it may only be possible to monitor CPUE of paired vessels working similar areas for similar periods of time. (All other factors being equal.)

Catch evaluation would involve separation of marketable catches of Hake from the catch to be discarded. Both components of the catch would be quantified by volume and/or weight and recorded with details including tow time and other relevant operational information (position, depth etc.).

Over a representative period of time the catches of marketable Hake and discarded Hake would then be compared per unit of fishing time for the vessels operating standard nets against those operating nets fitted with square-mesh panels.

Since length/frequency data will be unavailable for the species in question, discards of Hake (fish below market grade 6) would have to be quantified by weight preferably, or by bulk if this is not possible, for each unit of towing time (hours).

This may incur additional work for deck crews but if the exercise is to be of any value it was recommended that a rigid procedure of catch/discard monitoring be adhered to and maintained for the duration of the trials.

On Thursday 4th June a presentation was made to senior Irvin & Johnson Fishing Division staff along with a number of senior representatives from the South African Sea Fisheries Department and the Sea Fisheries Research Institute. The presentation made was based on

the seminar used by Seafish in the European Selectivity Tour.

The proposals made to Irvin & Johnson for the implementation of a programme of work to evaluate the effect of square mesh panels in nets used by the Irvin & Johnson fleet were outlined and discussed with those present.

The following is a list of those present at the meeting:

Dr. L. Botha	-	Chief Director of the South African Sea Fisheries Dept.
Dr. V. Shannon	-	Director of the Sea Fisheries Research Institute.
Dr. A Payne	-	Deputy Director of the Sea Fisheries Research Institute.
Dr. Wilkinson	-	Sea Fisheries Research Institute.
Mr. M. Japp	-	Senior Researcher, Sea Fisheries Institute.
Mr. Chris Smith	-	Chief Technician, Sea Fisheries Institute.

Irvin & Johnson staff -

Mr. C. Atkins	-	Managing Director.
Mr. Louis Fourie	-	Group General Manager, Fisheries Division, Cape Town.
Mr. Rob Whitehead	-	General Manager.
Mr. Amir Ovadia	-	Fishing Manager.
Mr. Barry Rose	-	Production Manager.

On Friday 5th May, the monthly meeting of representatives (Managers) of the Deep Sea Fishing Industry in Cape Town was held at the Head Offices of Irvin & Johnson in Cape Town.

One of the subjects on the agenda were the proposals discussed during my visit to Irvin & Johnson.

It was decided that a working group was to be set up by Rob Whitehead (General Manager, Irvin & Johnson) and one of his counterparts from one of the other major trawling companies in Cape Town.

The working group is to be involved in setting up and organising trials to evaluate the use of square-mesh panels. The work is to be carried out in very close co-operation with the South African Sea Fisheries Departments.

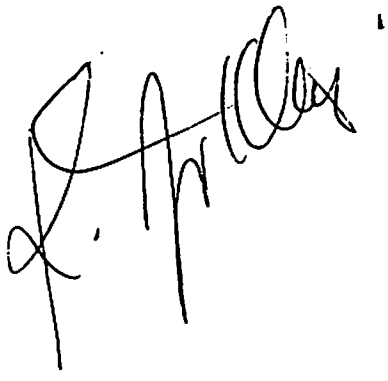
I was informed that the proposals put forward at the meeting were received with a very positive response.

If the initial trials are successful then it is essential that improved selectivity measures are taken-up and supported by the whole industry and not just one company.

Irvin & Johnson make up half of the Deep Sea Trawling Industry in South Africa and were prepared to go ahead with work irrespective of the other companies decisions on these matters.

The South African Sea Fisheries Department are happier to support any such exercise if the whole of the industry is involved. Any support or involvement with one particular company may be conceived as favouritism!

As a result of the films shown to Irvin & Johnson staff at the presentation, showing the uses and benefits of underwater photography and cameras in this work, Irvin & Johnson have expressed serious interest in acquiring underwater observation equipment of their own. They are shortly to commence enquiries into the possibilities of using such equipment on their fishing vessels.



Recommendations for Implementation of Improved Technical Conservation Measures - Irvin & Johnson Ltd

The use of square mesh selector panels or "windows" are recommended as the most suitable device for improving the selectivity of the existing fishing gear designs.

An alternative configuration to the square mesh using diamond mesh netting has also been suggested as a secondary consideration. This involves setting a diamond mesh "windows" panel in the extension of the net with the "run" of the netting set at 90° to the towing direction.

Bearing in mind the current situation with minimum mesh sizes and the target species involved in this fishery, it is recommended that Irvin & Johnson apply for permission to carry out experimental comparative fishing trials using square mesh panels of approximately 6m length fitted in the top panel only of the parallel extension section of their existing trawl designs.

The mesh size to be requested is suggested at 75mm (inside mesh). This requirement for permission will only be applicable for vessels operating to the west of the 20° longitude line.

A minimum period of three months but preferably six months, for the duration of the trials will be required in order to obtain valid data as to the effectiveness of the experiment.

It is recommended that the exercise be conducted by two matched pairs of vessels. The vessels must be as near identical in their design, operation and the fishing gear used so that catch data is comparable.

The recommended procedure would be for the matched pairs of vessels to operate wherever possible on the same grounds and if conditions allow, parallel tows should be conducted.

Comprehensive logs must be kept recording vessels position and operational conditions for each gear type used. Accurate towing times will also have to be recorded.

One vessel from each matched pair will operate a standard trawl gear, the other operating a standard net fitted with a square mesh selector panel section. The selector panel should be swapped between vessels on a regular basis throughout the duration of the trials in order to reduce any bias that may exist.

Catches should be split into marketable and non-marketable or discard Hake. Both the marketable and discard portions must be quantified by weight and/or volume and equated to each unit of fishing (towing) time (hours). All non-marketable Hake irrespective of size must be recorded in the discard portion of the catch.

This data should be accumulated and monitored on a regular basis to compare with the other partner vessels.

Results should be reviewed on a regular basis (trip by trip whenever possible).

After a period of 3-6 months sufficient towing time should have elapsed to evaluate whether the square mesh panel is effective or not, and over this period of time there is a high degree of confidence that the data obtained are valid and comparable.

It is suggested that quality checks should be carried out in order to establish whether there are differences in the quality of the catches taken by the nets fitted with the square mesh panels when compared with the standard nets.

A short initial trial (1 or 2 trips) is recommended using square mesh panels constructed using standard diamond mesh netting cut-out "on the square". Panels of both 75mm and 90mm square should be tried in order to try and establish the most suitable mesh size for the Hake, prior to ordering Knotless netting material from the Japanese Co. Nichimo, as recommended.

However, the decision to use 75mm mesh may be taken out of Irvin & Johnson's hands should the Fisheries Departments refuse permission to use this mesh size in the western sector. In this situation, effort would have to be concentrated in the eastern sectors where 75mm is allowed.

In any event a minimum mesh size of 75mm square mesh and a maximum of 90mm square mesh are recommended for this fishery.

The first choice material recommended for the construction of the square mesh panels is the Knotless, PE ultra-cross (U/C) material produced by the Nichimo company of Tokyo, Japan (as demonstrated).

Recommended specification;

PE Ultra-cross
240 ply x 4.9mm Ø
75mm mesh size
or 90mm mesh size } inside mesh measurement

The construction of the panels is straight forward (as demonstrated to Irvin & Johnson net rigging staff).

Points to note:

Top and bottom horizontal edges of the square mesh panel should be strengthened by lacing two bars (1 full mesh) together. Once edged the panel should be pulled into square mesh shape and stretched to set panel shape and ease with rigging. This is also made easier by selvedging the panel sides prior to joining/lacing to the lower diamond mesh panel. If a 2:1 joining rate is used, two full meshes or three bars should be taken into the selvedge. This corresponds to four full meshes or five knots on the lower sheet. As mentioned, by doing this the square mesh panel maintains its shape more readily.

Strengthening "belly lines" are recommended to be incorporated and to be compatible with existing roping on cod ends and extensions.

The ropes on the square mesh panels should be shorter than the panel itself in order to take the strain of the square mesh netting. It is recommended that these ropes should be at least 98% of the stretched panel length (approximately 4-6inch shorter).

When lacing the lower diamond mesh sheet to the square mesh panel it must be ensured that the square meshes run parallel and horizontal from selvedge to selvedge irrespective of mesh size used in the lower sheet.

By constructing the square mesh panel as a complete netting section (complete with strengthening ropes x 4) the unit can be interchanged from net to net or simply moved in position within the body of the net.[2]

The square mesh panel is recommended initially at 6m in length. This may be adjusted if results from trials indicate this.

The positioning of the panel within the net may be varied but initially it is recommended that it should be placed between the last belly section and the parallel extension (if fitted) or the cod end (if no extension fitted).

If a built up of fish occurs with the panel in this position, it may be necessary to move the position of the panel towards the cod end or place a short section of parallel extension between the last belly section and the square mesh panel.

A joining rate of 2:1 has been suggested based on experience gained in UK fisheries. This assumes a towing width of the extension determined by a fractional mesh opening (FMO) of 0.2 x the stretched mesh size of meshes in the extension (diamond mesh length).

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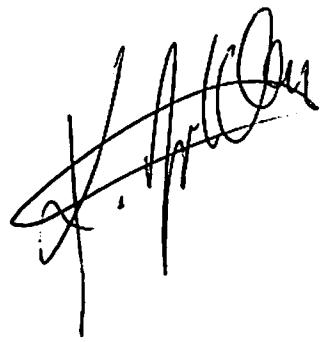
[2]These details and other information are contained in the Seafish data sheet - Selection in towed fishing gears 1991/1/FCI.

Since the trawling operation under consideration involves hauling the net up the stern ramp of the vessel, then there may be a problem in that the square mesh panel section may have insufficient netting in the top sheet to cope with this mode of hauling and the associated strains. To try and allow for any possible problem of this type, details of a 1.5:1 joining rate have been included in the recommended panel designs offered.

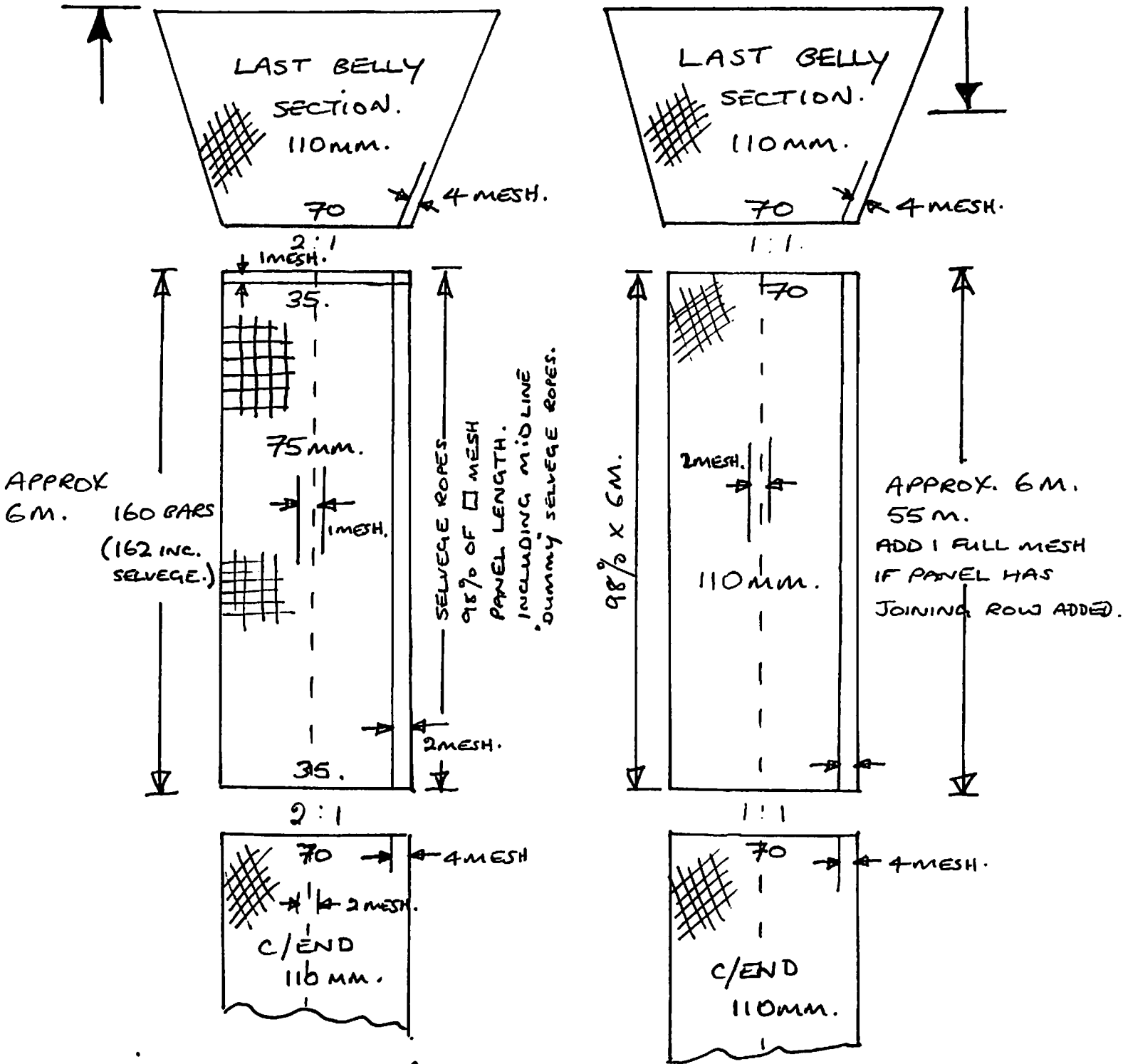
Presented to Irvin & Johnson Ltd
4th June 1992

K Arkley



PROPOSED DESIGNS OF SQUARE-MESH PANEL SECTIONS. 110MM. NETS.

2:1 JOINING RATE.



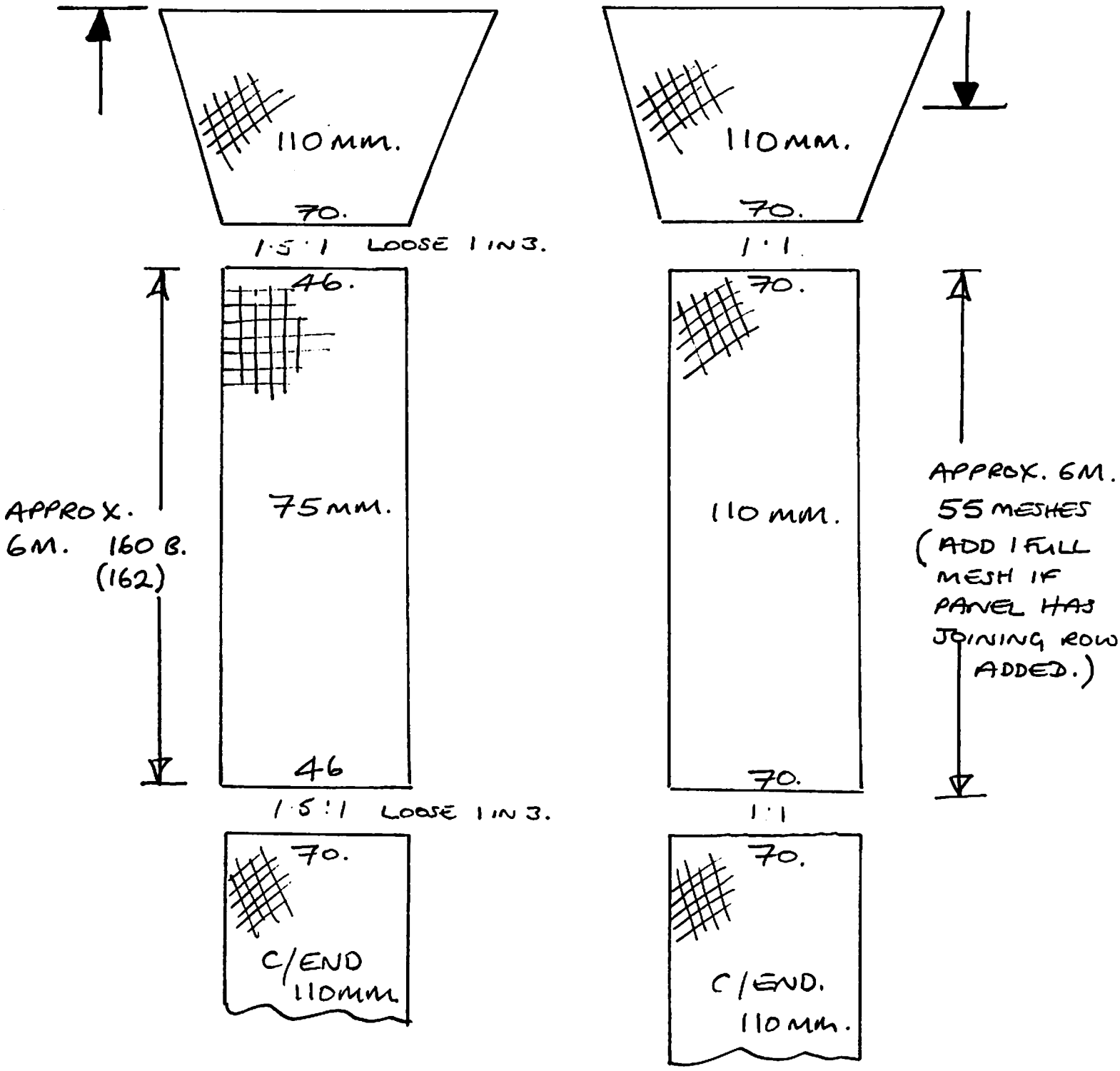
TOWING WIDTH OF ◇ EXT ≡ 1540 MM. AT F.M.O = 0·2

" " " □ PANEL ≡ 1312·5 MM.

□ DIFF. = − 227·5 MM (≏ 9").

PROPOSED DESIGNS OF SQUARE-MESH PANEL SECTIONS. 110 MM NETS.

1·5 : 1 JOINING RATE.



TOWING WIDTH OF ◊ EXT. ≡ 1540 mm. AT FM0 = 0·2.

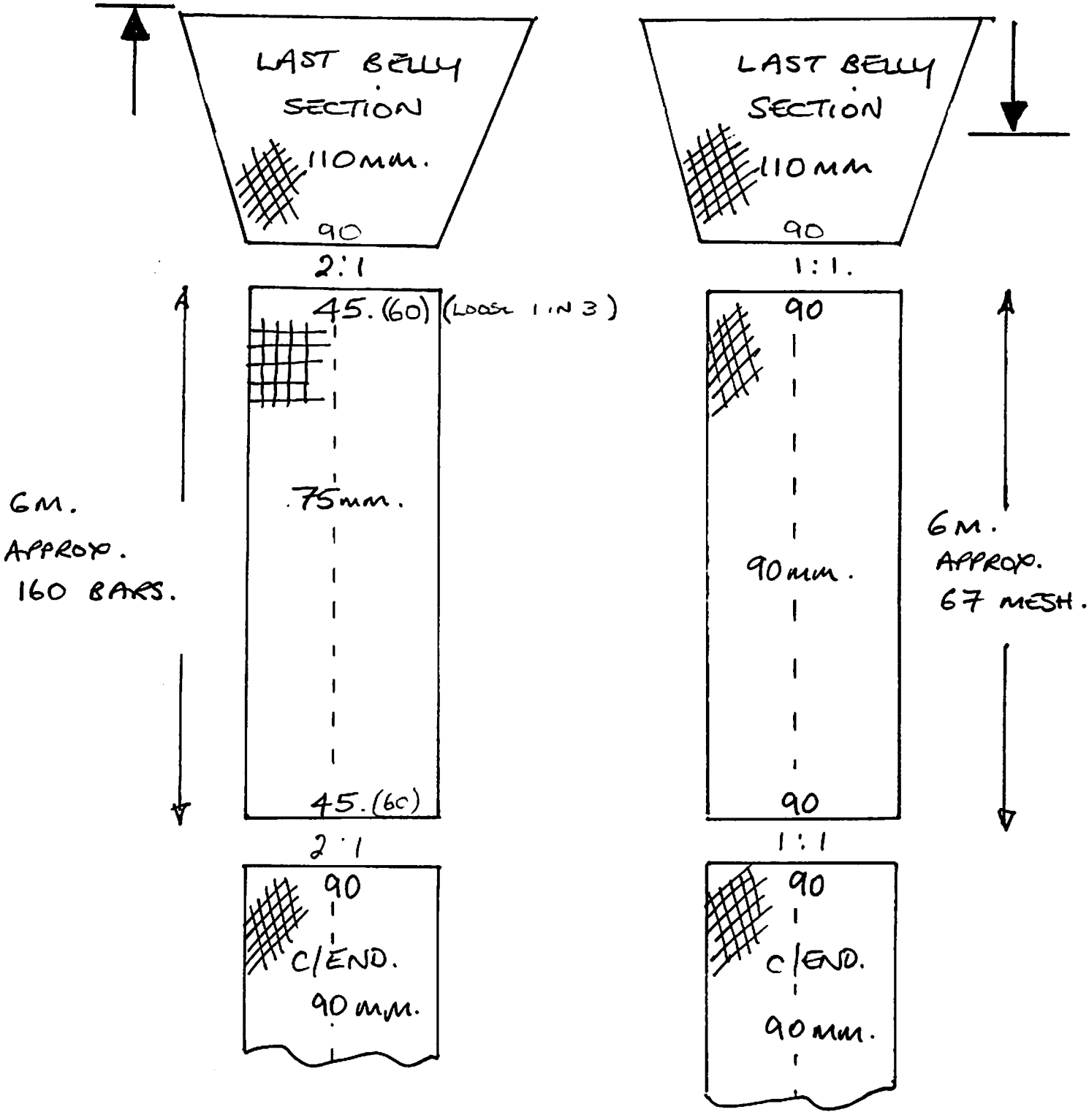
" " " □ PANEL ≡ 1725 mm.

□ DIFF. = + 185 mm. (≃7")

SQUARE-MESH PANEL SECTION

2:1 JOINING RATE. 90 mm. NET.

(1·5:1 " ")

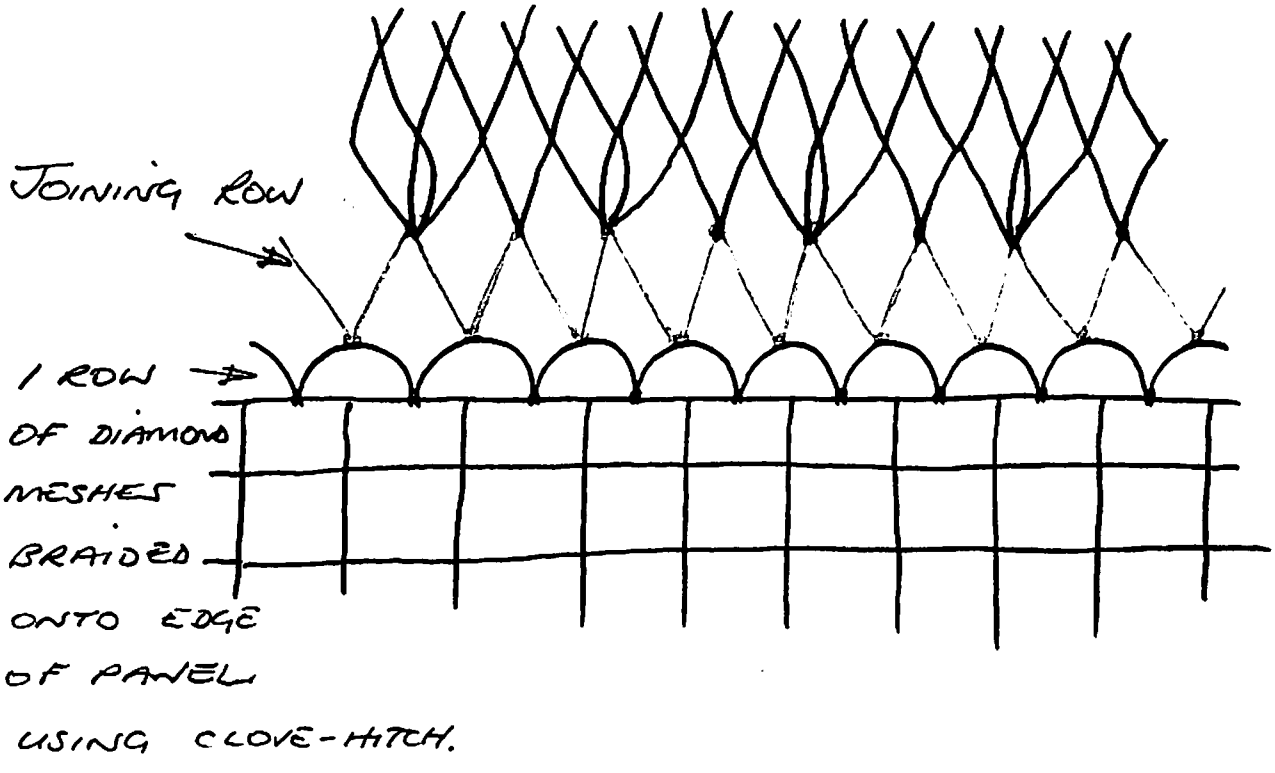


TOWING WIDTH OF ◇ EXT. ≡ 1620 mm.

" " " □ PANEL ≡ 1687·5mm.

□ DIFF. = + 67·5 mm (≃ 3").

Details of joining Rate 1.5 : 1.



PROPOSED SELECTOR PANEL DESIGN
UTILISING DIAMOND MESH NETTING.
(DIAMOND MESH SET IN TRANSVERSE DIRECTION)

2:1 JOINING RATE — 90 mm. NETS.