

**INQUIRY UNDER THE FATAL ACCIDENTS AND SUDDEN DEATH
INQUIRY (SCOTLAND) ACT 1976 INTO THE SUDDEN DEATH OF
THOMAS CONNOLLY**

CB504/05

**SHERIFFDOM OF TAYSIDE CENTRAL AND FIFE AT DUNDEE
UNDER THE FATAL ACCIDENTS AND SUDDEN DEATHS INQUIRY
(SCOTLAND) ACT 1976**

DETERMINATION

By

ELIZABETH C MUNRO

Sheriff of Tayside Central and Fife at Dundee

In

THE FATAL ACCIDENT INQUIRY

Into the Death of

THOMAS CONNOLLY

DUNDEE, 4 October 2006

In terms of Section 6 of the Fatal Accidents and Sudden Deaths Inquiry (Scotland) Act 1976, the Sheriff DETERMINES:-

In terms of Section 6(1)(a) of said Act,

that

Thomas Connolly, born 24 December 1964, formerly residing at Kasalito, Shore Road, Kilmun, Dunoon, died in the course of his employment by East West Developments Ltd, following an accident at the construction site at Douglas Terrace, Broughty Ferry, Dundee, on 30 May 2001 at 1640 hours or thereby.

In terms of Section 6(1)(b) of said Act,

that

the cause of the death of the said Thomas Connolly was mechanical asphyxiation due to burial in silt and sand and that the cause of the accident resulting in his death was that the said Thomas Connolly fell into loose ground or a void, which was

caused by the excavation process in which he was then engaged, relating to the construction of a gravity sewer pipeline.

In terms of Section 6(1)(c) of said Act,

that

the reasonable precautions whereby the death of the said Thomas Connolly and the accident resulting in his death might have been avoided were

- (i) the removal of the overburden at the excavation site, and the reduction of that site to foreshore level, prior to the commencement of the construction of the gravity sewer pipeline;
- (ii) the preparation of a current and specific Method Statement and Risk Assessment relating to the construction of the gravity sewer pipeline;
- (iii) the establishment of a formal supervision and inspection regime, which was the responsibility of suitably qualified persons, in relation to the construction of the gravity sewer pipeline.

In terms of Section 6(1)(d) of said Act,

that

a defect in the system of working, which contributed to the accident resulting in the death of the said Thomas Connolly, was the use of trench boxes as the system of trench support, while the overburden was still in place and in the face of tidal influences.

In terms of Section 6(1)(e) of said Act,

that

the facts relevant to the circumstances of the death of the said Thomas Connolly are set out in the Note appended to this Determination but particularly relevant facts are as follows:-

- (i) There is no record of an accident such as that which led to Mr Connolly's death, namely the collapse of ground adjacent to an excavation, having previously occurred in the United Kingdom, and it is important that awareness of the potential for such an accident is raised within the construction industry. The Health & Safety Executive and the relevant bodies such as the Construction Industry Training Board (CITB), the Construction Industry Research and Information Association (CIRIA) and the Institute of Civil Engineers should all take steps to ensure that industry guidance and training courses (for both managers and operatives) are updated to include reference to the circumstances of this accident, namely the risk of voids being formed outside the confines of trenched excavations in sands and gravels, and in the context of tidal conditions.

(ii) Site-based formal training, briefings and toolbox talks are important for imparting particular knowledge and information to those involved in excavation works in difficult and challenging conditions.

(iii) The companies which manufacture and supply trench support systems offer a free advice service to the construction industry in relation to the suitability of particular systems for particular undertakings; this service should be utilised by temporary works co-ordinators and other such persons who are responsible for deciding on the method to be used in temporary works, particularly where the excavation support is required to be deployed in difficult and challenging ground conditions such as on a foreshore.

NOTE

Background

(1) On 1 June 1997, Bechtel Limited (Bechtel) and Morrison Construction Limited (Morrison) entered into a Joint Venture Agreement for the design, engineering, procurement, construction and completion of work for the Tay Wastewater Project. This was a project set up by North of Scotland Water, under a Private Finance Initiative arrangement. Catchment Tay Limited, jointly owned by Bechtel and Morrison, was created to manage the contract for the project. Bechtel was responsible for the design of the scheme and Morrison for the construction.

(2) The Tay Wastewater Project comprised the construction and installation of a new sewage treatment plant, 7 pumping stations and 34 kilometres of pumped sewer.

(3) On 30 May 2001, Thomas Connolly died while he was working on part of this project, namely the installation of a gravity sewer at the Douglas Terrace site, on the foreshore at Broughty Ferry, Dundee.

(4) At the time of his death, Mr Connolly was employed by East West Developments Limited (referred to in the Inquiry as "East West"). This company had entered into a contract with the principal contractors, namely the Bechtel-Morrison Joint Venture (referred to in the Inquiry as "the Joint Venture") to complete a small part of the project, namely the installation of the gravity sewer. The purpose of this sewer was to link a new pumping station to an existing sewage outfall on the foreshore of Broughty Ferry. The sewer pipe was to extend approximately 100 metres across the foreshore and was required to be laid approximately 3 metres below the level of the foreshore. Thomas Connolly was the foreman of the East West team allocated to this contract and arrived on the site on 28 May 2001. The excavation work did not properly commence until the following day, 29 May. The accident leading to Mr Connolly's death occurred on the second day of the work being undertaken to lay the sewer pipe, namely 30 May 2001.

(5) A Fatal Accident Inquiry was held into the death of Thomas Connolly on 16 days between 16 January and 28 March 2006; final submissions were then made by the Crown and the representatives of the interested parties on 21 April 2006. Mr Bolland, QC, represented the widow of Mr Connolly; Mr Boyle represented East West; Mr Di Rollo, QC, represented Morrison; Mr Davidson, QC, represented Bechtel.

The Site

(6) As part of the Tay Wastewater Project, a box culvert, 600 metres in length, required to be installed below the foreshore adjacent to Douglas Terrace, Broughty Ferry. This was to be linked to a new pumping station (called the West Ferry Pumping Station) which in turn would be linked to a gravity sewer, to be laid from the pumping station to the existing sewage outfall.

(7) By the time the East West team commenced the work to install the gravity sewer, a large part of the work on the box culvert and the new pumping station had been completed. In order to allow the work on the culvert to be carried out below the level of the foreshore, a coffer dam had been constructed, consisting of interlinked metal piles driven into the ground, through to the bedrock. In addition, a smaller coffer dam had been erected around the construction site of

the new pumping station; this dam was approximately 7 metres square. It was next to this small coffer dam that the East West team were to begin laying the gravity sewer.

(8) Although the coffer dams formed a barrier to the tidal waters on the foreshore, such a construction cannot be completely water-tight; it can only prevent an in-rush of water, and accordingly pumps were in use on a virtually continual basis in order to remove the water which would inevitably seep in.

(9) A haul or access road had been created on the south side of the coffer dams. This road was formed largely from rock-fill brought onto the site and stood approximately 3 metres higher than the foreshore level. The gap between the haul road and the coffer dams (including the

smaller coffer dam surrounding the new pumping station) had been in-filled using material dug out during the culvert construction and, it would appear, during construction elsewhere on the Project. In any event, this material was of a coarser consistency than the sandy foreshore material.

(10) A foreshore site such as the one at Douglas Terrace was described, in various ways, by all those who gave evidence in this regard at the Inquiry, as being a particularly challenging and hazardous environment for the carrying out of excavation work. This is due to high and variable water levels, combined with the fine-grained granular materials of which a foreshore site consists.

The Contract

(11) Since the construction phase began on the Project in 1999, the Joint Venture had not used sub-contractors to any great extent; in the case of East West, their first involvement had been early in 2001, when they had entered into a contract with the Joint Venture for excavation work on another part of the Project, at South Balmossie. This work was on the foreshore but was not affected by tidal influences. Mr Connolly had been engaged on this work.

(12) According to Steven McRoberts, the site agent for the Douglas Terrace part of the Project, who had assumed responsibility for this site in March 2001, it was his decision to seek sub-contractors to carry out the installation of the gravity sewer. This was because there were no employees of the Joint Venture available to carry out the work at that time. He accordingly approached Dominic Moynihan, who had responsibility within the Joint Venture for "networks", which covered the pipeline side of the works. Mr McRoberts understood that Mr Moynihan would approach East West with a view to that company carrying out the work on a sub-contracted basis.

(13) Mr Moynihan obtained the necessary approval from the Project Team and contacted Roderick McFadzean of East West, with a view to extending the existing contract (for South Balmossie) to the gravity sewer work. An agreement was reached, following telephone calls and a site meeting, which took place on 14 May 2001. Exactly what was discussed at this meeting was the subject of conflicting evidence during the Inquiry (see *infra*) but the purpose was not disputed: they were to agree the scope of the works in order for East West to submit a proposed price, which in turn would require to be approved by the commercial manager, Donald Munro.

(14) The original contract (Crown Production number 27) was to the effect that East West would supply all labour, plant and supervision necessary to complete permanent drainage at South Balmossie pumping station. There was no additional contract completed in respect of the gravity sewer works. There was a letter dated 15 May 2001 (East West Production number 1) from Mr McFadzean to Brendan Burke, a quantity surveyor employed by the Joint Venture, in which a price was quoted on the basis that the work to be completed by East West in relation to the gravity sewer would be to "excavate lay and backfill", that all materials would be provided by the Joint Venture, as would trench boxes and pumps, and that the main contractor would "supply site plant fuel and health and welfare facilities" (sic). The rate quoted was

£150 per linear metre, with additional sums for manholes and for excavation in rock. The length of the excavation was specified as approximately 100 metres but there was no reference to the depth of the excavation. A letter from Mr Munro, dated 18 May 2001, accepted these terms and stated that additional work would be subject to the same terms and conditions as the base contract. There was no mention in that letter of the depth of the proposed excavation. The agreed starting date was 21 May 2001. Although no reference was made in this correspondence to supervision of the work to be undertaken, there was specific reference in the original contract to supervision being the responsibility of Alasdair Rankine of East West.

Health and Safety Plans and Risk Assessments

(15) The Health and Safety Plan in force at the time of Mr Connolly's death was Issue No 4 of the Plan, dated 11 October 2000 (Crown Production number 3) and produced by the Joint Venture for the construction phase of the Tay Wastewater Project. It was described by Mr McRoberts as being of standard format, with standard clauses, such as the Statement of Health and Safety Policy. For the purposes of the Inquiry, Appendix 7 of the Plan was the most relevant part as it referred, at paragraph 6, to the provision by any contractor (impliedly sub-contractor)

of a Safety Method Statement for approval by the principal contractors, prior to the sub-contractor commencing certain types of work, including excavation operations. The Safety Method Statement had to be specific to the contract and include the evaluation of all hazards and risks associated with the work. At paragraph 7, headed "Site Supervision", it was stated that the contractor/sub-contractor must ensure that a suitably trained and experienced employee was present to supervise the operations in question and to receive and implement instructions from the principal contractors.

(16) A Health and Safety Risk Assessment for Design dated March 1999 (Crown Production number 31) had been prepared for the Joint Venture by Bechtel Water Technology in relation

to the Douglas Terrace site. The first three hazards mentioned in the Risk Assessment related to excavation operations and were identified as:

- a. the collapse of excavation site and/or adjacent structures;
- b. persons and plant falling into excavation;
- c. flooding of the works.

The action to be taken by the designer was set out as being *inter alia* to minimize the depths of excavations where reasonable. Further action to be taken was to provide adequate temporary

support during construction and to provide Method Statements for such work. Such a Method Statement would be expected to identify the risks and hazards associated with a particular operation and the means of minimizing them.

Method Statements

(17) Two Method Statements (Crown Productions numbers 12 and 13 respectively) were produced at the Inquiry, both prepared on behalf of the Joint Venture, which encompassed the installation of a gravity sewer. None was prepared by East West, as would seem to have been anticipated by the Health and Safety Plan referred to above. However, this was not considered to be inappropriate or unusual by anyone who gave evidence at the Inquiry, on the basis that East West were the first sub-contractors to be used on this particular site and Method Statements and other documents had already been produced for the use of Joint Venture employees. East West were a relatively small organisation and it was therefore considered reasonable for them to accept the existing Method Statement.

(18) The principal witness who spoke to the Method Statements was Mr Moynihan. He had not been responsible for drafting the first, dated 9 March 2001, but had revised it and these

revisions were incorporated in the second, dated 2 May 2001. The revisions had been discussed with Mr McRoberts as site agent.

(19) Mr Moynihan is a Civil Engineer, aged 42, and he had worked on the Tay Wastewater Project since 2000. As a result of previous dealings with East West, he had been keen to

engage them for the work on the gravity sewer and was principally responsible for securing their services.

(20) The Method Statement (dated 2 May 2001), which was adopted for the purposes of East West's sub-contract, was not confined to the work relating to the gravity sewer installation: in fact, only a small section (C) referred specifically to this part of the work; a much larger

section of the Method Statement was devoted to the construction of the West Ferry Pumping Station.

(21) This section (C) which referred to the gravity sewer set out the system for protecting the excavation, identifying a "Rolling Strut system" as being suitable, because it would "enable the trench width to be minimal in tidal conditions". This section was, however, revised in the 2 May 2001 update, and a proviso was added in the following terms:-

"The Rolling-Strut system is one temporary works system that has been identified as being suitable. Another system may be used, such as standard heavy-duty trench boxes, in which case the Temporary Works Co-ordinator will satisfy himself that such a system is suitable".

This revision was agreed with Mr McRoberts who, as the site agent, also fulfilled the role of Temporary Works Co-ordinator. There was no mention in either the first Method Statement or in the revised version of the depth of the required excavation.

(22) The revised Method Statement contained a new Appendix (no 5) which was a Risk Assessment headed "Construction of West Ferry Pumping Station". The only reference to the gravity sewer was at paragraph 8, which related to the connection of the West Ferry outfall and the potential risk of damage to the temporary works coffer dam. When this

Risk Assessment was prepared, it was proposed as a measure for protecting the coffer dam that the gravity sewer work commenced after the coffer dam was removed. There was no reference to this in the Method Statement itself, in particular at Paragraph 1.1. headed "Sequence of Works". No one was able to assist the inquiry as to exactly why the gravity sewer work had commenced before the coffer dam was removed. According to Mr McRoberts, who was responsible for seeking to engage sub-contractors to carry out the work, at the time he did, there was no technical reason for installing the gravity sewer at this point, "other than programming". He did say, however, that the Project was behind schedule.

(23) By the time Mr Moynihan gave evidence to the Inquiry, he had obviously given careful consideration to what could or should have been done differently in relation to the Method Statement. He was of the view that a separate Method Statement should have been prepared for the gravity sewer operation, as method statements should,

by nature, be "specific". He was also sure that the depth of the excavation should have been mentioned. In addition, he thought that it would have been a good idea to incorporate references to other guidance documents such as the CIRIA (Construction Industry Research and Information Association) publication entitled "Trenching Practice" (Crown Production number 23). This guidance includes, for example, easily understood information regarding

ground movement. Mr Moynihan had come to the view - which he now puts into practice - that lists of "Do's and Don'ts", sketches and diagrams, are some of the best ways of communicating important information; sketches in particular could be particularly useful when it came to "tool box talks" (see *infra*).

(24) Mr Moynihan also made it clear that a Method Statement was a "living document" and that it must be revised whenever circumstances changed. He accepted that if, for example, the proposed depth of an excavation changed, the Method Statement would require to be

revised or re-written. In contrast, Mr McRoberts gave evidence that he himself was satisfied with the Method Statement as it stood at the time of the accident.

(25) The purpose of any Method Statement is to ensure that those carrying out the work to which it refers are clear as to the methodology, the risks and the hazards associated with the work. Mr Moynihan gave a copy of the relevant Method Statement to Mr McFadzean of East West when they met on site to discuss the scope of the proposed contract. However, neither the foreman of the East West team, namely the deceased Mr Connolly, nor any of the other members of the team received a copy at any stage.

The East West Team

(26) As previously described, Mr McFadzean was the person from East West who was responsible for negotiating the contract for the gravity sewer. Aged 40 and a qualified civil engineer, Mr McFadzean was the Managing Director of East West Developments Ltd at the relevant time. Alasdair Rankine, who had been named in the base contract with the Joint Venture, as being responsible for the supervision of the work to be carried out by East West, was the other senior person in East West. Aged 44 at the time of the Inquiry, he has been in the construction industry for 27 years and had known the deceased, Mr Connolly, all his life. Mr Rankine has an extensive knowledge and experience of all aspects of excavation and deep drainage work, including work on foreshore sites.

(27) Mr Connolly had specified the team he required for the job, and this was put together as follows:-

(i) Mr Connolly himself was to be the foreman for the work. He was 36 years of age when he died, and although he had no academic qualifications in respect of excavation and construction work, he had extensive practical experience,

including experience of several projects involving foreshore and tidal conditions. He was described by Mr Rankine as a "top-class worker, loyal, conscientious,

.....always checking things,safety conscious". Mr Rankine had asked Mr Connolly to join East West when it was first set up in 1996, having worked with him since the 1980s.

(ii) Ian Brown, aged 47, has been a machine operator for 25 years. Mr Brown joined East West in October 2000 and was qualified under the conditions of the Construction Industry Training Board to operate excavator equipment.

(iii) Walter Buchanan, aged 33, also has a qualification as a machine operator and has been eight years in the construction industry. He had been involved

previously in excavations as an excavator operator, a pipe-layer, and in what he described as "general stuff".

(iv) Alan Campbell, aged 32, was the final member of the East West Team. He has been a pipe-layer for eight years and before that, a general labourer. He has no formal qualifications and, as he described it, "learned on the job".

Supervision

(28) The base contract had, as previously described, stipulated that the supervision of the East West Team at the South Balmossie site was to be the responsibility of Mr Rankine of East West. The correspondence extending this contract to the installation of the gravity sewer at the Douglas Terrace site, adopted this contractual condition.

(29) However, Mr McRoberts of the Joint Venture said in evidence that this did not mean that "East West would simply be left to get on with it". In particular, he (Mr McRoberts) had what he described as an over-arching responsibility for the site, as did the Project Manager (Mr Moynihan) and others in the hierarchy above that. As site agent and Temporary

Works Co-ordinator, Mr McRoberts had a particular responsibility for safety on the site. Aged 40 at the time of the Inquiry, Mr McRoberts is a qualified civil engineer who joined Morrison after he graduated in 1988 and remained with that company until 2005. He began as a site engineer and was subsequently promoted to the position of site agent. He was first deployed on the Tay Wastewater Project in March 2001, on the Douglas Terrace site. He had extensive experience of construction sites, but none of working in foreshore conditions.

(30) Alan Imrie, aged 41, was the Senior General Foreman on the Douglas Terrace site. Although he had no academic qualifications, he had completed his apprenticeship as a steel fixer and had been in the construction industry since the age of 18. He had been employed as a foreman by Morrison since 1997, and at the time of the accident was employed by the

Joint Venture. At Douglas Terrace, he had been responsible for the day-to-day running of the site and, as he described it, "getting the job done as per the programme". In his evidence, which was extremely helpful to the inquiry, Mr Imrie was clearly anxious not to absolve himself of supervisory responsibility and indeed

said that he felt he had let himself down "supervision-wise", by not paying more attention to the job being carried out by East West.

The Overburden

(31) At the time of the meeting on 14 May 2001, on the Douglas Terrace site, between Mr McFadzean of East West and Mr Moynihan of the Joint Venture, to discuss the scope of the gravity sewer work and the extension to the contract with East West, the two men looked at the site of the proposed excavation, which was to commence immediately adjacent to the small coffer dam protecting the new pumping station. The small coffer dam was still in place as the work had not yet been completed, as was the larger coffer dam for the box culvert. The haul road could be clearly seen, constructed to a height of

approximately 3 metres above the level of the foreshore, as could the infill between the haul road and the coffer dams, which stood at approximately the same height as the haul road. The combination of the haul road and the infill, which together extended approximately 12 metres from the small coffer dam along the line of the proposed gravity sewer, was referred to throughout the Inquiry as the "overburden".

(32) What exactly was discussed between Mr Moynihan and Mr McFadzean did not become clear during the Inquiry, which is perhaps not surprising given the passage of four-and-a-half years between that meeting and the Inquiry being held. It was unfortunate that no notes were made of the discussions, particularly since Mr Moynihan told the Inquiry that

he normally made and kept notes of any such meeting. He did not know why he failed to do so on this occasion, and said that he regretted that he had "got it wrong".

(33) In any event, Mr McFadzean came away from that meeting believing that the overburden would have been removed by the time the East West Team started work. He was reinforced in this belief by the fact that the copy drawings he had been given by Mr Moynihan, in conjunction with a copy of the Method Statement, showed that the gravity sewer pipe was to be laid approximately 3 metres below the level of the foreshore (rising to between 1.5 and 2 metres at the outfall end).

(34) On the other hand, Mr Moynihan accepted that the set of drawings he gave to Mr McFadzean showed the longitude and profile of the gravity sewer, on the basis of the foreshore level, but recollected - although he described his recollection as "vague" - that he had told Mr McFadzean that the overburden would still be there when the work was due to commence. He also recollected - vaguely - that Mr McFadzean had asked him if the ground could be reduced in level before work commenced, and that he had replied that it was unlikely. Mr Moynihan also recalled that in one of their discussions, he and Mr

McFadzean had discussed trench support and had agreed on the use of trench boxes, although Mr McFadzean did not recall trench boxes being discussed.

(35) After this meeting, Mr McFadzean contacted Mr Connolly (who was on the South Balmossie site) and asked him to take the matter forward. Mr Connolly

telephoned Mr McRoberts on 15 May and arranged a meeting for 17 May. Obviously, the Inquiry only had the account of Mr McRoberts as primary evidence of that meeting, but Mr McFadzean, Mr Rankine and Mrs Connolly were able to tell the Inquiry about subsequent telephone conversations they had with Mr Connolly.

(36) According to Mr McRoberts, at the meeting on 17 May 2001, he and Mr Connolly discussed the job as a whole, including the fact it was a tidal environment, and they ran

through the entire operation of the laying of the sewer. In particular, he advised the Inquiry that they had discussed the rolling strut system of trench support mentioned in the Method Statement but had rejected it as neither was keen to use it, and opted for the trench box system instead.

(37) Mr Connolly's preference regarding the excavation was, by Mr McRoberts' account, that the depth of the dig should be reduced as much as possible, but he did not express concern at the potential depth including the overburden, namely 5.5 to 6 metres. Mr McRoberts told the Inquiry that he had not agreed to reduce the level of the dig: he had said that they (the Joint Venture) would remove the overburden if at all possible, but that it was unlikely. He made no written record of the discussions.

(38) Mr Connolly subsequently spoke to Mr McFadzean about the job, including about the team he required and the type of excavator needed. At that time, Mr Connolly thought that the overburden would be removed by the time the job started. His concern was that there was more ground there than he had anticipated; however, he was under the impression that it would be completely removed by the time he started. These conversations took place before the East West Team arrived on the gravity sewer site on 28 May 2001.

(39) On the evening of 28 May 2001, Mr McFadzean spoke again to Mr Connolly by telephone; Mr Connolly told him that he had asked for the overburden to be removed but that this request had been refused. Mr Connolly said that a drag box (see *infra*) had been brought in but that this had been inappropriate, so trench boxes had been ordered and would be available the next day. Mr McFadzean was asked at the Inquiry if the failure to remove the overburden meant, in effect, that his pricing was wrong; he said that it was to some extent but that, for the sake of 12 metres - what he described as 5 or 6 pipes - he would not have considered trying to renegotiate. He also said that it did not occur to him to stop Mr Connolly from carrying on with the job, as Mr Connolly said he was "comfortable" with it.

They had discussed "benching-back", that is reducing the level of the ground where the excavation was to take place, resulting in the area of the proposed excavation itself, plus approximately 1 metre around it, being dug out before the excavation itself begins. According to Mr McFadzean, this would have made the actual dig, for the purposes of inserting the trench boxes, approximately 4 metres in depth.

(40) Mr Connolly had also spoken to Mr Rankine about the job, when Mr Rankine went to deliver the excavator to the site, during the week prior to work starting. According to Mr Rankine, Mr Connolly had told him that he was "getting the overburden shifted". He spoke to Mr Rankine by telephone on 29 May but they did

not discuss the job; the subject matter of the telephone call was something else entirely.

(41) In addition, Mr Connolly had spoken by telephone to his wife, Margaret Jennifer Connolly, more than once in the two days before he died. He had said to her that the job was deeper than he had expected: he had been told 3 metres and it was about 6 metres. He said that he

had asked for the ground to be reduced to shore level but that this was not to happen and they were just going to get on with it. Mrs Connolly described her husband as having been confident that he could deal with the job.

(42) Finally, in this regard, there was evidence from Mr Moynihan of a meeting which he set up for 18 May 2001, but which did not take place. He himself had left work to go into hospital on 14 May 2001 (and did not return to work until 29 May) but before doing so, he arranged that Mr McRoberts, as site agent, Mr Imrie, as general site foreman, and Mr McFadzean representing East West, (and possibly also Mr Connolly, although the evidence on that was not clear), should meet together on 18 May, to discuss the work to be undertaken and, presumably, the methodology, including the overburden. Mr McFadzean did not recall the arrangement, nor was Mr Imrie aware of any such arrangement. Mr McRoberts did not remember the meeting being proposed but was of the view that his

meeting with Mr Connolly on 17 May was a substitute in the sense that it gave him an opportunity to discuss the job. However, he accepted that it would have been a good idea to include Mr Imrie. Mr Moynihan first became aware when giving evidence at the Inquiry that only Mr McRoberts and Mr Connolly had met, and said that it would have been preferable if all of those mentioned had in fact met together.

Site Induction and Toolbox Talks

(43) The system of site induction is an important aspect of the construction industry: its purpose is to ensure that every person who comes to work on a site is made aware of all safety issues affecting the site, with particular reference to, for example, hazards, emergency procedures, site rules and relevant personnel. A condition that persons failing to attend such an induction will be refused access to a site is commonplace.

(44) A system of toolbox talks is also in widespread use throughout the industry. Such talks could best be described as briefings on specific issues, and are often the responsibility of the site foreman, although these can be carried out by someone at a higher level. Before a particular job commences, it would be expected that the way the work is to be carried out would be discussed in such a forum, and indeed Mr Moynihan was of the view that the relevant Method Statement should be read out in its entirety at that initial toolbox talk.

(45) It is accepted good practice that a record should be kept of all those who undergo a site induction, and of all toolbox talks. Unfortunately, the Inquiry was presented with confusing records and inconsistent evidence on these issues. A document (Crown Production number 11) headed "Section Safety Induction" with a

sub-heading "Stannergate - Broughty Ferry" was produced. This contained general information about safety issues and site rules relating to health and safety. Attached to this document were the next-of-kin details of three of the East West team, namely Alan Campbell, Walter Buchanan and Ian

Brown; also attached was a photocopy of Mr Brown's certificate (or "ticket") which showed that he was a qualified construction plant operator. The record form attached to these documents and signed by Messrs Campbell, Buchanan and Brown was, however, headed "Toolbox Talk Record Form" and under the subject heading was written "Site Induction & Method Statement" with the "course tutor" being "S. McRoberts" and the date being 21 May 2001.

(46) Mr McRoberts gave evidence that when Messrs Campbell, Buchanan and Brown arrived on site on 21 May 2001, which was the date originally planned for starting the gravity sewer work, they were allocated to pipe-laying work elsewhere on the site, as agreed with East West Management. He and the three East West operatives agreed in evidence that the site induction was carried out that day.

(47) Mr McRoberts also gave evidence that he had given the three men a toolbox talk consisting of a Method Statement talk on the gravity sewer work, despite the fact that this work was not due to commence until a week later. According to him, this talk involved explaining the methodology to be adopted and related to the question of whether a trench box or rolling-strut system would be used. As far as the overburden was concerned, Mr McRoberts recalled telling the men the same as he had told Mr Connolly, namely that it was unlikely that the overburden would be removed before work commenced.

(48) In giving evidence, none of the three men recalled this toolbox talk/method statement talk, as distinct from a safety/site induction talk, although they acknowledged having signed the form in question. However, Mr Brown did recall that Mr McRoberts had mentioned reducing the depth of the excavation (i.e. removing or reducing the overburden) if he could; he had said he was looking into it.

(49) Mr Connolly did not receive any site induction on the Douglas Terrace site. He was working elsewhere during the week commencing 21 May 2001 and did not join his team

until Monday 28 May. Mr McRoberts accepted that this had been his responsibility and that the site induction of Mr Connolly should have been carried out by him. However, he

said that Mr Connolly had not reported to the site office when he arrived on 28 May, and it was only later that day that Mr McRoberts first saw him on site.

(50) The question arose during Mr Moynihan's evidence whether Mr Connolly may have received a site induction or any other form of induction for those parts of the Tay Wastewater Project on which he had previously worked. Overnight, certain forms were traced and produced to the Inquiry the following day (as Crown Production number 32). One form was a Safety Induction Record Form, relating to

the Inchcape Pumping Station, and was signed by Mr Connolly on 2 April 2001. There was also a form headed Toolbox

Talks Record Form, signed (but not dated) by Mr Connolly which bore to have as its subject "Site Induction" and which was dated "22-1-01" at the top.

(51) Attached to these forms was a document relating to the Project in general, and South Balmossie Pumping Station in particular, headed "Induction Talk". This document included all the basic safety information which was contained in the document given by Mr McRoberts to the East West employees on 21 May and produced earlier in the Inquiry. However, it was very different in style and to some extent in content: apart from being twice as long - and having a site map attached - it was much more specific to the site. In particular, it mentioned the nature of the ground and the effect of the tides, neither of which was mentioned in the document received by the East West team. Mr McRoberts explained that he had simply adopted the documentation which had been used by his predecessor as site agent.

The day the gravity sewer work was due to commence - 28 May 2001

(52) As previously described, the East West team (with the exception of Mr Connolly) had arrived on the Douglas Terrace site on 21 May 2001. However, because of a pipe-flushing

operation being conducted at that time, it had not been possible to commence the gravity sewer work until 28 May 2001.

(53) When the full East West team was assembled for the gravity sewer work on that date, the overburden was still in place and the depth of the required excavation was therefore approximately 5.5 to 6 metres (before any local reduction). The only work carried out on that date was an attempt to install a drag box at the starting point of the excavation, without success. This drag box had apparently already been somewhere on the site, and the East West team had obtained it from there.

(54) A drag box (also known as a shield) consists of two vertical plates held apart by braces, and its purpose is to protect those working between those plates. It is installed by lowering it into a pre-dug trench. The ends remain open and the excavation is continued by digging out the next section and "dragging" the box along the excavation, rather than pulling the box out, digging another trench and re-inserting it. It is commonly used where the material to be dug is firm and the excavation itself is relatively shallow.

(55) The reason for attempting to use the drag box was the subject of conflicting evidence at the Inquiry. The members of the East West team explained that they had been asked by Mr Connolly to install it in order to show that it was not suitable; that they had at the very least drawn the inference from what Mr Connolly had said to them, that he had been told by someone in the Joint Venture to use the drag box. They were certain that the idea did not come from them. However, Mr McRoberts said he had nothing to do with the instruction. On the other hand, Mr Imrie understood that the approach to the job was that East West were "to do a reduced dig and then install a drag box". He said that he got that information

either from the Method Statement or from Mr McRoberts telling him. There was no mention of a drag box in the Method Statement.

(56) In any event, East West's "demonstration" was successful: it was immediately clear that the use of a drag box was completely inappropriate due to the required depth of the excavation. However, despite what Mr McRoberts said in evidence to the effect that he had agreed with Mr Connolly that trench boxes would be used, there had been no trench boxes ordered and none were on site. Accordingly, they were ordered for the following day and the East West team left the site.

The excavation commences - 29 May 2001

(57) The East West team attended on site on 29 May 2001 and the trench boxes were delivered later that morning, in flat-packs, requiring assembly. The East West team had previous experience of this task and completed it expeditiously.

(58) When assembled, a trench box consists of two modular side-panels held apart by struts which are adjustable to suit the width of the trench. The base unit can be fitted with an extension unit to increase the height. The location of the struts is variable within limits, depending on the ground clearance required. The lower edge of each side-panel is tapered to form a cutting edge. For this particular job, two trench boxes were ordered, with extensions: the two base units were 2.6 metres in height and the two extension units were 1.3 metres in height, thereby allowing an excavation of approximately 3.9 metres in depth. Each unit was 3.5 metres in length. Depending on the nature of the ground to be excavated, the boxes can be lowered by excavator into a pre-dug trench (in firm ground) or be installed by progressive excavation (less firm ground).

(59) For the particular circumstances of the gravity sewer installation, the latter method was appropriate; this is commonly known as the "dig and push" method. However, before

starting this process, Mr Brown, operating the excavator, required to lower the ground level by between 1.5 and 2 metres; this local reduction extended beyond the dimensions of the proposed excavation by between 1 and 2 metres on each side. After finishing this preliminary excavation, Mr Brown then dug down approximately 1 metre to create a hole somewhat larger than the actual dimensions of the trench boxes - this was necessary because of the nature of the ground material which was not self-supporting - and the trench boxes were lowered into position, with the gaps around them back-filled. The boxes were described in the Inquiry as the "east box", meaning the box nearer to the small coffer dam and therefore the box in which the first piece of the gravity sewer was to be laid and the

"west box" meaning the next box in line for the pipe laying operation. The east box was the first to be installed.

(60) Once the above preliminary work had been completed, the "dig and push" method of installing the boxes to the required depth commenced. This method involves inserting the box in increments, which vary according to the nature and consistency of the ground being excavated. However, the basic method does not

vary in that the "dig" refers to the fact that the excavator is used firstly to remove material from the base of the excavation and the box is then "pushed" down by the excavator operator placing the excavator bucket on the corners of the box and exerting pressure on the box to insert it further. In many cases, the term "push" is rather a euphemism, as the excavator bucket is used more as a hammer to drive the box down. More material is then dug out from the base of the excavation and so it continues. It may also be necessary - as it was in this case - to excavate around the box as the "dig and push" proceeds, depending on the overall depth of the dig relative to the height of the box.

(61) The nature of the material into which East West was inserting the trench box meant that the increments should have been relatively small: sandy/silty ground is not free-standing for

long - if at all - and to avoid such material coming into the box, each "dig" of the base of the excavation should be limited to extracting a reasonable amount before "pushing" the box down. As Mr Rankine graphically described it in his evidence, the excavator in these circumstances should not be "greedy". According to Mr Brown, who was operating the excavator, the amount by which he reduced the excavation was 200-300 mm at a time; other witnesses put it at a maximum of 500 mm, but no one saw the way in which the job proceeded as unusual.

(62) On 29 May 2001, the East West team proceeded to install the trench boxes by the "dig and push" method described above. It was not possible to lower the west (second) box to the

same level as the east (first) box, as the west box had to be maintained at a higher level to allow the excavator to track across it (i.e. the tracks of the excavator were on either side of the west box) in order for the arm and bucket to reach down into the excavation in the east box. At any given point in the process, there was a substantial difference in depth of insertion between the two boxes: this difference was estimated by those who subsequently investigated the fatal accident as being 1.6 metres at the relevant time. Where there was such a difference, this inevitably meant that there was a substantial unsupported face of ground material where the two boxes met. At the opposite end of the west box (the end furthest from the coffer dam), sheet piling was excavated into place to prevent material coming into the excavation at that end; it would appear that this was done on 29 May 2001, although it was not clear at exactly what stage.

(63) The work came to an end on 29 May 2001 when the tide came in and the base of the excavation was filled with water.

(64) As the East West team were finishing work, there was a slight disagreement between Mr McRoberts and Mr Connolly, as Mr McRoberts was unhappy with the excavation being left unfenced. The dispute appears to have centred on whose responsibility it was to erect

some sort of barrier: Mr Connolly's team had no materials to do so, while Mr McRoberts clearly felt they should have asked for such materials. In any event, it was agreed that Mr

McRoberts would ensure that the night security staff on the site would be made aware of the situation and proper fencing-off would be carried out the next day.

The day of the accident - 30 May 2001

(65) The East West team arrived on site on the morning of 30 May 2001, ready to continue the excavation. However, the base of the excavation was full of sea-water and a pump was obtained, which was used to pump out the water. Thereafter, work continued to insert the

east box to the required depth. The general consensus among the witnesses to the Inquiry was that the dig proceeded by stages and that the trench box was pushed down by a maximum of 500 mm at a time, which was considered to be normal and acceptable practice.

(66) By early afternoon, the team had reached a depth which they considered may be the required level for laying the first pipe, and accordingly asked for an engineer to come and check the level. In order to have the exact level established, because it required to be measured from the inside base of the pipe (the "invert"), Alan Campbell went down by ladder into the excavation, laid a quantity of gravel as a base for the pipe, and then the pipe itself. Two engineers employed by the Joint Venture, namely Matthew Foreman and Douglas Livingstone, attended and carried out the requisite measurements. It was established that the required depth had not yet been reached and further excavation would be necessary. The extent by which the level had not been met was unfortunately not made entirely clear during the course of evidence to the Inquiry: on the one hand, Ian Brown recalled that there was "another 200 mm to go"; on the other hand, a statement of Douglas Livingstone (who did not give evidence) read to the Inquiry by the police officer who took

that statement on 7 August 2001, was to the effect that he and his colleague Matt Foreman (who also did not give evidence) established that a further metre was required to be excavated. Neither Alan Campbell nor Walter Buchanan was able to offer a specific measurement but confirmed that the pipe required to be removed and further excavation carried out.

(67) The position of the trench boxes at the time the level was given by the engineers was slightly clearer: the evidence was to the effect that the base of the excavation was between 200 mm (minimum estimated by Ian Brown) and 500 mm (the maximum estimated by Mr McRoberts) below the bottom edges of the east box and that the west box was at that stage

significantly higher - to the extent of around 1 metre - than the east box. This difference in levels was in accordance with the method adopted by the East West team in proceeding with the job. This meant that there were unprotected faces of at least 200 mm in height at the bases of both the landward and seaward panels of the east trench box; it also meant that there was an extensive unprotected face at the point where the east box met the west box. No one, including Mr McRoberts, who had viewed the excavation when he brought pipe-grease to the East West team when they were about to lay the pipe, was concerned about these unsupported faces.

(68) As indicated, it was established that the required level for the pipe had not yet been reached and that the team would require to lower the east box and the base of the excavation by further "digging and pushing". It would appear that at this stage, the top edges of the east box were approximately flush with the surrounding ground, and this meant that there would also require to be further local reduction around the trench box in order to insert the box more deeply. As Ian Brown described it, he had up until that point, been doing this local reduction as he went along: in other words, the method had not simply been "dig and push" but "dig, push and locally reduce", although not necessarily in that order.

(69) What no-one in the East West team could remember when giving evidence to the Inquiry was the order in which Ian Brown proceeded after the level was established, namely whether he began to dig out the base of the excavation first or whether he carried out some local reduction before doing so, or indeed whether he "pushed" down the box as the first step. In any event, at the time Alan Campbell was in the base of the excavation to remove the pipe, or just after he had got out, some material came into the base, from outside the box on the landward side. Again (and understandably in the circumstances), estimates varied about the amount of material involved: it was at least "half a bucketful" meaning half the capacity of the excavator bucket; "a whole bucketful" would amount to 1 cubic

metre. According to Ian Brown, when the material came in, he dug it out with the excavator bucket, but "more sand came in behind it" and he used the excavator both to take that out and to bang the box down.

(70) At this time, which was estimated as being around 1640 hours, Walter Buchanan was standing next to the excavation on the landward side (where the material had come in under the trench box) and Mr Connolly and Alan Campbell were standing on the seaward side. Ian Brown's view of Mr Connolly and Alan Campbell would have been obscured to some extent by the arm of the excavator, other than when the bucket was at the very base of the excavation. Alan Campbell had also seen the material coming into the base of the excavation under the landward edge of the box, amounting to "maybe a bucketful", but from where he was standing, he could not see the base at the seaward side.

(71) As Alan Campbell and Mr Connolly were standing, almost shoulder to shoulder, on the seaward side of the east trench box, Alan Campbell felt the ground beneath them move:

he said it felt "like a rumble in the ground - like a vibration". He did not hear anything. Alan Campbell quickly moved away, towards where the excavator was, up the slope from the excavation. He looked round and saw that Mr Connolly was, as he described it, "down

the side of the box". Mr Connolly's head was below the top of the box and his hands were clenched above his head. He was in a hole which was slightly bigger in size than his own body. Alan Campbell shouted out to Walter Buchanan and then saw the hole close over Mr Connolly, after which the ground "went back to normal".

(72) The first that Walter Buchanan became aware that there was anything wrong was when he heard Alan Campbell shout to him. He could not see where Mr Connolly and Alan Campbell had been standing because of the arm of the digger. He ran round and found that Mr Connolly had disappeared. He recalled at the Inquiry that the ground where they had been standing looked different, as if the level had gone down slightly.

(73) Ian Brown was unaware of anything being amiss until he heard shouting. Alan Campbell was pointing to where he and Mr Connolly had been standing and shouting "He's gone, he's gone". He could see nothing; the ground looked to him as it had before.

(74) A large number of people arrived on the scene, all trying to help, and frantic efforts were made to dig, with bare hands and with shovels, where Mr Connolly had disappeared. Ian Brown dug inside the box with the excavator, in the hope that by removing enough material, Mr Connolly would slip down under the box edge into the excavation. One of the pile-drivers, John McTier, obtained a ladder and went down into the box, but could not shovel out the material; it was rocks mixed with gravel. He saw a cavity about 2 feet long at the bottom of the box on the seaward side and put his arm in, but could not feel anything. He also noticed a space between the two trench boxes, about 16 inches above the base of the excavation.

(75) Others made equally heroic efforts to assist, despite risk to themselves. William Gray, a ganger, used a shovel in the hole where Mr Connolly had disappeared, digging through a mixture of sand, gravel and rocks. Gordon Milne, scaffolder, was one of the first on the scene as he had been heading to the East West team with scaffolding poles to erect around

the excavation, and he firstly started digging in the part where Mr Connolly disappeared, in what he described as "hard-core" material, but had to get out when the hole started to get bigger. He then put a ladder into the excavation, climbed down and was on his hands and knees at the part where Ian Brown had used the excavator to dig down two to two-and-a-half feet below the base of the trench box. He saw what he described as "rubble" rolling down into the box, and with the rubble, a hard hat (as it turned out, this was not Mr Connolly's, although, not surprisingly, Mr Milne and others assumed at the time that it was). He could see a hole on the other side of the trench box which he said was big enough for him to have climbed in. Mr Milne only stopped when a fire officer told him to, on the basis that it had been fully 20 minutes since Mr Connolly's disappearance.

(76) After the fire service officers arrived, they took charge of the rescue attempt and a small excavator was lowered in by crane. An extensive amount of excavation was carried out and at around 1940 hours, the body of Mr Connolly was found, against the piles of the small coffer dam, at the outside edge of the east box, his head approximately 3 metres from the top of the box. It would have been too dangerous at that time for anyone to attempt to recover Mr Connolly's body, due to the level of the tide, but a doctor was asked formally to pronounce life extinct and this was done at 2040 hours.

Pathological evidence

(77) Mr Connolly's body was recovered the following day and removed to the mortuary for examination. On 1 June 2001, Doctors David William Sadler and Eleanor Barbara Adams carried out a post-mortem examination of the body of Thomas Connolly, and completed a Report on their findings (Crown Production number 26). Dr Sadler gave evidence to the Inquiry. In summary, they found that Mr Connolly had, prior to his death, been healthy, other than being significantly overweight. The post-mortem examination showed the

classic signs of asphyxiation, consistent with the circumstances of the accident and the recovery of Mr Connolly's body, as described by the various eye-witnesses. In addition, the pathologists found that Mr Connolly had suffered a fracture to his lower left leg. Dr Sadler was of the opinion that this was most likely to have occurred at the time of the ground collapsing beneath Mr Connolly: as he fell, his leg may have caught something and the force would have been predominantly vertical, although some twisting may have occurred. Dr Sadler viewed the photographs available to the Inquiry (Crown Production number 2), which showed the position in which Mr Connolly's body had been found and

confirmed that if he had fallen that distance, approximately 3 metres from where he had been standing at the top of the box, this would have been sufficient to cause the fracture found at autopsy.

(78) Dr Sadler explained the terminology used by him in completing the causes of death on the death certificate (reproduced in Crown Production number 25), namely

(1)(a) Mechanical Asphyxia

due to

(1)(b) Burial in Silt and Sand

due to

(1)(c) Collapse of Worksite Trench (Pipe-Laying)

As far as the principal cause of death was concerned, namely mechanical asphyxia, he explained that this term was used when asphyxia - or suffocation - was caused by the chest being compressed by an external force. In this case, the external force was silt and sand, and this had caused Mr Connolly to be unable to breathe in and out. In these circumstances, the silt and sand would also obstruct the mouth and nose, making breathing

impossible; accordingly the secondary cause of death was expressed as being due to burial in silt and sand.

(79) However, Dr Sadler acknowledged that the cause of the burial in silt and sand having been expressed by him as being due to the collapse of the worksite trench (pipe-laying) was not entirely accurate: he had been given a copy of a report by the police into the accident prior to the autopsy and had understood that Mr Connolly was inside a trench when part of it collapsed. In fact, he now understood that Mr

Connolly had been standing outside the trench, at one side of it, when the ground collapsed beneath him.

(80) As far as the time of death was concerned, this was recorded for the purposes of the death certificate as having occurred between 1650 hours and 2040 hours on 30 May 2001. Again, Dr Sadler and his colleague had relied upon the information contained in the police report, which was to the effect that the collapse had occurred at approximately 1650 hours and that, following the discovery of Mr Connolly's body at approximately 1940 hours, a doctor had been called and pronounced life extinct at 2040 hours. However, Dr Sadler was of the opinion that Mr Connolly would have died very quickly after the ground collapsed and he was buried in the sand and silt, probably within a minute or thereby.

The Aftermath

(81) Members of Mr Connolly's family and Mr McFadzean and Mr Rankine of East West all travelled to the site, at various times, after they were contacted with the tragic news.

(82) In the meantime, the police and the Health & Safety Executive commenced their respective investigations, during which they liaised closely. Mr Niall Miller, Inspector with the Health & Safety Executive, realised that specialist expertise and advice would be required for the investigation. As there was no-one available within the Executive at that time, WS Atkins Consultants Ltd were asked by the Health and Safety Executive to assist

in the investigation and to provide geo-technical advice relating to the cause of the accident. John Chapman, Engineering Geologist and John Rigby-Jones, Geo-Technical Engineer, both employed by WS Atkins, accordingly attended at the site and carried out their own investigations. They subsequently submitted their Joint Report (see *infra*).

(83) During the course of these investigations by the police, the Health and Safety Executive and Messrs Chapman and Rigby-Jones respectively, reference was made by several of the witnesses who were interviewed to a particular phenomenon, which had occurred on the site during the weeks and months prior to the accident, namely the appearance of "voids"

or indentations in the ground. In the aftermath of a sudden and tragic accident such as that which led to the death of Mr Connolly, it is to be expected that there would be a great deal of what Mr McFadzean eloquently referred to as "site-talk". In other words, and this certainly does not apply only to the construction industry, speculation and rumour become rife.

(84) It was therefore very difficult at the Inquiry to separate hard fact from rumour in this regard. What seemed clear, however, was that there were three instances of ground movement from outside the coffer dam into the inside of the coffer dam, which caused indentations to appear outwith one or other of the coffer dams, with the movement of the tide. According to John McTier, the piling foreman, because they were using vibrating hammers to drive the piles down, this could lead to a pile

"bouncing" on the rock below ground, whereby it came to rest slightly above the rock, thereby allowing material to come in under the pile. By using an impact hammer to drive the pile further down, they were able to seal the gap. He could recall this happening once in relation to the main coffer dam, approximately 100 metres from where the East West team subsequently began work. However, he also said that this had happened twice near the small coffer dam and that at least one senior person, namely Douglas Livingstone, was aware of these incidents.

(85) Mr Imrie, the Senior General Foreman, who gave evidence as described above, was asked if he had seen any "voids" and recalled one described as 2 metres square and 1 metre deep, which had appeared on the haul road, beside the generator, while a fitter had been working beside it. He was of the view that the mechanism which had caused the void was that described by Mr McTier, but it was not clear whether this incident was one of the three incidents referred to by Mr McTier. In any event, he told the Inquiry that this void or indentation had been approximately 150 metres from where the East West team started work. He also said that it had happened around March 2001 and that he would have reported it to the Site Agent, who at that time would have been either Mr McRoberts or his predecessor.

(86) Mr McRoberts was asked specifically about these incidents when he was recalled to give evidence and said that he had been aware of them. He, however, said that he had not seen what he would describe as "voids" and that he could not remember whether the incidents in question were recorded. When asked whether Mr Imrie had reported such an occurrence to him in March 2001, he could not recall, and pointed out there was an overlap between his predecessor and himself in March 2001, so it could have been either one of them.

(87) One aspect which was clear was no-one from East West had been told of these incidents, whether in preliminary discussions (with Mr McFadzean, Mr Rankine or Mr Connolly) or in the talk given by Mr McRoberts to the East West team (minus Mr Connolly) on 21 May 2001.

Expert Evidence

(88) The Inquiry was greatly assisted by the expert evidence given by John Rigby-Jones and by Niall Miller who had responsibility for investigating the accident on behalf of the Health

and Safety Executive. In addition, the Crown had sought an expert opinion or "overview" from Philip Deebank, a civil engineer and Principal Inspector with the Health and Safety Executive, who had been asked in May 2005 to consider all the information gathered by the Crown and to prepare a Report for the Fatal Accident Inquiry. His evidence also was extremely helpful.

(89) While these persons could readily be classed as expert witnesses, given their qualifications and their respective remits in the investigations of this fatal accident, there was another witness to the Inquiry whom I would classify as "expert", despite the fact that he has no

formal qualifications as such; that is Alasdair Rankine of East West. He has extensive practical experience of all the aspects of construction and excavation work with which the Inquiry was concerned, and I consider it only proper that such experience should be treated as expert in these circumstances. Accordingly, I have summarised the evidence of all these four witnesses under this heading.

Alasdair Rankine

(90) Beginning with Mr Rankine, he did of course give evidence as to factual issues, as referred to above, but in addition he explained that after the accident, he had done everything he could to work out in his own mind what could have caused the accident leading to Mr Connolly's death. This was not surprising, given his close relationship with Mr Connolly for many years, which I mention only to point out that his views, while extremely valuable, may not be quite as objective as that of the other experts.

(91) Mr Rankine began his evidence by describing his extensive experience (now of 27 years or so) in excavation and deep drainage work, with particular reference to working in tidal foreshore environments, which he acknowledged to be particularly challenging. Despite this depth of experience, Mr Rankine had never heard of an instance when the ground had

collapsed beneath someone standing outside an excavation on a foreshore, such as had happened to Mr Connolly.

(92) When Mr Rankine arrived in Broughty Ferry, the morning after the accident, he had already been applying his mind as to what could possibly have occurred and he asked his workers (Messrs Brown, Buchanan and Campbell) if there had been a sudden influx of material from outside the trench box into the box at the time of the accident. They all said no.

(93) He and Mr McFadzean then had a meeting with senior personnel of the Joint Venture to try and piece together what had happened. From what he saw of the site prior and subsequent to the accident, together with what he gleaned from the East West team, and his experience of working in foreshore conditions, Mr Rankine concluded that the ground Mr Connolly had been standing on immediately prior to his disappearance had been "like a trap door". In other words, below that trap door had been a hole or a void, but in Mr Rankine's opinion, this void had in fact been far below the surface, beneath the level of the base of the excavation, rather than just below where Mr Connolly was standing. He reached this conclusion mainly because of two factors, namely:-

i. Mr Connolly's workmates had seen no sudden in-rush into the excavation

of ground material from outside the trench box;

ii. The trench box had not toppled at the time of Mr Connolly's

disappearance, which it would have done had the hole been at the side of

the trench box, rather than beneath it.

(94) Mr Rankine therefore concluded that the void into which Mr Connolly fell was beneath the excavation, and had not been caused by the excavation and insertion of the trench box. Instead, he was of the view that the continuous pumping of water from inside the coffer dams had not only extracted sea-water, but also "fines" as they are described, namely fine

material, from the foreshore; this could have caused voids at significant depths and at significant distances from the coffer dams themselves.

(95) Apart from this theory about the cause of the accident, Mr Rankine also gave evidence, from the perspective of his own experience, about the Method Statement provided by the Joint Venture in relation to the gravity sewer. In particular, he said that he would have expected the Method Statement to address specifically the question of the required excavation being in foreshore conditions and that the presence of voids should have been

mentioned. The Method Statement should also have addressed, specifically, the depth of the excavation. On that latter point, he said that if the depth was altered at any stage, the Method Statement should also have been altered, after any necessary discussion.

John Rigby-Jones

(96) The principal expert witness at the Inquiry was Mr Rigby-Jones who gave evidence over five days, during which time he proved to be a clear, articulate - and patient - witness.

Aged 34 at the time of the Inquiry, he qualified firstly as a civil engineer in 1992 and then obtained an MSc qualification in geo-technical engineering. As a senior engineer with WS Atkins, one of his responsibilities related to accident investigation. He was the junior member of the WS Atkins team which reported on the investigation of Mr Connolly's tragic accident, but in all respects he was able to explain and amplify the terms of the Report (referred to hereafter as "the Atkins Report" - Crown Production number 8).

(97) The evidence of Mr Rigby-Jones covered most of the principal aspects of the remit of the Inquiry, namely the site itself, the contract, the Method Statement and Risk Assessment, the overburden, the equipment used, the method of working, supervision and the cause(s) of the accident.

(98) The Site

From documentation held by the Joint Venture, Mr Rigby-Jones established that the appropriate geo-technical investigations had been carried out on behalf of the Joint Venture prior to the Tay Wastewater Project being designed and planned in detail. From these documents and his own investigations, Mr Rigby-Jones found that the foreshore at Douglas Terrace was made up of sandy gravel, with cobbles overlying

gravely sand, and that underneath the east trench box (as established by him after the accident), the ground

comprised a medium dense, silty sand. There were no voids identified underneath the east trench box at that time. The overburden (again established by him after the accident) at the locus of the accident consisted of material which was looser than the foreshore material and was described in the Report as a silty/clayey very sandy gravel. These materials are permeable and therefore sea-water would flow through according to the tides. Working time on any excavation on the foreshore would therefore be dictated and limited by the twice-daily tidal cycle.

(99) The Contract

The Atkins Report did not address in detail the adequacy of the contract between the Joint Venture and East West, other than to say that the relative responsibilities of the contracting parties appeared to be unclear, particularly with regard to plant and equipment. The Report did, however, cover the question of supervision which was referred to in the contract, and this is dealt with separately (*infra*) as Mr Rigby-Jones gave detailed evidence in this regard.

(100) The Method Statement

Mr Rigby-Jones was critical of the Method Statement produced by the Joint Venture and accepted by East West. While it is not unusual for a sub-contractor to accept the Method Statement provided by the principal contractor, it should be discussed and agreed between

the parties. The Method Statement in this case was a generic one; there should have been a specific Method Statement for the installation of the gravity sewer, which specifically addressed the way in which the works in a tidal environment would be carried out. Such a Method Statement should be capable of being read by another party and enable there to be a precise understanding of the work, of the equipment to be used and of how the work is to be done. In this particular Method Statement, the depth of the excavation was not even mentioned, and the trench support system was to be either a rolling strut system or another

system decided by the Temporary Works Co-ordinator. In his view, a Method Statement should refer to only one construction methodology, not a range. As far as the Risk Assessment attached to the Method Statement was concerned, this envisaged that the work on the gravity sewer would be commenced only after the small coffer dam around the storm-flow chamber was removed, although in fact this sequence of works was intended as a measure to prevent damage to the coffer dam. Although the Method Statement made no specific reference to the required depth of excavation, it was clear that it had been prepared in anticipation of a 3 metre dig, and had not been re-visited when the depth had in fact doubled. Referred to the separate, Design Risk Assessment, Mr Rigby-Jones said that the Method Statement should be developed in the context of a review of the Risk Assessment and agreed that the hazards associated with excavation were properly identified in that Risk Assessment, as was the action to be taken, namely to minimise the depths of excavation where reasonable. In any event, Mr Rigby-Jones was of the view that as

a result of the deficiency in the (unrevised) Method Statement, East West had commenced construction of

the pipeline when there was no clear method of working agreed with the Joint Venture. In his view, this lack of interaction had resulted in an unacceptable situation: a sub-contractor should not arrive and have to decide how they proceeded; they should not have to operate on a large construction site in isolation. He would not have expected a foreman such as Mr

Connolly to carry out a design assessment; he was not trained to carry out design calculations. He was of the view that if those responsible for the preparation/revisal of the Method Statement had sat down and prepared a specific Method Statement for a 6 metre excavation, they would have identified the primary cause of concern with the use of trench boxes, namely the formation of unsupported faces beneath a high groundwater level. If they had identified the problem, it is likely that they would have selected an alternative means of trench support or an alternative method of temporary works, such as lowering the ground surface.

(101) The Overburden

Mr Rigby-Jones gave evidence that when he commenced his investigations following the accident, he had been told by Mr McRoberts that it had been necessary to retain the overburden because of the pipe-flushing operations relating to another part of the site. It was put to him that Mr McRoberts had said in evidence that it had been necessary to do so, in order to ensure the stability of the small coffer dam. Mr Rigby-Jones said that was not

the reason given to him and, in any event, he did not consider that the stability would have been adversely affected if the overburden had been removed.

With the overburden present, consisting of a looser material than that found below foreshore level and the resultant depth of the excavation, Mr Rigby-Jones did not consider that the use of trench boxes was appropriate. The limited "benching-back", namely an initial reduction of the level of the ground by approximately 1.5 metres, over an area extending by 1 to 1.5 metres on either side of the trench boxes, had not been sufficient to remove the influence of the "surcharge" namely the overburden in this case. In order to remove such an influence, it is necessary to carry out the local reduction over an area of at least the depth of the excavation, which in this case would have been a minimum of 4

metres.

In his view, if the ground had been lowered to actual foreshore level and a trench box used, the likelihood of the accident would have been greatly reduced, to a level which would have enabled those responsible for approving a Method Statement to have done so. The risk would have been low because the factors which caused the accident would have been greatly reduced, namely the likelihood of material inflow, the presence of loose

material around the trench and the simplification of the construction operation. The operation would still have been subject to the constraints of the tide moving up and down and there would still have been groundwater in the excavation, but the limited window when the groundwater was lowest would have enabled a team such as East West to excavate, lay a pipe and backfill - and move on to the next step.

(102) Equipment

One of the principal conclusions of the Atkins Report was that the use of trench boxes had not been appropriate for the excavation being undertaken. While conducting his investigations, Mr Rigby-Jones sought advice from Ground Force, manufacturers and suppliers of the trench boxes used. He drew a diagram of what he described as the "worst possible scenario" in terms of depth of excavation, depth of water and the degree of benching-back, and submitted this to Ground Force for their comments. Ground Force responded to this request by stating that on the basis of the information given, the equipment used was unsuitable. Mr Rigby-Jones accepted in evidence that his diagram had not been an exact representation but had "modelled the most onerous situation to be encountered viewing the construction of the gravity sewer connection" and that the problem envisaged by Ground Force, namely that there would be "structural damage to the boxes" had not materialised. This did not however affect his conclusion: in his view, it would not have been possible to arrive at the methodology for this 6-metre excavation, using trench boxes, which would have reduced the risk factors to an acceptable level. In

fact, the Inquiry also heard evidence from Richard Cherrie of Ground Force, who explained that his company provided an advice service to contractors. If they are asked, they will provide a recommendation as to the system which would in their view be most appropriate for the proposed temporary works. In that situation, they would want to see the Site

Investigation Report and discuss with the contractor what types of plant and machinery were being used. This service is free and all sizes of companies ask for this advice.

The Atkins Report had also been critical of the type of excavator used, in that its size and reach had required it to track across the west trench box in order to excavate within the east trench box and to lower the pipe; this meant that the two boxes could not be excavated to the same depth at any given time, resulting in there being a large unsupported face where the two met. However, on reflection and taking into account the further information put to him by the parties' representatives at the Inquiry, Mr Rigby-Jones accepted that while simply using a larger excavator or one with a longer reach would perhaps have solved some problems, it would have caused others, and the basic problem was not the excavator selected for the job.

(103) Method of Working

As far as the method of working adopted by the East West team was concerned, Mr

Rigby -Jones described this as the typical "dig and push" method, which by its very nature, required a degree of "over-digging" i.e. excavating below the level of the

bottom edges of the trench box. This method also inevitably created unsupported faces at that level, before the box was pushed or banged down. The degree of over-digging and the extent of these unsupported faces was the subject of some criticism in the Atkins Report. The criticism was repeated in the evidence of Mr Rigby-Jones, with regard to the question of minimising unsupported faces, particularly at the point just before the accident; this was the point when the pipe was provisionally laid and the engineers called to check whether the correct level

had been reached. At that point, there were unsupported faces at the base of the east box of between 200 and 500 mm. In giving evidence, Mr Rigby-Jones agreed with the Report's conclusion that the further excavation which took place after the pipe was removed but before bringing the box down was very poor practice. He would have considered that the

excavation should have proceeded in very small increments, particularly at that stage, and in the presence of the large unsupported face between the east and west trench boxes.

(104) Supervision

Mr Rigby-Jones was highly critical of the lack of supervision of the East West team. Firstly, the extension of the sub-contract meant that Mr Rankine was responsible for supervision of the work. However, apart from being on site to deliver the excavator prior to the work commencing (at which time he had a 5-minute discussion with Mr Connolly, who said that he was getting the overburden shifted), he was not back at the site until after

the accident. Mr Rigby-Jones was of the view that supervision from East West should have been at the very least at the critical points, for example when the work started and when the first pipe was laid. However, an appropriate regime would have been daily inspection, whether this came from East West or the Joint Venture. He was of the view that there was a lack of what he described as a "support or reality check". As he put it in evidence, someone who is immersed in an operation can sometimes not see the wood for the trees; another pair of eyes is required. Secondly, there was no supervision specifically provided by the Joint Venture, something which should have been written into the Method Statement. In his experience, in an operation of this type, because of the depth and hazards involved, a team should not have been expected to work in isolation. According to Mr Rigby-Jones, appropriate supervision could have come from the site agent (Mr McRoberts) or the site foreman (Mr Imrie), but did not take place: the fact that the office of Mr McRoberts overlooked the site, and that he had seen the trench boxes being assembled (to

his satisfaction) and that the excavation was not fenced on 29 May (to his dissatisfaction) was not indicative of an appropriate level of supervision. In summary, he was of the view that while there had been "inter-action" between Mr Connolly and his senior colleagues (by telephone) and also inter-action on site, there had been no formal supervision and no-one

on site had been allocated a key responsibility for checking how the work was being carried out.

(105) Causation

As a result of their investigations, Mr Rigby-Jones and his colleague concluded that the collapse of the ground beneath Mr Connolly, leading to his death by asphyxiation, was caused by a combination of two mechanisms, namely (i) the collapse of very loose or voided ground adjacent to the south-facing (seaward) panel of the east trench box and (ii) the flow of material into the base of the excavation. As he explained in relation to (i) above, the material in the overburden, namely sand and rubble, was being put under pressure by the excavation work itself, and by the influence of ground (sea) water on the area of the excavation. This material was looser but dryer than the material below and the fact that it had been walked on by Mr Connolly and his co-workers would also have compacted it to some extent, at least on the surface or "crust". It was likely that as this material moved downwards during the excavation process, some of the material stayed hung up against the box, thereby creating a void underneath the crust. This would obviously not have been visible on the surface. Any such void would have been unlikely to have remained for longer than a few minutes, or indeed for as little as 30 seconds: for example, the banging down of the box by the excavator would have "settled" the material (cf. banging a bowl of sugar on the table) and removed the void. In relation to mechanism (ii), Mr Rigby-Jones explained that due to the unsupported faces created by the excavation, material was likely to have migrated in under the box as the excavator was digging within

the box. This flow of material could either have been sudden or, more likely, very gradual, and in the latter case, those around the excavation would not have noticed it. In particular, the operator of the excavator, whose view would be obscured by the excavator arm and bucket, would have had no way of telling where all the material he was digging out had

actually come from. This flow of material from outside the box would have meant that the ground below Mr Connolly migrated down into the box, eventually causing the collapse of the ground beneath him. Mr Rigby-Jones was satisfied that the probable cause of the accident was, as stated, a combination of these two mechanisms.

Mr Rankine's opinion as to the cause of the accident was put to Mr Rigby-Jones, namely that a void had been present below the level of the trench box and that this had been caused by a loss of fine material due to the pumping operations elsewhere on the site, particularly in the large coffer dam. Mr Rigby-Jones explained that because the coffer dam was a sealed structure, there had only been seepage under the piles of the coffer dam and that while this may have been a very small factor, pumping in an unsealed excavation, such as at the scene of the accident, would actually have resulted in a greater loss of fines. However, as such pumping had taken place over a very short period, namely at the start of work on the day of the accident, he did not consider it conceivable that fine material could have migrated sufficiently to cause a void below the base of the excavation. Mr Rigby-Jones was told that one of the factors upon which Mr Rankine had based his theory was that, according to his employees, there had been no sudden inflow of material from

outside the trench box into the base of the excavation, at the time of the accident. In response, Mr Rigby-Jones reiterated that there would not have needed to have been a sudden inflow, but that material could well have been entering gradually, unnoticed by anyone. One of the other factors on which Mr Rankine had based his theory was the fact that the trench box had not toppled in a seaward direction at the time of the accident, and that it would in his

opinion have done so if there had been a void at that side of the box, as opposed to below the level of the box. According to Mr Rigby-Jones, however, the size of void necessary to have caused the accident would have amounted to the equivalent of between a half and one bucketful of the excavator being used, which would be less than one cubic metre, and this

size of void would not have caused the box to topple. Mr Rigby-Jones also advised the Inquiry that at the time of his site investigation, probes had been inserted into the ground below the base of the excavation and although he did not suggest that the results could be completely conclusive, he said that there had been no void found.

Niall Miller

(105) Niall Miller, aged 37 at the time of the Inquiry, is an Inspector with the Health & Safety Executive, now based in Aberdeen. On 30 May 2001, he was informed of the accident at around 6 pm and arrived on site at around 7 pm, at which time the emergency services were still fully engaged. He was present when Mr Connolly's body was found. When nothing more could be achieved that night, he left the site and returned the next day; he was on site on a regular basis for the next 2-3 weeks, during which time he worked alongside Tayside Police and the Atkins Team. Mr Miller was able to advise the Inquiry of how the work to lay the gravity sewer had finally been completed, namely by removing the overburden and excavating from the level of the foreshore using a type of trench or drag box; the stability of the small coffer dam had not been affected. During the course of his investigations, Mr Miller obtained and collated various documents which were produced at the Inquiry, one of which was the Health & Safety Plan prepared by the Joint Venture, of which he made no particular criticism. However, of particular relevance to the Inquiry was the section of the Plan which referred to toolbox talks and which stated that "Morrison will arrange regular safety briefings and toolbox talks, the contents of which

will be dependent upon the site and the work taking place". Mr Miller made the point at this stage in his evidence that toolbox talks, despite their importance, are not held as often as the construction industry would like to believe they are held.

In relation to the Method Statement and the attached Risk Assessment, Mr Miller agreed with all the other relevant witnesses that this had not been sufficiently specific, in relation to the work on the gravity sewer, although he said that in isolation the Method Statement would have not given him a great deal of concern, providing it was underpinned by the associated Risk Assessment. In this case, the Risk Assessment did not underpin the Method Statement: there was nothing in the Risk Assessment to validate the suitability of

the equipment to be used in tidal conditions. He also shared the view of other witnesses that a Method Statement should be amended or indeed completely re-written if the circumstances changed; in other words, a Method Statement should always be current and specific. Mr Miller explained that the Health & Safety Executive had been trying to promulgate the use of drawings in Method Statements, as a good way of conveying necessary information in an easily understood format.

Mr Miller confirmed that he had never heard of an occurrence of exactly the same nature as that with which the Inquiry was concerned. When asked how awareness of the circumstances of the accident and a potential occurrence such as this could be raised within the construction industry, Mr Miller explained that the Health & Safety Executive no longer issued guidance to the same extent as they had done. However, where there were lessons to be learned, the Executive would utilise some or all of the Construction Industry Training Board (CITB), the Institute of Civil Engineers and the Construction Industry

Research and Information Association (CIRIA), all of whom provide guidance on best practice.

(106) Philip Deebank

As previously indicated, the Crown had asked Philip Deebank, Principal Specialist Inspector of the Health & Safety Executive, to consider the evidence ingathered by the

Crown and to provide a report. Mr Deebank was 46 at the time of the Inquiry and is a civil engineer whose specialism is construction engineering. His Report (Crown Production number 28) deals with the methods and systems of work (including organisational arrangements) which both were used and could have been used to construct the gravity sewer pipeline. He had been provided with *inter alia* copies of the witness statements and documents obtained by Mr Miller and a copy of the Atkins Report. He was also provided

by Mr Miller with a copy photograph of how the gravity sewer work was completed following the accident, and this was annexed to his Report. In general, both in his Report and in evidence to the Inquiry, Mr Deebank agreed with the terms of the Atkins Report but was able to supplement certain aspects of that Report from his perspective as a Health & Safety Executive Inspector.

(107) In particular, he explained the role of a temporary works co-ordinator on a construction site: while this role has no statutory basis, it is now fairly common practice and he himself had specific training in this role through the private sector. According to Mr Deebank, the temporary works co-ordinator should have knowledge of the site in question, although when a project first starts, that knowledge may of course have to come from the relevant plans and other documents. This knowledge is important as the role of a temporary works co-ordinator is to co-ordinate in the sense that it is his job to ensure that temporary works are properly designed and supervised. In the case of the Douglas Terrace site, Steven McRoberts had recently (March 2001) been appointed as Temporary Works Co-ordinator, as part of his job

as site agent. Any Temporary Works Co-ordinator should be involved in the approval process of the Method Statement for any particular temporary works, such as

in this case the laying of the gravity sewer. As Mr Deebank explained in his Report, decisions regarding the appropriateness of particular methods of excavation support in difficult and challenging ground conditions - particularly in water-bearing ground such as

the Douglas Terrace site - need to be informed by the input of suitably qualified and experienced civil engineers, together with practical experience of those who both use and supply equipment and systems. Account needs to be taken of the level of experience of those controlling and supervising excavation works as well as those actually carrying out the excavation works. In Mr Deebank's opinion, site-based formal training, briefings and toolbox talks may be helpful in imparting particular knowledge and information to those

involved, and this is particularly important in the context of a site such as Douglas Terrace, given that there are no CITB courses on excavation works which cover the type of ground conditions encountered there.

(108) Mr Deebank was of the view that there was actually no need for separate training courses to be run by the CITB in relation to the particularly challenging conditions existing at the Douglas Terrace site, although he considered that, in a general training course, reference should be made to such conditions, that is working below the water table. Instead of a formal training course, Mr Deebank was of the view that this should be covered in detail "on the job" and the particular conditions and the experience required should be identified in the Risk Assessment, with training to be given if the relevant personnel (including managers) do not have the requisite experience.

(109) Mr Deebank addressed the use of trench boxes in the circumstances existing at the commencement of the temporary works to lay the gravity sewer, and concluded that the deepening of the trench excavation, as a result of a decision not to remove the overburden, had significantly changed the conditions in which the trench boxes were to be used. He specifically referred to the photographic evidence of the eventual, successful completion of

the work, by using a drag or trench box, to an excavated depth of between 2 and 3 metres. In his view, careful consideration is required regarding the use of trench boxes in tidal foreshore environments in sands and gravels. The experience obtained at the Douglas

Terrace site suggested to him that such boxes should only be considered appropriate for relatively shallow depths of 2.5 metres maximum. This would allow excavation, pipe-laying and the backfilling operations, using one trench box, to be completed within a single tidal window.

(110) When giving evidence, Mr Deebank was asked to give his views on the alternative approaches which could have been used to complete the gravity sewer installation: in his

view it came down to a stark choice between sheet piling or removing the overburden. He explained that sheet piling would have been time-consuming and expensive, and would not have been guaranteed to work, unless the piles had been driven into rock. In conclusion, he was of the view that it was a question of sequencing and proper planning: the overburden could have been removed and if necessary replaced; all that needed to be taken into account was that the haul road could not be used for a few days. As far as he was concerned, the reduction of the ground to its original level was a good, practical solution.

(111) On the method of working adopted in this case, Mr Deebank explained that in his view, the likelihood of a void being created at the side of the trench box was increased by several factors, namely the nature of the ground, the exposure of the excavation to a number of tidal cycles, the use of pumping, over-digging in the presence of unsupported faces and the presence of gaps, including a lack of alignment between the abutting trench boxes. In his opinion, the mechanisms of collapse recorded in the Atkins Report were clearly possible, and given the assumed working methods, in the particular ground conditions, were foreseeable.

(112) Although published guidance is available regarding the risks involved when working with saturated sands, Mr Deebank concluded that the risks of voids being formed outside the confines of trench boxes and other types of trenched excavations in sands and gravels are not well documented, particularly in the context of the potential risks associated with

fluctuating water levels in tidal conditions. While Mr Deebank had been unable to find any record in the United Kingdom of an accident such as that which led to Mr Connolly's death, he was of the view that circumstances such as these could and should be addressed when updating industry guidance.

Submissions

(113) Once all the evidence given to the Inquiry was concluded, a date was fixed to hear submissions from the representatives of the various interested parties, and in advance of that date, draft written submissions from all those who wished to address the Inquiry were provided, on the understanding that these drafts could be supplemented or revised when addressing the Inquiry in person. I am indebted to all parties involved for their clear and focussed submissions.

(114) I was firstly addressed by Mr Wheelan for the Crown. He acknowledged that the job of those who had investigated the accident had been hampered by the fact that the attempted rescue operation and the recovery of Mr Connolly's body had effectively destroyed the site of the accident and vital clues as to its cause. This in turn had made the task of the Inquiry more difficult, as did the consequences of the passage of time between the accident and the holding of the Inquiry, which had resulted in an inevitable diminution of memory on the part of the witnesses. In the latter regard,

Mr Wheelan submitted that, in relation to the credibility and reliability of witnesses, reliability was more of an issue, as in his view all witnesses had apparently done their best to tell the truth.

(116) He accepted that there were differences in the accounts given by witnesses in relation to, for example, the removal of the overburden: all those from East West who gave evidence stated that they expected the overburden to have been removed prior to the

work beginning on the gravity sewer; Mr McRoberts and Mr Moynihan of the Joint Venture said that they had told East West that the overburden would be removed if possible, but that this was unlikely. Unfortunately there were no notes kept of discussions relating to the overburden (or indeed of any other discussion), there was nothing mentioned in the contract and there was not even a reference to the depth of

the dig in the Method Statement. What mattered at the end of the day, according to Mr Wheelan, was that the depth of the dig was significantly deeper than if East West had started at the level of the foreshore.

(117) In Mr Wheelan's submission, the situation whereby those engaging East West were familiar with the work of East West and confident of their competence and whereby East West were in turn confident of their own competence to undertake the excavation, no matter the depth, had led to a degree of over-confidence or complacency between the contracting parties. There is no doubt that Mr Connolly's experience and abilities played a part in this regard in that, although he expressed concerns regarding the increased depth of dig, he apparently decided that it was not beyond the competence of his team.

(118) Mr Wheelan submitted that while the cause of Mr Connolly's death was clear, the cause of the accident which led to his death could not be precisely established. Nevertheless, the Inquiry should look at all the factors and the reasonable precautions

which might have been taken and could be taken in future which might have prevented the accident and the recurrence of such an accident in the future.

(119) According to Mr Wheelan, there were 9 factors which should be examined, viz:-

(i) The depth of the excavation - it is universally accepted that the deeper the dig, the greater the risk, something which applies particularly in foreshore

environments, given the nature of the ground and the tidal influences twice a day;

(ii) The use of trench boxes - while the experts agreed that such boxes could be used for the depth of dig originally contemplated, they were less definite

about their use for the actual dig carried out, given the increased exposure to tidal influences;

(iii) The ground conditions and tidal influences - the act of excavation would have removed material not only from the bottom of the trench but also material coming in from outside the trench boxes; the excavator bucket would hide what was actually going on at the bottom of the trench;

d. Method of work - the dig and push method inevitably creates some unsupported faces as it is carried out, and in this case, there was evidence

that the extent of these unsupported faces was, at least in the immediate run-up to the accident, unacceptable;

e. The Method Statement - it was generic and not specific to the job;

f. The impact of the pumping operations - while Mr Rigby-Jones did not agree with Mr Rankine's view that, in effect, it was the loss of fines caused by

extensive pumping operations which had created the fatal void, he did accept that loss of fines may have been a small factor;

g. The use of only two trench boxes (with extensions) - the significance of this would seem to be that it indicated a lack of planning and/or supervision, rather than the use of only two boxes being a direct factor in the cause of the

accident. A greater degree of supervision, by someone independent of the work, could be seen in general as an obvious benefit (to be balanced with other requirements on site);

h. The lack of specification in the contract - the addition to the contract was silent on the depth of the dig and the number of boxes to be used;

i. The history of previous collapses or voids or holes - the Joint Venture had been aware of such occurrences, which had clearly been caused by the

workings on the foreshore, although the reasons for them seem to have been different from those pertaining to the accident.

(120) Mr Wheelan discounted other factors in the sense that these had, in his submission, no bearing on the accident, namely the type of excavator used by East West and the nature of the site induction and toolbox talks (if any) given to East West employees, including the deceased.

(121) Mr Wheelan's submission in terms of Section 6(1)(a) of the Fatal Accidents and Sudden Deaths Inquiry (Scotland) Act 1976 was in terms of the Petition which established the Inquiry, namely that Mr Connolly's death was caused by mechanical asphyxia due to burial in silt and sand, due to the collapse of a worksite trench (pipe-laying), as recorded in the death certificate issued by Dr Sadler. Further, as set out in the Petition, he submitted in terms of Section 6(1)(b) of the Act that the cause of the accident which led to the death of Mr Connolly was that the ground on which Mr Connolly was standing gave way and that he fell into the void below.

(122) In terms of Section 6(1)(c) of the Act, which deals with the reasonable precautions whereby the death and any accident resulting in the death might have been avoided, Mr Wheelan submitted that the question of reasonable foreseeability was not the issue: as the word "might" rather than "would" was used, the point was

that if reasonable things could have been done at the time and these things might have meant the avoidance of the accident and

consequent death, then the Inquiry is entitled to make such a finding in terms of Section 6(1)(c).

(123) In Mr Wheelan's submission, there were various precautions which could reasonably have been taken, concerning the following, viz:-

(i) The contract - or more accurately, its extension - should have specified the depth of the dig, the number and size of the trench boxes, and should have addressed the question of the overburden. This would have allowed an early opportunity whereby the Joint Venture and East West could have assessed the

degree of risk and a relatively simple, commercially viable way in which the work could have been carried out safely. Had the contract specified that the overburden was to be removed and it had then not been removed, East West would of course have been entitled to resile from the contract, or should have had it amended.

(iii) A Method Statement should have been prepared which was separate, detailed and specific to the installation of the gravity sewer. Had this happened, the Joint Venture personnel might have given more thought to the ground conditions, the depth of the dig, the time it would take, the effect of the tide and the equipment to be used; it might have caused East West to put forward suggestions; it might have had an impact on the contract. The work on the gravity sewer should have been the

subject of supervision by someone independent of the work, able to advise the East West team, who were simply left to get on with it.

(iii) Connected with (ii) above was the way in which the trench boxes were used and the creation thereby of unsupported faces. In Mr Wheelan's submission, the evidence pointed to the possibility that the method adopted by the East West team created larger unsupported faces than were absolutely necessary, and that a supervisory person, independent of the actual work, with the requisite type of expertise, may have been in a position to advise the team to adjust their method.

(124) Mr Wheelan did not make any firm submission in relation to Section 6(1)(d) of the Act, which deals with the question of any defect in a system of working which contributed to the death or any accident resulting in the death. However, he did say that it was arguable that the question of lack of supervision could be classified as such a defect. Further, while the use of trench boxes might be said to be a defect in the system of working, this could only be the case where the overburden remained; if the most practical, commercially effective, safe way had been adopted, namely to reduce the dig to the original depth, the use of trench boxes would have been acceptable.

(125) In referring to Section 6(1)(e) of the Act, which deals with "any other facts which are relevant to the circumstances of the death", Mr Wheelan submitted that in May 2001, no-one connected to the accident could reasonably have foreseen that the accident would occur, and that there was no question of these persons having

wilfully ignored known risks. However, now that the risks were known, it was appropriate for the Health and Safety Executive and the construction industry as a whole to adopt measures to try to make sure such an accident did not happen again.

(126) Mr Wheelan thereby concluded his submissions and I shall now deal with the other parties' submissions in turn. However, having gone into the Crown submissions in detail and at

length, and bearing in mind that there was agreement among all parties of many of the issues, I shall highlight those submissions which are additional to, or differ from, those made by the Crown.

(127) On behalf of Mrs Connolly and her family, Mr Bolland submitted that the accident which befell Mr Connolly was a preventable one. He narrated the circumstances of the accident and the events which led up to it; as I have indicated, these were broadly a matter of

agreement. He was, however, critical of the Method Statement in particular and the planning of the work in general. Further, he submitted that Mr Connolly had done everything he could to have the overburden removed prior to starting the excavation, but had been left with no option other than to lead his team in a difficult and hazardous operation. He had done so without any support or supervision, either from those above him in East West or from anyone in the Joint Venture. In Mr Bolland's submission, critical mistakes were made on the one hand by Mr McRoberts of the Joint Venture, in insisting on the work being undertaken with the overburden in place, and on the other hand by Mr McFadzean of East West in not insisting that the overburden be removed prior to the work commencing. In the event that the overburden had not been removed, the trench boxes were in his submission, completely unsuitable for the task, as had been explained by Mr Rigby-Jones.

(128) On the question of causation, Mr Bolland accepted - as did all parties - that there was no evidence which pointed to a single, precise cause of the accident. However, he was of the view that the opinion of Mr Rigby-Jones provided a clear and expert insight into the possible mechanisms of the accident, and allowed the possible causes of the accident to be determined. Firstly, Mr Rigby-Jones considered that it was possible that there was a void created at the south side of the east box; this would have been temporary in nature and would have been caused by the nature of the material in the overburden, namely sand and

rubble. This ground was being put under pressure by the work undertaken, the tide and the water within it, and the insertion of the trench box. Loose material could have "hung up", however briefly, during the banging down of the east box. Where this created a void, such a void would collapse very quickly, maybe within 30 seconds. Mr Connolly may have fallen into one of these voids. A second possibility was that material outside the south face of the box was migrating in under the box as the digger excavated material from the base of

the excavation within the box. This could have caused the collapse of the ground on which Mr Connolly was standing. In the opinion of Mr Rigby-Jones, however, the

most likely cause of the accident was a combination of these two mechanisms, and I was encouraged to accept that opinion.

(129) On matters of credibility and reliability, Mr Bolland expressed a particular view in relation to the evidence of Mr McRoberts and asked me to accept that in certain respects, Mr McRoberts was an unreliable witness, a particular example being in relation to whether he had instructed Mr Connolly to use a drag box.

(130) In terms of Section 6(1)(c) of the Act, Mr Bolland submitted that there were several reasonable precautions whereby the death might have been avoided, namely:-

(i) The gravity sewer should have been installed before work began on the pumping station.

(ii) If not the above, then the overburden should have been removed prior to the installation of the gravity sewer.

(iii) A separate Method Statement should have been written.

(iv) This should have taken into account the particular hazards of working on a tidal foreshore.

(v) The specific Method Statement should have specified the depth of the required dig and taken into account the presence of the overburden (in the event that it was not to be removed).

(vi) The specific Method Statement should have provided an appropriate method for the installation of the gravity sewer relative to the site at the time of the installation.

(vii) There should have been provision of appropriate and qualified supervision of Mr Connolly on a daily basis, by someone with the required competence, experience, knowledge and expertise.

(viii) That in the event that the overburden was not to be removed, the use of a driven sheet pile excavation rather than the use of trench boxes should have been adopted to install the gravity sewer.

(ix) That a system for undertaking site induction and toolbox talks should be implemented on site.

(x) That there should be a training programme to alert construction industry workers to the distinct hazards of working in tidal environments.

(131) In respect of Section 6(1)(d) of the Act, Mr Bolland submitted that there were several defects in the system of working, which contributed to the death of Mr Connolly, namely:

(i) The system of planning of this project was defective by failing to have installed the gravity sewer before the construction of the coffer dam for the pumping station.

(ii) That having failed to take the precaution of installing the gravity sewer firstly, the Joint Venture's system of work which required digging through the overburden, was defective.

(iii) That the system of working in the absence of a site-specific Method Statement was defective.

(iv) That the system of drafting a Method Statement which did not take into account the particular issues involved was a defect in the system of working.

(v) That the system of supervision used by both the Joint Venture and East West was inappropriate.

(vi) That the system of trench support was defective in respect that trench boxes should not have been used.

(132) I was then addressed by Mr Boyle on behalf of East West Developments Ltd, who submitted that in terms of Section 6(1)(a) of the Act, the place, time and cause of Mr Connolly's death were clearly determined. However, he submitted that the cause of the accident which led to Mr Connolly's death was more difficult to identify, although he stated that it may be possible to postulate that the presence of the overburden was at least one cause of the accident. In terms of Section 6(1)(c), Mr Boyle's position was that no precaution could be said to be reasonable unless the circumstances of the accident were within the reasonable contemplation of the key parties and that this was not the case in respect of this accident, given the absence of any similar accident in the

past and the absence of any reference to such a risk in published guidance or in training courses.

(133) In terms of Section 6(1)(d) of the Act, Mr Boyle made a similar point, in respect that he submitted that a defect required to have been identified objectively, based upon the information which was available at the time. In his view, it was inappropriate to

apply hindsight to reach a determination in terms of either Section 6(1)(c) or 6(1)(d), both of which he referred to as "causative".

(134) Mr Boyle dealt with various aspects of the evidence which had been heard by the Inquiry under the general heading of Section 6(1)(e) of the Act; in particular, he referred to the extensive experience and expertise of the deceased and said that Mr Connolly was "as experienced an excavator workman as one could find". Mr Boyle's point was that Mr Connolly was an entirely appropriate person to carry out and supervise the excavation works in question; indeed the additional supervision suggested by Mr Rigby-Jones in fact amounted to a suggestion that the deceased required a mentor rather than a supervisor, and Mr Connolly's ability and opportunity to discuss matters with either Mr McRoberts of the Joint Venture or with Mr McFadzean and Mr Rankine of East West was sufficient in the circumstances. In relation to both the contract and the risk assessment, Mr Boyle submitted that, while

neither was ideal, it was unlikely that any deficiency had a substantial bearing on the circumstances surrounding the accident.

(135) As far as the type of excavator was concerned, which was the subject of some criticism in the Atkins Report, although Mr Rigby-Jones was not nearly as critical when giving evidence, Mr Boyle suggested that an alternative type of excavator would not have made any difference. Similarly, he submitted that the method of working adopted by the East West team was not defective in any way. In his view, the use of trench boxes

was acceptable, even with the presence of the overburden, and that there were practical problems preventing the use of any other systems.

(136) Mr Boyle referred to the opinion of Mr Rankine relating to the impact of pumping operations elsewhere on the site, and the risk that these had created voids, one of which must have been present underneath the excavation, as a direct result of which the accident occurred. In relation to the voids, he referred specifically to the fact that the appearance of voids on the site had not been brought to the attention of East West.

Although he did not go so far as to suggest that if the deceased and others had been told about these voids, that they would have definitely done things differently, he did suggest that, with the benefit of hindsight, Mr Rankine took the view that, had he known about the existence of voids and pumping, he would have reached the conclusion that the overburden must be removed.

(137) In common with all the parties to the Inquiry, Mr Boyle drew attention to the fact that existing publications and training courses did not contemplate the risk of an accident such as that which befell Mr Connolly.

(138) Finally, on matters of credibility and reliability, Mr Boyle supported the view of Mr Bolland that, where there was a conflict between employees of East West and Mr McRoberts, the evidence of the East West employees should be preferred and the evidence of Mr McRoberts be treated as unreliable.

(139) Mr Di Rollo was the last to make submissions. In particular, he submitted that because the precise cause of the ground collapse had not been established, it would be inappropriate to make any determination in terms of either Section 6(1)(c) or 6(1)(d). However, he did deal with various matters which were relevant to the circumstances of the death, in terms of Section 6(1)(e), and entirely appropriately referred to the purpose of the Inquiry, being not to attribute blame to any person or organisation, but to provide an opportunity for lessons to be learned, to prevent a similar tragedy occurring in the future. In his submission, there were several factual issues, such as the stage, if any, at which East West knew that the overburden was not going to be removed before work started, the reasons for deciding not to remove the overburden and the decision to use a drag box on 28 May 2001, all of which it would be difficult, if not impossible, to resolve; in his submission it would be more fruitful for the Inquiry to concentrate on the steps that may prevent a re-occurrence of this type of accident.

(140) In particular, Mr Di Rollo was somewhat critical of the method of working adopted by the East West team: while he accepted that the generation of unsupported faces is unavoidable during the transient stage of inserting a trench box support system, he submitted that it was at least possible that the East West team did not carry out the process with optimal care and expertise. In his submission, a risk assessment for this

type of work should include, as a hazard in relation to such work at such a depth, in such an environment, the risk that the continued presence of unsupported faces in an excavation may result in the collapse of ground adjacent to the excavation. However, he emphasised that such a hazard had not been in contemplation prior to Mr Connolly's accident, and that the accident was both unprecedented and unpredicted, in terms of records and health and safety literature.

(141) Mr Di Rollo took issue with several of the conclusions contained in the Atkins Report and spoken to in evidence by Mr Rigby-Jones. In particular he submitted that it had been perfectly legitimate for the work to be sub-contracted to East West on a full labour, plant and supervision basis and that there was no justification for the conclusions of Mr Rigby-Jones and his co-author that the supervision was inadequate. He also said that there was no question of the excavator used in the operation being anything other than adequate; further, in his submission, the use of trench boxes was entirely appropriate.

(142) Other aspects of the Report to which he specifically referred related to the Method Statement and Risk Assessment: he submitted that Mr Rigby-Jones had not gone as far as to say that the Method Statement was inadequate, other than to say that it would have been preferable to have a separate Method Statement. In relation to the part of the Risk Assessment which referred to the construction of the gravity sewer taking

place after the small coffer dam around the pumping station was removed, he submitted that this referred only to the actual connection between the gravity sewer and pumping station and that the risk identified was damage to the coffer dam itself.

(143) Mr Di Rollo also submitted that, despite what had been said in the Atkins Report, there had been no lack of clarity in regard to responsibility for the design of the temporary

works in question and that it had not been established during the Inquiry that the use of trench boxes in the construction of the gravity sewer pipeline had been inappropriate.

(144) He also submitted that the evidence heard by the Inquiry had not supported various factors on which the Atkins Report was based, in relation to the inflow of material into the base of the excavation.

(145) In summary and conclusion, Mr Di Rollo submitted that I was entitled to make certain recommendations, viz:-

a. In devising, maintaining and enforcing a safe system of support for any excavation, regard should be had not only to the danger of collapse of the walls of the excavation but also to the danger posed by the creation of unsupported ground next to it. Trench boxes may be used to carry out an excavation at such a depth and in such an environment if used appropriately and with adequate care.

b. In future, a Risk Assessment should identify the specific hazard of collapse of the ground outside and adjacent to the excavation. Where excavation is to be carried out on the foreshore then a risk assessment should address specific hazards of (1) working in tidal conditions (2) working in saturated

granular materials and (3) the effect of unsupported faces. It should reinforce the need to install the trench support system correctly. If trench

boxes are to be used then steps should be taken to guard against the continued presence of unsupported faces. These include (1) inserting the

box incrementally; (2) avoiding over-digging the excavation; (3) ensuring that the wall of the box reaches the base of the excavation; (4) ensuring that the box is level when it reaches its final support position; (5) if more than one box is used, ensuring that the boxes are placed in the excavation in such

a way that they are both level with one another and both reach the base of the excavation.

(146) Conclusions

This Fatal Accident Inquiry was concluded almost five years after the tragic death of Thomas Connolly. In these circumstances, the ability of the witnesses to remember the exact events surrounding his death is inevitably diminished. Nevertheless, and in many cases because the events were personally traumatic, I have no doubt that during the course of the Inquiry, most of the witnesses were able to recollect these events reliably and with clarity. The only issue which arose in relation to reliability and credibility was where there was a conflict between the evidence of Steven McRoberts and the evidence of other witnesses, notably those associated with East West. Where such conflicts arose, I did not accept the evidence of Mr McRoberts as reliable.

(147) Some of the conclusions I have reached in making my Determination have been more straightforward than others, particularly where issues were not disputed. It was not disputed that in terms of Section 6(1)(a) of the Sudden Deaths and Fatal Accidents Inquiry (Scotland) Act 1976, Mr Connolly died on 30 May 2001 at 1640 hours or thereby. I am conscious, however, that the time of death on the death certificate was "between 1650 hours and 2040 hours", the latter time being that at which a doctor pronounced life extinct.

For the record, I consider it important to stress that Mr Connolly must have died very quickly after the accident occurred, at around 1640 hours, and I have so determined.

(148) There was also no dispute about the medical cause of Mr Connolly's death, namely mechanical asphyxia due to his being buried in the ground into which he fell, which comprised silt and sand. However, as the pathologist Dr Sadler explained, he had, at the time of the post mortem examination, understood that Mr Connolly had been within the trench when there was a ground collapse, as opposed to standing outside the trench; I have accordingly corrected that misapprehension in my Determination in terms of Section 6(1)(b) of the Act.

(149) Section 6(1)(b) requires the Sheriff also to make a Determination in terms of the cause of the accident resulting in the death. In their submissions, some of the parties suggested that the cause of the accident had not been established. However, I consider that it would be more accurate to say that a single, precise mechanism for the ground collapse had not been established. I am satisfied on the balance of probabilities that the accident occurred because the temporary works involved in the construction of the gravity sewer pipeline caused loose ground or a void to occur, where Mr Connolly was standing, adjacent to the east trench box, and that he fell into that loose ground or void. In reaching that conclusion, I am therefore rejecting Mr Rankine's theory that the temporary works in which the East West Team were engaged were not responsible for the creation of a void and that the void was below the depth of the trench boxes and caused by pumping elsewhere on the site. As well as being satisfied as to the cause of the accident, I also consider it highly likely that the cause of the accident was due to a combination of the two mechanisms identified in the Atkins Report. The first of these mechanisms related to the material in the overburden, which was being put under pressure both by the excavation work and the presence of ground water; as this material moved downwards, some of it stayed "hung up" against the

trench box, thereby creating a void underneath the surface, at least briefly. The second mechanism was directly related to the unsupported faces created during the excavation process and the insertion of the trench boxes; during this process, material was likely to have migrated in under the trench box.

(150) Mr Boyle and Mr Di Rollo both submitted that because no precise cause of the accident had been established, it would be inappropriate to make any determination in terms of Section 6(1)(c) of the Act, which requires the Sheriff to set out any reasonable precautions whereby the death and any accident resulting in the death might have been avoided. I disagree. As has been said by other sheriffs many times in the past, the operative word is "might", not "would", and the whole purpose of a Fatal Accident Inquiry is to establish if there were any precautions which were not taken, but which might reasonably have been taken, and if these reasonable precautions might have prevented the fatal accident in question.

(151) I am satisfied in this case that the removal of the overburden was an entirely reasonable precaution which could and should have been taken, and that it was not necessary to retain it in order to protect the stability of the small coffer dam. From the very start of the Tay Wastewater Project, and the writing of the Design Risk Assessment, it was appreciated that deep excavations carry risks and that the depth of an excavation should be minimised where reasonable. In this case, that basic safety issue was ignored, with fatal results, and the only reason the Inquiry was given was the wholly unacceptable one of "programming".

(152) On the other hand, an example of a precaution which would not have been "reasonable" for the purposes of the Act would have been one whereby the overburden was retained and sheet piling used instead of trench boxes; this would simply not have made economic sense. I have therefore not made any alternative finding in that respect.

(153) I did not understand parties to dispute the fact that the Method Statement and Risk Assessment which covered the construction of the gravity sewer pipeline was inadequate, although they disagreed as to the extent to which this was the case. The Inquiry did not hear evidence from the original author of the Method Statement, but heard evidence from Dominic Moynihan, who revised it in consultation with Steven McRoberts. Mr McRoberts was the lone voice in the Inquiry, proclaiming satisfaction with the Method Statement, and Mr Moynihan himself fully accepted its deficiencies, particularly with regard to the fact that there should have been a separate Method Statement for the construction of the gravity sewer pipeline. He also accepted that the depth of the excavation should have been specified and that where circumstances change, the Method Statement should be revised or re-written. In fact, as Mr Moynihan explained, he had changed his approach to method statements, making them much more accessible and easily understood: he now incorporates "do's and don'ts", diagrams and drawings, an approach which was echoed in the evidence of Niall Miller, who said that this was exactly what the Health & Safety Executive was trying to encourage. I accepted the conclusions of the expert witnesses that there should have been a specific Method Statement, which specifically addressed the way in which the works in a tidal environment would be carried out, and that it should have referred to one specific construction methodology, not a range. In particular, I accepted the opinion of Mr Rigby-Jones that if those responsible for the preparation or revisal of a Method Statement for those temporary works had attempted to prepare a suitable Method Statement, for a 6 metre excavation, they would quickly have identified the primary cause of concern connected with the use of trench boxes, namely the formation of unsupported faces beneath the high groundwater level. Having identified the problem, they should have then selected an alternative means of trench support or an alternative method of temporary works such as lowering the ground surface by removing the overburden. Accordingly, the preparation of

a current and specific Method Statement was a reasonable precaution whereby the accident resulting in Mr Connolly's death might have been avoided.

(154) It was submitted to me by Mr Boyle and Mr Di Rollo that the supervision of the East West Team had been adequate. In particular, Mr Boyle submitted that Mr Connolly had been an entirely appropriate person to carry out and supervise the temporary works and that he had had the opportunity to discuss the methodology both with his senior colleagues and with Steven McRoberts. Mr Di Rollo submitted that East West were competent and experienced sub-contractors capable of carrying out the work without it being necessary to be supervised by the main contractor and that it was perfectly legitimate for the work to be sub-contracted to them on a full labour, plant and supervision basis. I do not agree with these submissions: even Mr McRoberts said in evidence that he and others in the Joint Venture had a supervisory responsibility, particularly for safety on the site, and that there was no question of the contract meaning that "East West would simply be left to get on with

it". Unfortunately, the evidence clearly points to this being exactly what happened and as a result the senior site foreman, Mr Imrie, gave evidence that he felt that he had let himself down in terms of supervision. It would, in my view, be very unfair indeed to suggest that Mr Imrie was at fault in that regard: he had not even been brought into the preliminary discussions with East West, although Mr Moynihan had planned that he would, and he had not been allocated any specific responsibility for supervising the work of the East West Team. Indeed, no person had. I reached the conclusion that the Method Statement should have set out a supervision and inspection regime which would have clearly identified those responsible and that those persons should have been suitably qualified and experienced. However, in relation to supervision, I should make it clear that I only consider such a regime to have been a reasonable precaution which might have avoided the occurrence of this fatal accident, if that supervision was of a type and degree

which would have resulted in the insertion of the trench boxes into the overburden being prevented or quickly abandoned, on the grounds that this methodology was unsuitable. Once the decision had been taken to use this methodology and it had reached a certain stage, I do not consider that any amount of supervision would have ensured that the work could be completed safely.

(155) In terms of Section 6(1)(d) of the Act, it was suggested by both Mr Boyle and Mr Di Rollo that it would be inappropriate for me to make any determination that there was a defect in any system of working which contributed to the accident and Mr Connolly's death, because the precise cause of the accident was unknown. Again, I disagree. Accordingly, I firstly considered the system of working which the East West Team adopted in inserting the trench boxes. All the evidence pointed to this having been the "normal" method but that this method was used in what were in fact abnormal and particularly hazardous conditions. While it would appear - and I agree with Mr Wheelan and Mr Di Rollo in this regard - that the East West Team's working practices were not ideal, particularly at the point just before the accident took place, when they carried out over-digging in the presence of unsupported faces, I find it difficult to be critical of their system of working, given the particular conditions. In my view, these conditions - namely the presence of the overburden and the use of the trench boxes - rendered the task virtually impossible, no matter the care they had taken. I accordingly have made no determination in this regard.

(156) Secondly, and on the other hand, I considered the system of working involving the use of trench boxes, in the presence of the overburden and in the face of the tidal conditions affecting the excavation site. I reached the conclusion that this was a defect in the system of working which contributed to the accident and Mr Connolly's death. As I have already explained, I consider that this defect occurred because proper consideration was not given by suitably qualified and experienced persons to the preparation of a Method Statement

which stipulated a safe construction methodology, including a suitable method of trench support.

(157) In my Determination, I have included certain "facts which are relevant to the circumstances of the death" in terms of Section 6(1)(e) of the Act. While I have tried to ensure that all the facts relevant to Mr Connolly's death have been included in this

Note, I considered it appropriate to highlight certain of these facts in my Determination under this sub-section. In particular, I have highlighted the fact that the risk of voids forming adjacent to trenched excavations in ground comprising sand and gravel, in foreshore conditions, is not well documented; indeed there has been no record found by the expert witnesses to this Inquiry of an accident similar to that which befell Mr Connolly. In these circumstances, it is in my view important that the relevant bodies take steps to raise awareness of such risks.

(158) Further, it is in my view, insufficient for reference simply to be made to these risks when updating construction industry guidance. It is vital that site-based training take place, tailored to the needs of the persons undertaking specific work, at the point when they are about to begin that work. The system of toolbox talks is in my view an essential way of communicating necessary information, and is invaluable if used properly. It is also vital that those who communicate the information and deliver that training are suitably qualified and experienced. In this case, if a toolbox talk on the Method Statement did take place - and I am not satisfied that it did - then it would inevitably have been inadequate because of (i) the inadequacy of the Method Statement itself and (ii) the lack of experience of working in foreshore conditions of Mr McRoberts, the putative deliverer. Suitable training must be given not only to those carrying out the work itself, but also to the managers and supervisors involved.

(159) I have also highlighted in my Determination under this sub-section, the fact that companies such as Groundforce, who supplied the trench boxes in this case, offer an advice

service (at no cost) to the construction industry. This advice service covers the suitability of the equipment they provide for the particular circumstances in which it is proposed to use such equipment. As Mr Rigby-Jones graphically illustrated, it took him a mere 10-15 minutes to draw a diagram and fax an enquiry to Groundforce. In the circumstances of this case, where the presence of the overburden had altered the working conditions so significantly, I find it difficult to understand why this was not done in advance of the commencement of the works.

(160) Finally, I wish to record my appreciation of the way in which all parties conducted this Inquiry. I also wish to say that Mrs Connolly was a dignified presence throughout and I sincerely hope that most if not all of her legitimate questions and concerns have been addressed. I extend my sympathy to her and to the other members of Mr Connolly's family.