مؤسسة مياه بيروت وجبل لبنان

إعادة تأهيل خزان الغينة وربطه بالشبكة الموجودة

مصلحة الصفقات والشؤون القانونية

فرنسوا بشعلاني

مصلحة المشاريع

المهندس احمد سرحال

المدير العام بالإنابة

المهندس ربيع خليفة

وافق مجلس الإدارة

قراره رقم:

تاريخ:

محتويات الملف المسلّم لتقديم العروض

تسلّم المؤسسة إلى كل من ينوي الإشتراك في هذا الإلتزام وبناءً على طلبه المستندات التالية:

1- دفتر الشروط هذا

2- جدول الأسعار وتقدير الكميات.

3- نموذج التصريح / التعهّد.

4- نموذج تصريح النزاهة.

5- نموذج التعهّد برفع السرّية عن الحسابات المصرفية المتعلقة بهذا الالتزام.

6- تصريح بمعاينة مواقع العمل نافي للجهالة.

7- غلاف مدوّن عليه من قبل المؤسسة موضوع الالتزام وتاريخ فض العروض مع إسم وعنوان المؤسسة.

1- دفتر الشروط

إعادة تأهيل خزان الغينة وربطه بالشبكة الموجودة	
مُلخّص عن الصفقة	
إسم الجهة الشارية	مؤسسة مياه بيروت وجبل لبنان
عنوان الجهة الشارية	المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي
عنوان الصفقة	**إعادة تأهيل خزان الغينة وربطه بالشبكة الموجودة**
موضوع الصفقة	إعادة تأهيل خزان الغينة وربطه بالشبكة الموجودة بعد تغيير مسار الخط، وذلك وفقاً للمواصفات ولأحكام دفتر الشروط
طريقة التلزيم	طلب عروض اسعار
نوع التلزيم	اشغال
مدة صلاحية العرض	90 يوماً إعتباراً من التاريخ المحدد لفض العروض
ضمان العرض	/100.000.000/ل.ل. مئة مليون ليرة لبنانية
مدة صلاحية ضمان العرض	تُحدد مدة صلاحية ضمان العرض بإضافة /28/ يوم على مدة صلاحية العرض.
ضمان حسن التنفيذ	10% من قيمة العقد
الإرساء	السعر الادنى
مكان استلام دفتر الشروط	مديرية الشؤون المالية – الطابق الثاني – من المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي
مكان تقديم العروض	قلم المؤسسة الطابق الرابع – من المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي
مكان تقييم العروض	الطابق الثالث من المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي
ثمن دفتر الشروط	/15.000.000/ل.ل خمسة عشر مليون ليرة لبنانية
مدة التنفيذ	ستة اشهر من تاريخ توقيع العقد
عملة العقد	الليرة اللبنانية
دفع قيمة العقد	الليرة اللبنانية
العارضون المقبولون	المتعهدون اللبنانيون المسجلين على لوائح المؤسسة الواردة أسماؤهم في الجدول المرفق والذين يستوفون الشروط المذكورة في هذا الدفتر

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1- تعاريف عامة:

في هذا الدفتر ترمز كلمة:

- "المؤسسة" : إلى مؤسسة مياه بيروت وجبل لبنان.
- "العارض" : إلى الشخص الطبيعي أو المعنوي الذي يقدم عرضاً.
- "العرض" : إلى مجموع المستندات الموجودة في ملف التعهد.
- " طلب عروض اسعار": إلى دعوة للمنافسة بشأن التزام تجري على أساس استدعاء من المؤسسة.
- "العارض الافضل" : الى العارض الذي يحتفظ مؤقتاً بعرضه بوصفه العارض الانسب والادنى سعراً لتنفيذ الصفقة.
- "الملتزم"، "المتعاقد": إلى المتعهد الذي أسند إليه الالتزام بصورة نهائية.
- "مندوب المؤسسة"، "مندوب الإدارة" : إلى أي شخص طبيعي أو معنوي تكلفه المؤسسة مراقبة تنفيذ الالتزام.
- "أشغال"، "منشآت" : إلى مختلف الأشغال والمواد والمنشآت التي يتوجب تنفيذها ضمن الالتزام.
- "وكيل الملتزم" : هو الشخص المنتدب من قبل الملتزم بموجب كتاب تفويض لمواكبة تنفيذ الاعمال المطلوبة بموجب المناقصة ويجب أن يكون هذا الوكيل مقبولاً من قبل المؤسسة.
- "الأشغال" : وتشمل تقديم اليد العاملة والمواد والتجهيزات والمعدات اللازمة للتنفيذ حسب المستندات وتشمل:

ب- الأشغال الدائمة: وهي المطلوب تنفيذها وتسليمها حسب المواصفات المطلوبة عند نهاية مهلة الالتزام وهذه الأشغال تدخل ضمن الكشوفات.

ت- الأشغال المؤقتة: وهي الأشغال الإضافية المتوجب القيام بها لحسن تنفيذ الأشغال الدائمة والتي يجب إزالتها بعد إنهاء الأشغال الدائمة أو إعادتها إلى ما كانت عليه قبل البدء في الأشغال ولا يدفع بدل هذه الأشغال المؤقتة على حدة بل يجب إدخال تكاليفها ضمن أسعر الألتزام.

ج- أشغال إضافية: وتشمل أي جزء من الأشغال لا ينص عليه جدول الأسعار ويعتبر من قبل المؤسسة ضرورياً لإكتمال الالتزام الأساسية.

2- موضوع الإلتزام:

إعادة تأهيل خزان الغينة وربطه بالشبكة الموجودة بعد تغيير مسار الخط، وذلك وفقاً للمواصفات ولأحكام دفتر الشروط . وذلك وفق دفتر الشروط هذا ومرفقاته التي تُعتبر كلها جزءً لا يتجزأ منه.

1- عند التعارض بين أحكام دفتر الشروط هذا وأحكام قانون الشراء العام تطبق أحكام قانون الشراء العام.

2- تتم الدعوة الى هذا التلزيم عبر الإعلان على المنصة الالكترونية المركزية لدى هيئة الشراء العام.

3- مرفقات دفتر الشروط

- الملحق رقم 1: جدول الأسعار
- الملحق رقم 2: مستند التصريح/التعهد
- الملحق رقم 3 : مستند تصريح النزاهة
- الملحق رقم 4: تصريح رفع السرية المصرفية
- الملحق رقم 5: تصريح بمعاينة مواقع العمل

4- يمكن الإطلاع على دفتر الشروط هذا والحصول على نسخة منه من مديرية الشؤون المالية – الطابق الثاني – من المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي بعد دفع البدل المالي البالغ /15.000.000/ل.ل. خمسة عشر مليون ليرة لبنانية.

5- يُنشر دفتر الشروط هذا على المنصة الالكترونية المركزية لدى هيئة الشراء العام.

6- يُطبق على دفتر الشروط هذا أحكام قانون الشراء العام والأنظمة الأخرى المرعية الإجراء.

3- أحكام خاصة بطلب عروض الاسعار:

1- تتم الدعوة الى طلب عروض الأسعار هذا وفق نموذج الدعوة الصادر عن هيئة الشراء العام وتبلغه للعارضين المعنيين بطريقة مباشرة وبوسيلة سريعة ومضمونة.

2- ينحصر حق الإشتراك في هذه الصفقة بالعارضين المدعوين من قبل مؤسسة مياه بيروت وجبل لبنان للإشتراك في هذا التلزيم والواردة أسمائهم في اللائحة المعتمدة لهذه الغاية.

4- العارضون المسموح لهم الاشتراك بهذه الصفقة:

إنّ العارضين المقبولين في هذه الصفقة هم الشركات والمؤسسات التي تتعاطى هذا النوع من الاعمال، و الذين تتوفر فيهم شروط المشاركة في هذه الصفقة والمبينة في المواد التالية.

5- الرجوع الى النصوص العامة:

تطبق بكل ما لا يتعارض وأحكام دفتر الشروط هذا:

1- دفتر الشروط النموذجي الصادر عن هيئة الشراء العام قبل الاعلان عن الصفقة.
2- قانون الشراء العام رقم 2021/244.
3- النظام المالي في مؤسسة مياه بيروت وجبل لبنان بموجب المرسوم الرقم 14637 تاريخ 2005/6/16.

6- طريقة التلزيم:

يجري التلزيم بطريقة طلب عروض اسعار على أساس تقديم أسعار وفقا للسعر الادنى.

يسند الالتزام مؤقتا الى العارض المقبول شكلا من الناحية الادارية والفنية والذي قدم السعر الادنى الاجمالي للصفقة.

اذا تساوت الاسعار بين العارضين، اعيدت الصفقة بطريقة الظرف المختوم بين اصحابها دون سواهم في الجلسة نفسها، فإذا رفضوا تقديم عروض اسعار جديدة او اذا ظلت اسعارهم متساوية عين الملتزم المؤقت بطريقة القرعة بين أصحاب العروض المتساوية.

يقدم العارض عرضه بالليرة اللبنانية.

7- درس مستندات الإلتزام:

يتوجب على كل عارض تم استدعائه للاشتراك بهذا الالتزام و يرغب الإشتراك بهذا الالتزام أن يدرس بدقة مستندات هذا الالتزام ويعاين مناطق العمل ليطّلع على الحالة الراهنة من جميع الوجوه، إن من حيث طبيعة الأشغال ونوعها وكمياتها وصعوبات التنفيذ.

يعتبر تقديم العرض تسليماً صريحاً من قبل العارض بأنه درس مستندات الالتزام وأصبح يلمّ تمام الإلمام بظروف العمل المحلية وطبيعة الأشغال وأن العرض المقدم منه قد أخذ جميع الأمور بعين الإعتبار، كما وأنه يملك الإمكانات والمقدرة اللازمة لأدائه على أكمل وجه خلال المدة المحدّدة في هذا الدفتر.

8- شروط مشاركة العارضين:

1-يجب أن تتوافر في العارضين الشروط التالية، ويصرح عنها وفق المستندات المطلوبة في الفقرة (أولًا: الغلاف رقم (1) الوثائق والمستندات الإدارية) من هذه المادة:

أ. ألّا يكون قد ثَبُتَت مخالفتهم للأخلاق المهنية المنصوص عليها في النصوص ذات الصلة، إن وُجدت؛

ب. الأهلية القانونية لإبرام عقد الشراء؛

ج- الايفاء بالالتزامات الضريبية واشتراكات الضمان الاجتماعي؛

د- ألا يكون قد صَدَرَت بحقهم أو بحق مديريهم أو مستخدميهم المعنيين بعملية الشراء أحكام نهائية ولو غير مبرمة تُدينهم بارتكاب أيّ جرم يتعلّق بسلوكهم المهني، أو بتقديم بيانات كاذبة أو ملفّقة بشأن أهليّتهم لإبرام عقد الشراء أو بإفساد مشروع شراء عام أو عملية تلزيم، وألّا تكون أهليّتهم قد أُسقِطَت على نحوٍ آخر بمقتضى إجراءات إيقاف أو حرمان إدارية، وألا يكونوا في وَضع الإقصاء عن الاشتراك في الشراء العام؛

هـ- ألا يكونوا قيد التصفية أو صَدَرَت بحقهم أحكام إفلاس؛

و- ألا يكونوا قد حُكِموا بجرائم اعتياد الربى وتبييض الأموال بموجب حُكم نهائي وإن غير مُبرم؛

ز- ألا يكونوا مشاركين في السلطة التقريرية لسلطة التعاقد وألا يكون لديهم مع أيّ من أعضاء السلطة التقريرية مصالح مادية أو تضارب مصالح؛

ح- غير ذلك من الشروط التي تَفرِضها سلطة التعاقد في دفتر الشروط الخاص بمشروع الشراء والتي تتناسب مع الاعمال المطلوبة.

ط- افادة من وزارة الاقتصاد تثبت انطباق احكام قانون مقاطعة العدو الاسرائيلي بالنسبة للشركات الاجنبية (نبذة مضافة بالقانون رقم ٣٠٩ تاريخ ٢٠٢٣/٤/١٩)

ي- التصريح عن اصحاب الحق الاقتصادي (نبذة مضافة بالقانون رقم ٣٠٩ تاريخ ٢٠٢٣/٤/١٩)

2- يقدم العرض بصورة واضحة وجليّة جداً من دون أي شطب أو حك أو تطريس.

3- يصرح العارض في عرضه أنه اطلع على دفتر الشروط الخاص هذا والمستندات المتممة له وأخذ نسخة عنه؛ وأنه يقبل الشروط المبينة فيه ويتعهد التقيّد بها وتنفيذها جميعها من دون أي نوع من أنواع التحفظ أو الاستدراك وأنه يقدم عرضه على هذا الأساس ويلصق على التصريح طوابع مالية بقيمة مليون ليرة لبنانية تغطي المستندات كافة (صورة التصريح مرفقة بهذا الدفتر).

4- يرفض كل عرض يشتمل على أي تحفّظ أو استدراك.

5- يحدّد العارض في عرضه عنوانًا واضحًا له ومكانًا لإقامته لكي يتم إبلاغه ما يجب إبلاغه إيّاه بالسرعة الممكنة.

أولًا: الغلاف رقم (1) الوثائق والمستندات الإدارية

يتوجب على العارض الذي يرغب بالإشتراك في هذا التلزيم أن يقدم المستندات التالية (أصلية أو صورة طبق الأصل أو صورة عنها على ان يبرز العارض الأصلية خلال جلسة فضّ العروض ويصدق عليها رئيس لجنة التلزيم)، لا يعود تاريخها لأكثر من سنة من تاريخ جلسة فض العروض وذلك بالنسبة للمستندات التي تصدر دون تاريخ صلاحية باستثناء مستند السجل العدلي الذي يجب أن لا يتعدى تاريخه الثلاثة أشهر من تاريخ جلسة فض العروض.

أ- الشروط العامة الموحدة:

1- كتاب التعهد (التصريح) وفق النموذج المرفق موقّعًا وممهورًا من العارض مع طوابع مالية بقيمة /1.000.000/ل.ل. (مليون ليرة لبنانية) ويتضمن التعهد، تأكيد العارض لالتزامه بالسعر وبصلاحية العرض.

2- مستند تصريح النزاهة موقعًا وفقًا للأصول من قبل العارض (مرفق ربطًا).

3- مستند رفع السرية المصرفية وفق النموذج المرفق ربطا.

4- مستند التصريح بمعاينة مواقع العمل نافي للجهالة وفق النموذج (المرفق ربطا).

5- ضمان العرض المُحدد بموجب دفتر الشروط الخاص هذا.

6- إيصال صادر عن المؤسسة بإسم العارض ومُعنون بإسم الصفقة، يُثبت أن العارض دفع بدل دفتر الشروط.

7- نسخة عن دفتر الشروط هذا مؤشر من العارض على كل صفحة من صفحاته وموقع ومؤرخ منه على الصفحة الأخيرة.

8- إذاعة تجارية يُبيّن فيها صاحب الحق المفوّض بالتوقيع عن العارض ونموذج توقيعه.

9- التفويض القانوني اذا وقع العرض شخص غير الشخص الذي يملك حق التوقيع عن العارض بحسب الإذاعة التجارية، مصدّق لدى الكاتب العدل.

10- سجل عدلي للمفوض بالتوقيع أو "من يمثله قانونًا" لا يتعدى تاريخه الثلاثة أشهر من تاريخ جلسة فض العروض.

11- عقد الشراكة مصدق لدى الكاتب العدل في حال توجبه.

12- شهادة تسجيل العارض لدى مديرية الضريبة على القيمة المضافة إذا كان خاضعاً لها، أو شهادة عدم التسجيل اذا لم يكن خاضعًا، وفي هذه الحالة يلتزم العارض بسعره وان أصبح مسجلًا في الضريبة على القيمة المضافة خلال فترة التنفيذ.

13- شهادة تسجيل العارض لدى وزارة المالية – مديرية الواردات.

14- براءة ذمة من الصندوق الوطني للضمان الإجتماعي "شاملة أو صالحة للإشتراك في الصفقات العمومية" صالحة بتاريخ جلسة فض العروض، تفيد بأن العارض سدد جميع اشتراكاته (يجب أن يكون العارض مسجلًا في الصندوق الوطني للضمان الإجتماعي وترفض كل إفادة يُذكر عليها عبارة "مؤسسة غير مسجلة").

15- إفادة صادرة عن البلدية التي يقع المقرّ الحالي للعارض ضمن نطاقها، تفيد انه سدد كامل الرسوم البلدية المتوجبة عليه.

16- إفادة شاملة صادرة عن السجل التجاري تبيّن المؤسسين والأعضاء والمساهمين أو الشركاء، المفوضين بالتوقيع، المدير، رأس المال، نشاط العارض.

17- افادة صادرة عن المرجع المختص تُثبت ان العارض ليس في حالة إفلاس.

18- افادة صادرة عن المرجع المختص تُثبت ان العارض ليس في حالة تصفية قضائية.

19- تصريح من العارض يبيّن فيه صاحب/أصحاب الحق الاقتصادي وفقًا للنموذج م18 الصادر عن وزارة المالية (كل شخص طبيعي يملك او يسيطر فعليًا في المحصلة النهائية على النشاط الذي يمارسه العارض، بصورة مباشرة او غير مباشرة، سواء كان هذا العارض شخص طبيعي او معنوي).

20- نسخ عن بطاقات التعريف (هوية / جواز سفر) لصاحب (أصحاب) الحق الاقتصادي.

21- نسخ عن بطاقات التعريف (هوية / جواز سفر) لكل شخص يمثل العارض (من ينوب عن العارض في علاقته مع سلطة التعاقد: وكيل قانوني، ممثل الشخص المعنوي أو المفوّض بالتوقيع عنه...).

ثانياً: الغلاف رقم (2):

- يُقدم العارض بيانًا بالأسعار – ضمن ظرف مقفل ويتضمن السعر الافرادي والإجمالي (بالعملة اللبنانية) مدوناً بالأرقام والأحرف دون حك أو شطب او تطريس أو زيادة كلمات غير موقّع تجاهه
- يشمل السعر الضرائب والرسوم والمصاريف مهما كان نوعها، وفي حال خضوع الملتزم للضريبة على القيمة المضافة عليه أن يقدم سعره مفصلاً مع السعر الإجمالي بما فيه الضريبة على القيمة المضافة.
- في حال الإختلاف بين الأرقام والأحرف يؤخذ بالسعر الإفرادي المُدون بالأحرف، ويرفض السعر غير المدون بالأحرف الكاملة والأرقام معاً.

ثالثاً: الغلاف رقم (3)

توضع الغلافات المذكورة ضمن غلاف موحّد مسلّم من المؤسسة مع ملف الإلتزام معَنوَن بإسم مؤسسة مياه بيروت وجبل لبنان ومدوّن عليه موضوع الإلتزام. يلصق ويغلق هذا الغلاف من قبل العارض دون أية عبارة أو إشارة.

تسليم العروض:

1- ترسل العروض بواسطة البريد العام أو الخاص المغفل أو باليد مباشرة وذلك في المركز الرئيسي – شارع سامي الصلح – ملك شدراوي – الطابق الرابع.

2- يُحدد الموعد النهائي لتقديم العروض وفق ما ينص عليه الإعلان المتعلق بهذه الصفقة، والمنشور على المنصة الالكترونية المركزية لهيئة الشراء العام. (يكون موعد جلسة التلزيم فوراً عند انتهاء مهلة تقديم العروض).

3- تُزوّد المؤسسة العارِض بإيصال يُبيّن فيه رقمٌ تسلسليٌّ بالإضافة إلى تاريخ تَسلُّم العرض بالساعة واليوم والشهر والسنة.

4- تُحافِظ المؤسسة على أمن العرض وسلامته وسرّيته، وتكفل عدم الاطلاع على محتواه إلا بعد فتحه وفقاً للأصول.

5- لا يُفتَح أيُّ عرض تتسلّمه المؤسسة بعد الموعد النهائي لتقديم العروض، بل يُعاد مختوماً إلى العارض الذي قدّمه.

6- لا يحق للعارض أن يتقدم بأكثر من عرض واحد تحت طائلة رفض كل عروضه.

ملاحظات هامة

أ- يملأ العارض جدول الأسعار وتقدير الكميات والتعهد والتصريح بدون أي تحشية أو حك أو شطب أو تطريس أو زيادة كلمات أو أرقام غير موقع تجاهها. يرفض كل عرض يذكر فيه كلمة ضمّ أو حسم ويستعاض عن الأولى بعبارة زيادة على الأسعار والثانية بعبارة تنزيل على الأسعار.

ب- لا يجوز إسترداد العرض أو تعديله أو إكماله بعد تقديمه.

ج- لا يقبل أي طلب بتعديل عرض سبق تقديمه بحجة سهو أو خطأ أو إهمال حصل عند وضعه.

د- لا يحق للعارض إجراء أي تعديل على جدول الأسعار وتقدير الكميات الموضوعين من قبل الإدارة ما عدا تكملتهما في الأماكن المخصصة لهذه الغاية.

هـ- لا يحق للعارض إسترداد أي وثيقة ترفق بعرضه بإستثناء المستندات التي تقرر لجنة التلزيم إعادتها إليه.

و- إن السعر المقدّم يشمل سعر الكلفة والجمرك والمرفأ والنقل والتفريغ والتأمين واليد العاملة والربح وسواها وكذلك جميع الضرائب والرسوم.

ز- عند حصول أي تناقض بين الأسعار تعتمد الأسعار الإفرادية المفقطة بالأحرف وفي حال التباين بين السعر الإجمالي والسعر الإفرادي يعتمد السعر الإفرادي. في حال التباين بين أي مستند والسعر الإفرادي المدون بالأحرف على جدول الأسعار وتقدير الكميات يؤخذ بالسعر الإفرادي المدون بالأحرف.

9- طلبات الاستيضاح:

يحقّ للعارض تقديم طلب استيضاح خطّي حول دفتر الشروط خلال مهلةٍ تنتهي قبل عشرة أيام من تاريخ تقديم العروض. على المؤسسة الإجابة خلال مهلة تنتهي قبل ستة أيام من الموعد النهائي لتقديم العروض. ويُرسَل الإيضاح خطيّاً، في الوقت عينه، من دون تحديد هويّة مُصدِر الطلب، إلى جميع العارضين الذين زوّدتهم الجهة الشارية بملفات التلزيم، وتطبق أحكام المادة 21 من قانون الشراء العام في حال ارتأت الإدارة اجراء تعديلات على دفتر الشروط لأي سبب كان أو بمبادرة منها أم نتيجة لطلب استضياح مقدم من احد العارضين، وفي كل ما يتعلق بعقد الإجتماعات مع العارضين، كما يُمكن للمؤسسة، عند الاقتضاء، تحديد موعد معيَّن للعارضين المحتملين لمعاينة الموقع.

10- مدة صلاحية العروض:

يبقى العارض مرتبطاً بعرضه تجاه المؤسسة لمدة 90 يوماً إعتباراً من التاريخ المحدد لفض العروض ولا يحق له الرجوع عن عرضه كما لا يحق له المطالبة بأي تعويض أو عطل أو ضرر من جراء عدم تصديق الالتزام ولا يصبح العارض متعاقداً نهائياً إلا بعد تصديق الالتزام من المراجع المختصة وإبلاغه قرار إسناد الالتزام إليه.

وإذا لم يبلَغ العارض الذي رسا عليه الإلتزام مؤقتاً تصديق الالتزام خلال فترة 90 يوماً يمكن لهذا العارض التخلي عن عرضه بواسطة إعلام خطي، وعندها يعاد إليه ضمان العرض. أما إذا لم يستعمل العارض هذا الحق قبل تبليغه قرار إسناد الالتزام فإنه يصبح ملزماً نهائياً تجاه المؤسسة بموجب هذا التبليغ.

11-ضمان العرض:

حددت قيمة ضمان العرض لإشتراك العارض بالإلتزام بـ /100.000.000/ل.ل. مئة مليون ليرة لبنانية.

يمكن أن يُدفع هذا الضمان نقداً إلى صندوق المؤسسة لقاء إيصال مالي أو أن يقدم بموجب كتاب ضمان مصرفي صادر عن مصرف مقبول من الحكومة اللبنانية وساري المفعول بإضافة 28 يوماً من تاريخ انتهاء صلاحية العرض على أن يذكر عليه أنه يتجدد حكماً إذا لم تبدِ المؤسسة موافقتها على إلغائه.

يعاد ضمان العرض للعارضين الراغبين الذين لم يرسُ الإلتزام عليهم فور انتهاء جلسة فض العروض. أما العارض الذي رسى الإلتزام عليه فيعاد له ضمان العرض بعد تقديمه ضمان حسن التنفيذ.

12-ضمان حسن التنفيذ:

1- تحدد قيمة ضمان حسن التنفيذ بنسبة 10% من قيمة العقد.

2- يجب تقديم ضمان حسن التنفيذ خلال فترة لا تتجاوز //15// خمسة عشر يوماً من تاريخ توقيع العقد. وفي حال التخلُّف عن تقديم ضمان حسن التنفيذ، يُصادَر ضمان العرض.

3- يبقى ضمان حسن التنفيذ مجمدًا طوال مدة التلزيم، ويُحسم منه مباشرةً وبدون سابق إنذار ما قد يترتب من غرامات أو مخالفات أو عطل أو ضرر يحدثه الملتزم إلى حين إيفائه بكامل الموجبات.

4- يعاد ضمان حسن التنفيذ الى الملتزم بعد انتهاء مدة التلزيم واتمام الإستلام النهائي الذي يجري بعد تأكّد الإدارة من أن التلزيم جرى وفقًا للأصول.

5- يدفع ضمان حسن التنفيذ نقداً إلى صندوق المؤسسة لقاء إيصال مالي، وإما بموجب كتاب ضمان مصرفي غير قابل للرجوع عنه، صادر عن مصرف مقبول من مصرف لبنان يُبيّن أنه قابل للدفع غب الطلب، ويقدم ضمان العرض بإسم (المشروع) لصالح المؤسسة.

13-تقديم العروض:

1- يوضع العرض ضمن غلافَين مختومَين يتضمن الأول الوثائق والمستندات المطلوبة، ويتضمن الثاني بيان الأسعار، ويذكر على ظاهر كل غلاف:

- الغلاف رقم ( )
- اسم العارض وختمه.
- محتوياته
- موضوع الصفقة
- تاريخ جلسة التلزيم.

2- يوضع الغلافان المنصوص عنهما في الفقرة (1) من هذه المادة ضمن غلاف ثالث موحد يتم الحصول عليه من مديرية الشؤون المالية – الطابق الثاني – من المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي مختوم ومعنون باسم مؤسسة مياه بيروت وجبل لبنان ولا يذكر على ظاهره سوى موضوع الصفقة والتاريخ المحدد لإجرائها ليكون بالأرقام على الشكل التالي: اليوم / الشهر / السنة، وذلك دون أية عبارة فارقة أو إشارة مميزة كإسم العارض أو صفته أو عنوانه، وذلك تحت طائلة رفض العرض، وتكون الكتابة على الغلاف الموحد بواسطة الحاسوب على ستيكرز بيضاء اللون تلصق عليه عند تقديمه إلى المؤسسة.

3- ترسل العروض بواسطة البريد العام أو الخاص المغفل أو باليد مباشرة إلى قلم المؤسسة الطابق الرابع – من المبنى الرئيسي الكائن في شارع سامي الصلح – ملك الشدراوي.

4- يُحدد الموعد النهائي لتقديم العروض وفق ما ينص عليه الإعلان المتعلق بهذه الصفقة، والمنشور على المنصة الالكترونية المركزية لهيئة الشراء العام.

في حالة طلب عروض الأسعار: يُحدد الموعد النهائي لتقديم العروض وفق ما تنص عليه الدعوة المتعلقة بهذه الصفقة، والمبلّغة للعارضين المدعوين للإشتراك في طلب عروض الأسعار هذا بطريقة مباشرة.

5- تُزوِّد الجهةُ الشارية العارِض بإيصال يُبيِّن فيه رقمٌ تسلسليٌّ بالإضافة إلى تاريخ تَسلُّم العرض بالساعة واليوم والشهر والسنة.

6- تُحافِظ الجهة الشارية على أمن العرض وسلامته وسرّيته، وتكفل عدم الاطلاع على محتواه إلا بعد فتحه وفقاً للأصول.

7- لا يُفتَح أيُّ عرض تتسلّمه الجهة الشارية بعد الموعد النهائي لتقديم العروض، بل يُعاد مختوماً إلى العارض الذي قدّمه.

8- لا يحقّ للعارض أن يقدّم أكثر من عرض واحد تحت طائلة رفض كل عروضه.

14-فتح العروض:

1- تَفتَح العروض لجنة التلزيم المنصوص عنها في المادة 100 من قانون الشراء العام حيث تتولى حصرًا دراسة ملف التلزيم وفتح وتقييم العروض وبالتالي تحديد العرض الأنسب، وذلك في جلسة علنية تعقد فور انتهاء مهلة تقديم العروض.

2- على رئيس اللجنة وعلى كلٍّ من أعضائها أن يتنحّى عن مهامه في اللجنة المذكورة في حال وقع بأيّ وضع من أوضاع تضارب المصالح أو توقُّع الوقوع فيه، وذلك فور معرفته بهذا التضارب.

3- يمكن للجنة التلزيم الاستعانة بخبراء من خارج أو داخل الإدارة للمساعدة على التقييم الفني والمالي عند الإقتضاء، وذلك بقرار من المرجع الصالح لدى الجهة الشارية. يخضع اختيار الخبراء من خارج الإدارة إلى أحكام قانون الشراء العام.

4- يلتزم الخبراء السرية والحياد في عملهم ولا يحق لهم أن يقرّروا بإسم اللجنة أو أن يشاركوا في مداولاتها أو أن يفصحوا عنها علانية، ويمكن دعوتهم للاستماع والشرح من قبل الجهات المعنيّة. كما يتوجّب على الخبراء تقديم تقرير خطي للجنة يُضَمّ إلزامياً إلى محضر التلزيم.

5- في حال التباين في الآراء بين أعضاء اللجنة، تؤخذ القرارات بأغلبية أعضائها ويُدوّن أيّ عضو مخالف أسباب مخالفته.

6- يحقّ لجميع العارضين المشاركين في عملية التلزيم أو لممثّليهم المفوّضين وفقاً للأصول، كما يَحقّ للمراقب المندوب من قبل هيئة الشراء العام حضور جلسة فتح العروض. كما يمكن للجهة الشارية دعوة وسائل الإعلام لحضور هذه الجلسة على أن تَلحَظ ذلك في ملف التلزيم

7- تقوم لجنة التلزيم بفتَح العروض بحسب الآلية التالية:

1- فتح الغلاف الخارجي الموحّد لكل عارض على حدة وتعلن اسمه ضمن المشاركين في الصفقة، وذلك وفق ترتيب الأرقام التسلسلية المُسجلة على الغلافات الخارجية والمسلّمة للعارضين.

2- فتح الغلاف رقم (1) – المستندات الإدارية والفنية، وفرز المستندات المطلوبة والتدقيق فيها تمهيداً لتحديد وإعلان أسماء العارضين المقبولين شكلاً والمؤهلين للاشتراك في بيان مقارنة الأسعار.

3- فتح العرض المالي أو الغلاف رقم (2) – بيان الأسعار للعارضين المقبولين شكلًا كلّ على حدة واجراء العمليات الحسابية اللازمة، وتدوين السعر الإجمالي لكل عارض بما فيه الضريبة على القيمة المضافة في حال كان العارض خاضعًا لها، تمهيدًا لإجراء مقارنة واعلان اسم الملتزم المؤقت.

8- تُسجَّل وقائع فتح العروض خطياً في محضر يوقّع عليه رئيس وأعضاء لجنة التلزيم، كما توضع لائحة بالحضور يوقّع عليها المشاركون من ممثّلي المؤسسة وهيئة الشراء العام، والعارضين وممثليهم على أن يشكّل ذلك إثباتاً على حضورهم. تُدرَج كل المعلومات والوثائق المتعلّقة بوقائع الجلسة في سجلّ إجراءات الشراء المنصوص عليه في المادة 9 من قانون الشراء العام.

9- تُدرَج جميع المراسلات التي تجري بموجب هذه المادة في سجل إجراءات الشراء بحسب المادة 9 من قانون الشراء العام.

15-تقييم العروض:

1- تقوم لجنة التلزيم بتقييم العروض ضمن مهلة معقولة تتلاءم مع مهلة صلاحية العروض ومع طبيعة الشراء، وتَضَع محضراً بذلك يُدرَجُ في سِجِلّ إجراءات الشراء المنصوص عليه في المادة 9 من قانون الشراء العام.

2- تُقيّم لجنة التلزيم العروض المقبولة، بغية تحديد العرض الفائز وفقاً للمعايير والإجراءات الواردة في دفتر الشروط. ولا يُستخدَم أيُّ معيار أو إجراء لم يَرِد في هذا الدفتر.

3- يمكن للجنة التلزيم، في أيّ مرحلة من مراحل إجراءات التلزيم، أن تطلب خطياً من العارض إيضاحات بشأن المعلومات المتعلِّقة بمؤهلاته أو بشأن عروضه، لمساعدتها في التأكُّد من المؤهّلات أو فحص العروض المقدَّمة وتقييمها.

4- في حال كانت المعلومات أو المستندات المقدَّمة في العرض ناقصة أو خاطئة أو في حال غياب وثيقة معيَّنة، يَجوز للجنة التلزيم الطلب خطّياً من العارض المعني توضيحات حول عرضه، أو طلب تقديم أو استكمال المعلومات أو الوثائق ذات الصلة خلال فترة زمنية محدَّدة، شرط أن تكون كافة المراسلات خطية واحترام مبادىء الشفافية والمساواة في المعاملة بين العارضين في طلبات التوضيح أو الاستكمال الخطية، ومع مراعاة أحكام الفقرة 3 من البند الثاني من المادة 21 من قانون الشراء العام.

5- لا يمكن طلب إجراء أو السماح بإجراء أيّ تغيير جوهري في المعلومات المتعلِّقة بالمؤهلات أو بالعرض المقدَّم، بما في ذلك التغييرات الرامية إلى جعل مَن ليس مؤهَّلاً من العارضين مؤهَّلاً أو جعل عرض غير مستوفٍ للمتطلبات مستوفياً لها.

6- لا يمكن إجراءُ أيّ مفاوضات بين الجهة الشارية أو لجنة التلزيم والعارِض بخصوص المعلومات المتعلّقة بالمؤهلات أو بخصوص العروض المقدَّمة، ولا يجوز إجراء أيّ تغيير في السعر إثر طلب استيضاح من أي عارض.

7- تَعتبر لجنة التلزيم العرض مستجيباً جوهرياً للمتطلّبات إذا كان يفي بجميع المتطلّبات المبيَّنة في دفتر الشروط وفقاً للمادة 17 من قانون الشراء العام.

8- تَرفُض لجنة التلزيم العرض:

أ- إذا كان العارض غير مُؤهَّل بالنظر إلى شروط التأهيل الواردة في دفتر الشروط وتطبيقاً لأحكام المادة 7 من قانون الشراء العام؛

ب- إذا كان العرض غير مُستجيب جوهرياً للمتطلّبات المحدَّدة في ملف التلزيم؛

9- تَدرس لجنة التلزيم العروض الماليّة على نحو مُنفصل بحيث تَدرسها بعد الانتهاء من تدقيق وتقييم العروض الإدارية والفنيّة، ولا يحق للجنة التلزيم فتح العرض المالي أو إرساء التلزيم مؤقتًا على أي عارض دون التأكد من أن العرض أصبح مقبولًا من الناحية الإدارية والفنية، وذلك تحت طائلة تحمل المسؤولية الكاملة أمام المراجع الرقابية المختصة.

10- تُصحِّح لجنة التلزيم أيَّ أخطاء حسابية محضة تكتشفها أثناء فحصها العروض المقدَّمة وفقاً لأحكام دفتر الشروط، وتبلّغ التصحيحات إلى العارض المعني بشكل فوري.

16- استبعاد العارض:

تستبعد الجهةُ الشارية العارض من إجراءات التلزيم بسبب عرضه منافع أو من جرّاء ميزة تنافسية غير منصفة أو بسبب تضارب المصالح وذلك في احدى الحالتين المنصوص عنهما في المادة الثامنة من قانون الشراء العام.

17- حظر المفاوضات مع العارضين:

تُحظَّر المفاوضات بين الجهة الشارية أو لجنة التلزيم وأيّ من العارضين بشأن العرض الذي قدَّمَه ذلك العارض.

18- الأنظمة التفضيلية:

خلافاً لأي نص آخر، يمكن إعطاء العروض المتضمنة سلعاً أو خدمات ذات منشأ وطني أفضلية بنسبة //10// عشرة بالمئة عن العروض المقدّمة لسلع أو خدمات أجنبية. تُعطى الأفضلية لمكوّنات العرض ذات المنشأ الوطني.

19- رفع السرية المصرفية:

ان يُعتبر العارض فور تقديمه العرض مُلتزمًا برفع السرية المصرفية عن الحساب المصرفي الذي يودع فيه أو ينتقل إليه أي مبلغ من المال العام المتعلق بهذا التلزيم، سندًا للقرار رقم 17 تاريخ 2020/5/12 الصادر عن مجلس الوزراء.

20- الغاء الشراء او أي من اجراءاته:

يمكن للجهة الشارية أن تُلغي الشراء و/ أو أيّ من إجراءاته في أيّ وقت قبل إبلاغ الملتزم المؤقت إبرام العقد، وذلك في الحالات التي نصّت عليها المادة 25 من قانون الشراء العام.

21- قواعد بشأن العروض المنخفضة الأسعار إنخفاضاً غير عادياً:

يجوز للمؤسسة أن ترفض أيَّ عرض إذا قرَّرَت أنَّ السعر، مُقترناً بسائر العناصر المكوِّنة لذلك العرض المقدَّم، مُنخفض انخفاضاً غير عاديّ قياساً إلى موضوع الشراء وقيمته التقديرية وتُطبق أحكام المادة 27 من قانون الشراء العام في هذا الشأن.

22- قواعد بشأن العروض المرتفعة ارتفاعاً غير مبرر:

يجوز للمؤسسة أن ترفض أيَّ عرض إذا قرَّرَت أنَّ السعر، مُقترناً بسائر العناصر المكوِّنة لذلك العرض المقدَّم، مرتفع إرتفاع غير مبرر بما يتجاوز نسبة 30 % من القيمة التقديرية للمشروع.

23- قواعد قبول العرض الفائز (أو التلزيم المؤقت) وبدء تنفيذ العقد:

1- تَقبل المؤسسة العرَض المقدَّم الفائز وفقاً لاحكام الفقرة (1) من المادة 24 من قانون الشراء العام

2- بعد التأكُّد من العرض الفائز تُبلغ المؤسسة العارض الذي قدَّم ذلك العرض، كما تنشر بالتزامن قرارها بشأن قبول العرض الفائز (التلزيم المؤقت) والذي يدخل حيّز التنفيذ عند انتهاء فترة التجميد البالغة عشرة أيام عمل تبدأ من تاريخ النشر، الذي يجب أن يتضمَّن على الأقلّ، المعلومات التالية:

أ- إسم وعنوان العارض الذي قدَّم العرض الفائز (الملتزم المؤقت)،

ب- قيمة العرض، ويمكن إضافة ملخص لسائر خصائص العرض الفائز ومزاياه النسبية إذا كان العرض الفائز قد تمّ تأكيده على أساس السعر ومعايير أخرى،

ج- مدة فترة التجميد بحسب هذه الفقرة،

3- فور انقضاء فترة التجميد، تقوم المؤسسة بإبلاغ الملتزم المؤقت بوجوب توقيع العقد خلال مهلة لا تتعدّى //15// خمسة عشر يوماً.

4- يوقّع الرئيس المدير العام العقد خلال مهلة //15// خمسة عشر يوماً من تاريخ توقيع العقد من قِبَل الملتزم المؤقّت. يمكن أن تُمدَّد هذه المهلة إلى //30// ثلاثين يوماً في حالات معيَّنة تحدَّد من قبل الرئيس المدير العام.

5- يبدأ نفاذ العقد عندما يوقّع الملتزم المؤقّت والرئيس المدير العام.

6- لا تتَّخذ سلطة التعاقد ولا الملتزم المؤقّت أيَّ إجراءٍ يتعارض مع بدء نفاذ العقد أو مع تنفيذ الشراء خلال الفترة الزمنيّة الواقعة ما بين تبليغ العارض المعني بالتلزيم المؤقت وتاريخ بدء نفاذ العقد.

7- في حال تمنُّع الملتزم المؤقت عن توقيع العقد، تُصادِر المؤسسة ضمان عرضه. في هذه الحالة يمكن للمؤسسة أن تُلغي الشراء أو أن تختار العرض الأفضل من بين العروض الأخرى الفائزة وفقاً للمعايير والاجراءات المحدَّدة في قانون الشراء العام وفي ملفات التلزيم، والتي لا تزال صلاحيتها سارية المفعول. تُطبَّق أحكام هذه المادة على هذا العرض بعد إجراء التعديلات اللازمة.

24-الطوابع القانونية:

تلصق على مستندات العروض الطوابع القانونية المفروضة وتعطّل وفق الأصول.

ان كافة الطوابع والرسوم التي تتوجب وفقًا للأنظمة والقوانين المرعية الإجراء الناتجة عن هذا الإلتزام هي على عاتق الملتزم بما فيها قيمة الضريبة على القيمة المضافة في حال توجبها.

يُسدّد الملتزم رسم الطابع المالي البالغ /4/ بالألف خلال خمسة أيام عمل من تاريخ ابلاغ الملتزم تصديق الصفقة، و/4/ بالألف عند تسديد قيمة العقد.

25- قيمة العقد وشروط تعديله:

1- تكون البدلات المتَّفق عليها في العقد ثابتة ولا تَقبل التعديل والمراجعة إلا عند إجازة ذلك أثناء تنفيذه ضمن ضوابط محدَّدة وفقاً لشروط التعديل والمراجعة في الحالات الاستثنائية التي نصّت عليها المادة 29 من قانون الشراء العام.

2- تُراعى شروط الإعلان المنصوص عليها في المادة 26 من قانون الشراء العام عند تعديل قيمة العقد.

26- محل إقامة المتعاقد:

يجب أن يتضمن العرض إتخاذ العارض محل إقامة مختاراً ضمن نطاق مؤسسة مياه بيروت وجبل لبنان ورقم هاتف و/او رقم الفاكس و/او البريد الالكتروني تبلغ إليه جميع المراسلات العائدة للإلتزام.

إذا لم يبيّن المتعاقد في عرضه محل إقامته بصورة واضحة، تلصق جميع التبليغات على لوحة الإعلانات في المدخل الرئيسي للمؤسسة وتعتبر هذه التبليغات قانونية وملزمة له.

إذا تغيّب المتعاقد عن محلّ إقامته أو تمنع عن التبلغ بتوقيعه أصل النسخة المراد تبليغه إياها، يعتبر المتعاقد مبلغاً بواسطة بريده الالكتروني أو لصق وثيقة التبليغ على باب إقامته وعلى لوحة الإعلانات في المدخل الرئيسي للمؤسسة ويعتبر هذا التبليغ قانونياً وملزماً له.

تنظم الإدارة المختصة في حال التبليغ بطريقة اللصق محضراً يحدد فيه تاريخ وساعة تعليق وثيقة التبليغ ويضم إلى الملف.

على المتعاقد إعلام المؤسسة رسمياً بكل تغيير قد يطرأ على مكان إقامته أو بريده الالكتروني.

27-الضرائب / الرسوم / الجمارك:

كل المصاريف العائدة لدفع الضرائب والرسوم والجمارك والنقل والتفريغ والتأمين إلخ ... هي على عاتق المتعاقد وتعتبر مغطاة بأسعار العرض.

28-منع التنازل أو التلزيم لمتعهد آخر بدون إذن التعاقد الثانوي:

1- يجب على الملتزِم الأساسي أن يتولّى بنفسه تنفيذ العقد ويبقى مسؤولاً تجاه سلطة التعاقد عن تنفيذ جميع بنوده وشروطه، ويُمنع عليه تلزيم كامل موجباته التعاقدية لغيره.

2- في صفقات الأشغال والخدمات يُمكن أن يَعهد الملتزم إلى مُتعاقد ثانوي تنفيذ جزءٍ من العقد والتي يجب ألّا تتخطّى 50% من قيمة العقد. على الملتزم أَخذ الموافقة المُسبقة على التعاقد الثانوي من سلطة التعاقد التي يجب عليها اتّخاذ قرارها بالموافقة أو الرفض المعلَّل خلال مهلة زمنية تحدد بمدة أقصاها 10 ايام من تاريخ تقديم الطلب، ويُعَدّ سكوتها عند انقضاء هذه المهلة قراراً ضمنياً بالقبول.

3- تُطبَّق على المتعاقد الثانوي أحكام دفتر الشروط هذا.

29- براءات الإختراع:

على المتعاقد، عند تنفيذ الالتزام، الإمتناع عن إستعمال أي طريقة أو رسم أو تصميم حائز على براءة إختراع دون إذن مسبق من أصحاب الحقوق على هذه البراءة، وكل حقوق ومستحقات قد تنجم عن مثل هذا الإستعمال تكون كلياً على مسؤولية المتعاقد ونفقته. كما تحتفظ المؤسسة بحق مطالبة المتعاقد بالتعويضات الناتجة عن عدم تقيده بالتدابير المشار إليها أعلاه خاصة في حال ضبطه متلبساً بالمخالفة. على المتعاقد بالإضافة إلى ذلك، تحمل مسؤولية كل مطالبة أو عمل موجه ضد المؤسسة بهذا الخصوص.

30- حالات القوة القاهرة:

تدرس المؤسسة فقط حالات القوة القاهرة التي يعلمها بها المتعاقد خلال مهلة 10 أيام على الأكثر من حصولها وفي هذه الحالة لا يُعطى المتعاقد إلا ما توافق عليه المؤسسة. لن تقبل أية مطالبة بشأن حالة قاهرة إذا مرت أكثر من عشرة أيام على حصول هذه الحالة.

31- قوانين وأنظمة:

على المتعاقد التقيّد بالقوانين والأنظمة اللبنانية النافذة في كل ما له علاقة بالشراء، وعليه أن يحصل مباشرة على التراخيص اللازمة من أجل تأمين المواد أو إستعمال لوازم معينة كل ذلك على همته وحسابه ومسؤوليته.

32- تغيير في الكميات:

إن الكميات في "تقدير الكميات" موضوعة على سبيل الذكر فقط، ويمكن للمؤسسة بموافقة المدير العام تجاوزها زيادةً أو نقصاناً دون أن يحق للمتعاقد بأية مطالبة أو تعويض أو إعتراض، على ان لا تتعدى النسبة 20 % من قيمة الالتزام الاجمالية.

33- أسباب إنتهاء العقد ونتائجه:

اولاً: النكول

يُعتبر الملتزم ناكلاً إذا خالف شروط تنفيذ العقد أو أحكام دفتر الشروط هذا، وبعد إنذاره رسمياً بوجوب التقيُّد بكافّة موجباته من قبل المؤسسة، وذلك ضمن مهلة تتراوح بين خمسة أيام كحدٍّ أدنى وخمسة عشر يوماً كحدٍّ أقصى، وانقضاء المهلة هذه دون أن يَقوم المُلتزم بما طُلب إليه. وإذا اعتُبر الملتزم ناكلاً، يُفسخ العقد حكماً دون الحاجة إلى أيّ إنذار وتطبق الإجراءات المنصوص عليها في البند (أولًا) من الفقرة الرابعة من المادة 33 من قانون الشراء العام.

ثانياً: الانتهاء

1- ينتهي العقد حكماً دون الحاجة إلى أيّ إنذار في الحالتين التاليتين:

أ- عند وفاة الملتزم إذا كان شخصاً طبيعياً، إلاّ إذا وافقت المؤسسة على طلب مواصلة التنفيذ من قبل الورثة.

ب- إذا أصبَح المُلتزم مُفلساً أو مُعسَراً أو حُلّت الشركة، تُطبَّق عندئذ الإجراءات المنصوص عليها في الفقرة الثانية من البند الرابع من المادة 33 من قانون الشراء العام.

2- يَجوز للمؤسسة إنهاء العقد إذا تعذّر على الملتزم القيام بأيّ من إلتزاماته التعاقدية بنتيجة القوة القاهرة.

ثالثاً: الفسخ

1- يُفسخ العقد حكماً دون الحاجة إلى أيّ إنذار في أيّ من الحالات التالية:

أ- إذا صدَرَ بحقّ المُلتزم حكمٌ نهائيّ بارتكاب أيّ جرم من جرائم الفساد أو التواطؤ أو الإحتيال أو الغش أو تبييض الأموال أو تمويل الإرهاب أو تضارب المصالح أو التزوير أو الإفلاس الإحتيالي، وفقاً للقوانين المرعية الاجراء؛

ب-إذا تحقَّقَت أيّ حالة من الحالات المذكورة في المادة 8 من قانون الشراء العام.

ت-في حال فُقدان أهلية الملتزم.

2- إذا فُسِخ العقد لأحد الأسباب المذكورة في الفقرة الأولى من هذا البند تُطبَّق الإجراءات المنصوص عليها في الفقرة الأولى من البند الرابع من هذه المادة.

رابعاً: نتائج انتهاء العقد

1- في حال تطبيق إحدى حالات النكول أو الفسخ المحدَّدة في المادة 33 من قانون الشراء العام، أو في حال تحقَّقَت حالة إفلاس الملتزم أو إعساره، أو في حال وفاة الملتزم وعدم متابعة التنفيذ من قبل الورثة، تُتَّبع فوراً، خلافاً لأيّ نص آخر أحكام الفقرة رابعًا من المادة 33 من قانون الشراء العام.

2- لا يترتَّب أيّ تعويض عن الخدمات المُقدَّمة أو الأشغال المنفَّذة من قبل من يثبت قيامه بأيٍّ من الجرائم المنصوص عليها في الفقرة الفرعية "أ" من الفقرة الأولى من «ثالثاً» من المادة 33 من قانون الشراء العام.

3- يُنشر قرار انتهاء العقد وأسبابه على الموقع الالكتروني للمؤسسة إن وُجِد وعلى المنصة الإلكترونيّة المركزيّة لدى هيئة الشراء العام.

34- الاقتطاع من الضمان:

إذا ترتّب على الملتزم في سياق التنفيذ مبلغ ما، تطبيقاً لأحكام وشروط العقد، حقّ للمؤسسة اقتطاع هذا المبلغ من ضمان حسن التنفيذ ودعوة الملتزم إلى إكمال المبلغ ضمن مدّة معيَّنة، فإذا لم يفعل اعتُبِر ناكلاً وفقاً لأحكام الفقرة (أولا) من المادة 33 من قانون الشراء العام.

35- القضاء الصالح:

كل نزاع أو خلاف عائد للالتزام يحدث بين المؤسسة من جهة والمتعاقد من جهة أخرى سواء أثناء التنفيذ أو بعد الإنتهاء منه وسواء قبل أو بعد إلغاء أو تخلٍّ أو توقف عن تكملة الالتزام، يفصل به أمام المحاكم اللبنانية المختصة.

في حال حصول أي خلاف لا يجوز للمتعاقد توقيف الأشغال الجارية أو اللاحقة لأي سبب كان تحت طائلة تطبيق التدابير المنصوص عنها في المادة /33/ من دفتر الشروط مع إحتفاظ المؤسسة بحق فرض جزاء التأخير عند الإقتضاء.

36- الاقصاء:

تطبق أحكام الإقصاء على الملتزم الذي يعتبر ناكلًا أو الذي يصدر بحقه حكم قضائي وفقًا لما نصت عليه المادة 40 من قانون الشراء العام.

37- النزاهة:

تُطبّق أحكام المادة 110 من قانون الشراء العام.

38- الشكوى والاعتراض:

يَحقّ لكلّ ذي صفة ومصلحة، بما في ذلك هيئة الشراء العام، الإعتراض على أيّ إجراء أو قرار صريح أو ضمني تتّخذه أو تعتمده أو تُطَبِّقه أيّ من الجهات المعنيّة بالشراء في المرحلة السابقة لنفاذ العقد، ويكون مخالفاً لأحكام قانون الشراء العام والمبادئ العامة المتعلقة بالشراء العام، وتُطبق أحكام الفصل السابع من قانون الشراء العام في هذا الشأن، على ان تتبع إجراءات الإعتراض المعمول بها لدى مجلس شورى الدولة لحين تشكيل هيئة الإعتراضات المنصوص عنها في قانون الشراء العام.

39- تحفظات المتعاقد:

على المتعاقد ان يقدم جميع تحفظاته واعتراضاته التي يترتب عنها دفع أي مبلغ مرفقة بتبرير المبالغ المضبوطة أو المفصلة والمعللة التي يطالب بها وذلك تحت طائلة رد طلبه وفقدان حقه. كما عليه أن يرفق مع تحفظه بشأن التأخير أو تمديد المهلة الأسباب الموجبة بالتفصيل مع اثبات الوقائع التي أدت إلى ذلك مع بيان مدة التمديد المطلوبة تحت طائلة فقدان حقه بها.

40- التقيّد بجدول الاسعار:

ان الأسعار الافرادية المدونة والمفقطة في جدول الأسعار هي التي يعول عليها، وفي حال وجود تناقض بين مستندات الالتزام فإن نص جدول الأسعار يعتبر وحده صحيحاً ويقتضي الرجوع اليه للوقوف على تفاصيل ومواصفات الأعمال المطلوبة، مع العلم أنه يعول على النسخة الأساسية لكل مستندات الالتزام دون بقية النسخ.

41- دفع المبالغ المتوجبة:

يجري دفع قيمة الاعمال المنفذة على الشكل التالي:

- (90%) تسعين بالمئة من ثمن الاعمال المنفذة بموجب فاتورة يقدمها الملتزم الى المؤسسة مرفقة بالكشوفات ونماذج تسليم المواد موقعة من قبل رؤساء الدوائر المعنية، وتدفع وفقاً لأصول المحاسبة المعتمدة في المؤسسة.
- (10%) عشرة بالمئة من ثمن هذه الاعمال بعد الاستلام النهائي (التوقيفات العشرية).

إن جميع المعاملات المالية والمدفوعات تنظم بالعملة اللبنانية.

42- التوقيفات العشرية:

عند كل دفع، يجري على سبيل الضمان توقيف 10% (عشرة بالمائة) من القيمة المستحقة. يظل هذا التوقيف مربوطاً بضمان الإرتباطات المتعاقد عليها حتى الإستلام النهائي.

43- غرامة التأخير :

يخضع المتعاقد لغرامة تأخير تساوي واحد بالألف من قيمة العقد عن كل يوم تأخير بعد إنتهاء المهلة التعاقدية. غير أنه لا يمكن للمجموع الإجمالي لغرامة التأخير أن يتجاوز عشر القيمة الإجمالية للعقد.

يبقى المدير العام للمؤسسة صاحب السلطة والرأي الأخير في ما يعود لتمديد مهلة التنفيذ ولإعفاء الملتزم من غرامات التأخير أو قسم منها.

44- الاستلام المؤقت:

بعد تنفيذ الالتزام يطلب المتعاقد إستلاماً مؤقتاً، عندها يعمد إلى هذا الإستلام من قبل المؤسسة بحضور المتعاقد. في حال غياب المتعاقد يذكر ذلك في المحضر.

على المتعاقد أن يعلم المؤسسة عن التاريخ الذي تنتهي به الأعمال المطلوبة منه في هذا الالتزام والذي يكون به على إستعداد لاجراء استلاماً مؤقتاً، وذلك قبل أسبوع واحد على أقل تعديل من ذلك التاريخ، وذلك بموجب كتاب يوجهه إلى المؤسسة.

45- مهلة الضمان:

حددت مهلة الضمان بشهر واحد اعتباراً من الاستلام المؤقت لهذا الالتزام.

46- الاستلام النهائي:

يجري الإستلام النهائي بعد نهاية مهلة الضمان التي تلي الإستلام المؤقت. على المتعاقد إخطار المؤسسة خطياً بالتاريخ الممكن إجراءه فيه. تعمد المؤسسة إلى إجراء الإستلام النهائي بعد التأكد من عدم وجود أي عيوب أو نواقص في التنفيذ. يعاد للمتعاقد عندئذ التأمين النهائي بعد حسم ما يمكن أن يكون قد ترتب للمؤسسة من جراء تطبيق أحكام دفتر الشروط. إذا لم يتقدم الملتزم بأية إعتراضات أو تحفظات مفصلة خطياً في غضون (10) عشرة أيام من تاريخ محضر الإستلام النهائي، يسقط حقه في الإعتراض والتحفظ لأي سبب كان.

47- إعادة التأمينات:

يعاد ضمان حسن التنفيذ والتوقيفات العشرية إلى المتعاقد خلال شهر على الأكثر من تاريخ الإستلام النهائي وبعد أن يكون قد قام بجميع إلتزاماته.

48- جمع المعلومات عن شروط الأشغال:

إن للمعلومات الفنية والإرشادات المعطاة في مستندات الصفقة صفة توجيهية عامة، وعلى المتعاقد مراجعتها والتدقيق فيها بوسائله الخاصة وعلى مسؤوليته.

لن يحق للمتعاقد رفع أية مطالبة بسبب نقص في المعلومات.

49- ممثل المؤسسة:

تحتفظ المؤسسة بحق تسمية مهندس تكون له صفة اعطاء أو نقل مذكرات العمل إلى المتعاقد.

ان مراقبة تنفيذ الأشغال من قبل المهندس أو من مندوبه لا تنقص مسؤولية المتعاقد في تأدية التزاماته كاملة بأمانة ودقة واتقان.

50- مذكرات العمل:

يمكن للمتعاقد خلال فترة التنفيذ ان يتلقى من المهندس مذكرات عمل خطية، وعليه أن يتقيد بها بدقة.

عندما يقدّر المتعاقد بأن تعليمات مذكرة عمل تفوق موجبات عقده، عليه تحت طائلة الاسقاط، تقديم ملاحظاته الخطية المبررة بشأن هذه التعليمات خلال مهلة 10 أيام.

الاعتراض لا يوقف تنفيذ مذكرة عمل، إلا إذا أمرت المؤسسة بغير ذلك.

51- أشغال الليل:

يحق للمؤسسة الطلب إلى الملتزم تنفيذ أشغال عائدة إلى جزء أو بعض أجزاء من الورشة أثناء الليل وذلك لعدم عرقلة السير أو لأية أسباب أخرى تراها ضرورية ولا يحق للملتزم بأية مطالبة أو تعويض.

52- عقود التأمين:

على المتعاقد، قبل بدء التنفيذ وعلى نفقته، أن يعقد تأميناً ضد حوادث العمل لعمّاله وموظفي المؤسسة الموجودين على الورشة، والآليات والحوادث المسببة للغير عند شركة تأمين مسجلة وفقاً للأصول.

تخضع قيمة عقود التأمين وشروط تطبيقها لموافقة المدير العام للمؤسسة دون أن يعفِ ذلك المتعاقد من مسؤوليته الكاملة.

يجب أن يظل التأمين ضد حوادث العمل قائماً طيلة فترة العمل في الورشة. يعتبر واجب المتعاقد بعقد التأمين مطبقاً في حال سمحت المؤسسة للمتعاقد بتلزيم صفقته لفريق ثالث وقام هذا الفريق بعقد التأمين. على المتعاقد تقديم البوليصة أو البوالص ومخالصات الأقساط للمؤسسة.

53- إعداد الورشة وتجهيزها:

كل الأشغال والمستلزمات العائدة لاعداد كل ورشة وتجهيزها هي على عاتق المتعاقد، بما فيه تأمين الطرق إلى الأملاك العامة، وتعتبر الاكلاف الناتجة داخلة في أسعار العرض، كذلك الاكلاف الناتجة عن إعادة الاماكن إلى حالتها الأصلية بعد انتهاء الورشة.

يتوجب على المتعاقد تحت عنوان اعداد الورشة وتجهيزها، تأمين استمرارية السير على الاملاك العامة والطرق إلى الاملاك المجاورة. وعليه الإشارة ليلاً ونهاراً، بشكل مناسب، إلى كل حاجز ناتج عن ذلك فوق الأملاك العامة.

يبقى المتعاقد هو المسؤول الوحيد عن الأشغال من جميع الوجوه وخاصة فيما يتعلق بسرقة المعدات والتجهيزات وأي مواد موجودة على الورش.

تسلم مؤسسة مياه بيروت وجبل لبنان المتعاقد الطلبات اللازمة التي عليه ان يقدمها إلى الجهات المعنية للحصول على التراخيص أو الإجازات اللازمة لتنفيذ الأشغال ويكون المتعاقد مسؤولاً مسؤولية تامة عن الحصول على هذه التراخيص أو الاجازات وعن عدم تنفيذ القوانين والأنظمة النافذة.

يباشر المتعاقد بتنفيذ الأشغال بعد الحصول على التراخيص أو الإجازات اللازمة وبعد تقديم المتعاقد شهادات صادرة عن الإدارات المعنية تثبت انه أخذ علماً بمواقع تمديدات الهاتف والكهرباء والمجارير والتمديدات المائية في الشوارع التي تقع فيها الورشة.

على المتعاقد في حال تأخر حصوله على التراخيص أو الاجازات اللازمة ان يبدأ بتنفيذ الأشغال على مسؤوليته المطلقة، تدخل في هذه المدة أيام ألآحاد والأعياد والعطل.

يمكن تمديد المهلة المذكورة أعلاه في حال تقدم المتعاقد بالأسباب التبريرية المثبتة بالوقائع والمستندات التي حالت دون الحصول على التراخيص وذلك قبل ثلاثة أيام على الأقل من انتهاء كل مهلة.

يتحمل الملتزم كل المصاريف والرسوم والتأمينات وأية مصاريف أخرى من أي نوع كانت مطلوبة من قبل البلديات أو الوزارات للحصول على هذه التراخيص والإجازات العائدة لتنفيذ الأشغال وتعتبر هذه المصاريف والرسوم والتأمينات مغطاة بأسعار الالتزام. ان استرداد قيمة التأمينات التي قد يدفعها الملتزم إلى الإدارات أو الباقي منها سيكون على عاتق الملتزم وذلك حسب التعليمات والأنظمة المحددة من قبل هذه الإدارات.

54- معدات الورشة:

على الملتزم بعد توقيع العقد تأمين كافة المعدات اللازمة لتأمين حسن تنفيذ الصفقة.

وتقديم كل معدات الورشة اللازمة لتنفيذ الأشغال وإستعمال الأماكن والتجهيزات العامة. وعلى المتعاقد تسيير وصيانة وتصليح هذه المعدات على نفقته.

يتحمل الملتزم كل المصاريف والرسوم والتأمينات اللازمة للإستحصال على عدّاد كهرباء في حال توجّبه أو نقله من مكان إلى آخر، وبعد موافقة المؤسسة، مع الوصلات والتركيب وكلفة تقديم الطلبات وملاحقة التراخيص والإجازات للحصول على هذه الإشتراكات التي يجب أن تكون بإسم المؤسسة.

55- نوعية التجهيزات والمواد ومصادرها:

1- التجهيزات والقطع المستعملة لتنفيذ الوصلات

يجب أن تكون هذه القطع والتجهيزات جديدة مطابقة للأوصاف الملحوظة في دفتر الشروط هذا.

وإذا تبين أن أوصاف هذه القطع والتجهيزات لا تطابق الأوصاف الملحوظة تقوم المؤسسة بإنذار الملتزم رسمياً بوجوب التقيد بكامل موجباته وذلك ضمن مهلة معينة يعود لها أمر تحديدها وإذا إنقضت المهلة المحددة دون أن يقوم الملتزم بتنفيذ ما طلب منه يحق للمؤسسة رفض الإستلام بالنسبة للقطع والتجهيزات المخالفة وإتخاذ التدابير التي تراها مناسبة على حسابه ومسؤوليته ولا يحق له المناقشة بقيمة الأكلاف مهما بلغت.

أما إذا كان عدم التطابق غير جوهري فيعود للمؤسسة وحدها أمر تقدير الغرامات التي يجب فرضها على الملتزم.

2- باقي المواد

يجب أن تكون هذه المواد من أجود الأصناف لكل نوع. لا يمكن إستعمالها إلا بعد التأكد منها وقبولها من قبل المهندس أو المكلفين من قبله. بالرغم من هذا القبول، ولحين الإستلام النهائي للأشغال يمكن أن ترفض هذه المواد من قبل المهندس في حال فوجئ برداءة النوعية أو بسوء الإستعمال، وعلى المتعاقد إستبدالها عند ذلك على نفقته.

يمكن للمهندس رفض المواد أو المعدات التي يجلبها المتعاقد لإستعمالها في الأشغال إذا كانت لا تتناسب مع المهمة أو لا تتوافر فيها الشروط الفنية، عندها، على المتعاقد سحبها من الموقع دون تأخير وجلب غيرها.

تخضع مصادر المواد الداخلة في تنفيذ الأشغال إلى موافقة المهندس قبل البدء في التنفيذ، ويمكن للمهندس الطلب من المتعاقد إجراء الإختبارات على عيّنات تؤخذ لتحديد مدى مطابقتها للمواصفات، على أن مطابقة نتائج الإختبارات على هذه العينات لا يحل مسؤولية المتعاقد عن المواد الموردة على مواقع الأشغال والتي سيصير أخذ عينات أخرى منها في أي وقت قبل تنفيذ العمل وأثناءه.

إذا إتضح أن مصادر المواد التي سبق إعتمادها لم تعد تفي بالمواصفات فيجب على المتعاقد أن يجهز مواد صالحة من مصادر أخرى معتمدة، مع العلم أن جميع المواد المستعملة عرضة للتفتيش والإختبارات في أية لحظة، ولا يصرح للمتعاقد بإستعمال المواد المرفوضة وعليه نقلها خارج نطاق العمل على حسابه ومسؤوليته.

56- نقل المواد وتخزينها:

يجب أن تنقل المواد بطريقة تمنع تلفها أو تغيير خصائصها، وفي حالة نقل المواد الصلبة القابلة للإختلاط فيجب العناية التامة بها لعدم إختلاطها بالأتربة والمواد الغريبة الأخرى، وأن يكون نقلها بطريقة تمنع الإنفصال للأحجام المختلفة. كما يجب حفظ هذه المواد في أماكن توافق عليها الإدارة المحلية الممثلة بالبلدية أو من يقوم بأعمالها ولا تؤثر سلباً على حركة المرور.

تخزن المواد التي تتأثر بالأحوال الجوية داخل أماكن ضمن نطاق الإلتزام مسقوفة ومعزولة ضد الحرارة والرطوبة.

وللمؤسسة الحق في إعادة إجراء الإختبارات على أي مواد سبق قبولها وجرى تخزينها لأية فترة بحيث لا يصرح بإستعمالها إذا ظهر فيها تلف أثناء عملية التخزين، وعلى المتعاقد في مثل هذه الحالة نقل المواد التالفة خارج نطاق العمل على حسابه ومسؤوليته.

57- إختبارات المواد:

تؤخذ العينات المراد إجراء الإختبار عليها بمعرفة المهندس أو مندوبه، ومن المواد الموردة على مواقع الأشغال. وإذا رأى المهندس لأسباب عملية أخذ العينات من مصادر التوريد قبل نقلها إلى موقع العمل فلا يمنع هذا من حقه في رفض أي مواد يتم نقلها إلى موقع العمل وتكون غير مطابقة للمواصفات. ويتوجب على المتعاقد تقديم جميع التسهيلات اللازمة لجمع العينات ونقلها وفق توجيهات المهندس، ولا يمكنه إستعمال المواد التي أخذت العينات منها إلا بعد أن تظهر نتائج الإختبار وإنطباقها على المواصفات الموضوعة لها، على أن يقدم المتعاقد العينات دون مقابل.

يقوم المتعاقد بإجراء جميع الإختبارات المطلوبة واللازمة للتأكد من مطابقة المواد للمواصفات بإشراف المهندس مع مراعاة المادة "مراقبة الأشغال" المذكورة لاحقاً وذلك على حسابه وبواسطة أخصائيين في أحد المختبرات المعتمدة والمشهود لها بالكفاءة اللازمة والموافق عليها من الإدارة.

إذا تبين بنتيجة الإختبارات أن بعض المواد لا تطابق المواصفات الموضوعة لها يطلب المهندس من المتعاقد نقلها خارج نطاق العمل خلال مهلة محددة وإستبدالها بأخرى مطابقة للمواصفات، فإذا لم يمتثل للطلب تقوم المؤسسة بنقلها على حسابه ومسؤوليته إلى أي جهة تراها مناسبة ولا يحق للملتزم مناقشتها بالتكاليف مهما بلغت.

58- فتح الطرقات وتأمين السير:

يتوجب على المتعاقد فتح الطرقات اللازمة لتأمين إيصال المواد إلى مواقع العمل وقطع الحد الأدنى اللازم من الأشجار عند الحاجة حفاظاً على الطبيعة وذلك على نفقته الخاصة. كما يتوجب عليه إدخال التعديلات الفنية على المجاري والبنى التحتية التي قد تعترض تنفيذ أشغاله وكذلك عليه أن يتخذ، على نفقته الخاصة، التدابير المقتضاة كي لا يتوقف السير أثناء تنفيذ أشغاله.

59- تعويض أخذ أو إستيداع أتربة:

إن جميع تعويضات أصحاب الأراضي وسائر ذوي الشأن من جراء أخذ أتربة أو إستيداعها هي على عاتق المتعاقد. ويتم إستيداع الأتربة الناتجة عن الحفريات في أماكن ومكبات توافق عليها الإدارة المحلية الممثلة بالبلدية أو من يقوم بأعمالها.

60- إزالة الأشغال غير المطابقة:

على المتعاقد أن يقوم فوراً وبالطريقة التي يوافق عليها المهندس وضمن المهلة التي يحددها المهندس بتصليح جميع الأشغال المنفذة التي يتبين عدم مطابقتها للمواصفات الفنية سواء كان ذلك نتيجة سوء الصنع أو إستعمال مواد رديئة أو نتيجة لإهمال المتعاقد أو لأي سبب منه، وفي حال تأخر المتعاقد عن القيام بذلك تقوم المؤسسة بتنفيذ التصليحات على حسابه ومسؤوليته.

61- إيقاف العمل بسبب مخالفات:

للمهندس المشرف الحق بتوقيف أعمال المتعاقد حينما يكون هناك مخالفات في التنفيذ لدفتر الشروط وعدم إنصياع المتعاقد لمعالجتها الفورية ولا يحق للمتعاقد المطالبة بتمديد مدة الصفقة أو بأي تعويض مهما كان نوعه لقاء هذا التوقف وعلى المتعاقد، وعلى نفقته الخاصة وبدون تأخير، أن يقوم بمعالجة المخالفة بالشكل اللازم لتنال موافقة المهندس، ولا يمكنه تكملة العمل أو معاودته إلا بعد إزالة المخالفات كافة.

كذلك يمكن للإدارة توقيف أعمال المتعاقد مؤقتاً من أجل التوافق بين هذا المشروع وأشغال أخرى تنفّذ في نفس الوقت، ولا يحق للمتعاقد المطالبة بأي تعويض مهما كان نوعه لقاء هذا التوقف.

62- حسن تنفيذ الأشغال:

يجب أن تنفذ الأشغال بدقة وعناية وفقاً للمسطّحات والمعطيات الفنية ولطبيعة الأشغال ولقواعد الفن.

63- تدقيق المستندات والمصورات / تحضير الخرائط التنفيذية:

يجب على المتعاقد، وعلى مسؤوليته، أن يعمد قبل البدء بالتنفيذ ووضع الخرائط التنفيذية إلى التثبت من نتائج سبر الاغوار، والموافقة عليها من قبل مندوب الادارة.

على المتعاقد، قبل بدء التنفيذ القيام على نفقته ومسؤوليته بالأعمال التالية:

- إجراء المسح الطوبوغرافي الخاص به وأخذ الشقلات.
- أجراء فحوصات سبر الاغوار لتحديد نوعية وقوة التربة.
- اعداد الخرائط التنفيذية بعد أعداد تقرير عن الحسابات الهندسية calculation note واجراء كل الاعمال الهندسية اللازمة لحسن تنفيذ الاشغال المطلوبة.

يحق للمؤسسة عندما ترى ذلك مناسباً أن تطلب من الملتزم إجراء تعديلات على التصاميم هذا دون أن يحق للمتعاقد الإعتراض أو المطالبة بأي تعويض نتيجةً لذلك.

64- تركيز الاشغال:

يجري تركيز الأشغال بواسطة الملتزم وعلى نفقته ومسؤوليته أمام مهندس الإدارة أو من ينوب عنه وفقاً للخرائط والمصورات التنفيذية المحضرة من الملتزم والموافق عليها من قبل الإدارة، وعلى الملتزم أن يأخذ موافقة المهندس على هذا التركيز عند إنجازه وقبل المباشرة بالعمل. وعلى كل حال فإن الملتزم يبقى وحده مسؤولاً عن التركيز وأخطائه تجاه الإدارة.

65- تعيين المهندس والوكلاء:

على المتعاقد فور تسلّمه مواقع العمل لتنفيذ الأشغال، أن يعين مهندساً ووكيلاً دائماً على الورشة لمراقبة تنفيذ الأشغال ولغاية إنجازها ويجب أن يكونا مقبولين من المؤسسة ويعتبران صالحين حكماً لإجراء الكيول وتوقيعها وإستلام التعليمات والمذكرات والخرائط والتبليغات والقرارات إلخ،... وذلك طيلة مدة تنفيذ الأشغال ولغاية تصفية حسابات المتعاقد النهائية وعلى الوكيل أن يكون موجوداً بصورة دائمة على الورشة، ويحق للمؤسسة الطلب إلى المتعاقد إبدال مهندسه ووكليه إذا تبين لها أنهما غير كفوئين بالتنفيذ وفقاً لمتطلبات دفتر الشروط هذا، على أن تؤخذ موافقة المؤسسة المسبقة على المهندس والوكيل البديلين.

يجب على المتعاقد أن يقدم قائمة تسلسلية بالأشخاص المقيمين في الورشة والمؤهلين لتمثيله في حال غياب المهندس أو الوكيل بحيث أن كل تبليغ عائد للإلتزام يستلمه أحدهم حسب ترتيبه في القائمة يعتبر تبليغاً صحيحاً وقانونياً. على المتعاقد الحضور إلى مكتب المهندس ومرافقته في جولاته كلما طلب المهندس ذلك.

66-جهاز مستخدمي المتعاقد:

على المتعاقد أن يضع على الورشة مجموعة كاملة مؤلفة من الجهاز البشري اللازم وكل المعدات والمواد لتنفيذ الأشغال. ويجب أن يكون هذا الجهاز البشري حائزاً على المعرفة الفنية اللازمة لإيصال تنفيذ الأشغال إلى نهاية جيدة وأن يخضع لموافقة المؤسسة المسبقة.

يمكن للمهندس أن يفرض تغيير أو طرد وكيل أو عمال المتعاقد لعدم الطاعة أو عدم الكفاءة أو نقص في الإستقامة. يبقى المتعاقد، على كل حال، مسؤولاً عن الغش وسوء التنفيذ الذي قد يرتكبه وكيله أو عماله في تقديم أو إستعمال المواد.

67- إجتماعات الورشة:

الإجتماع على الورشة، وهو أسبوعياً من حيث المبدأ، هو الطريقة العادية للإتصال بين المهندس والمتعاقد، وعلى المتعاقد أو ممثله الإشتراك فيه. يوضع بشأن هذه الإجتماعات محاضر موقعة من الطرفين وتعتبر تعليمات المهندس إلى المتعاقد الواردة فيها بمثابة مذكرات عمل.

68- أيام وساعات العمل:

يجب متابعة العمل كل أيام الأسبوع بإستثناء أيام العطل والآحاد والأعياد التي يتوجب للعمل فيها أخذ إذن مسبق من المؤسسة وحضور المهندس.

يمكن للمتعاقد، في ظروف خاصة، زيادة ساعات العمل أو العمل ليلاً شرط الحصول على إذن خطي من المهندس، الذي يمكنه أن يرفض إعطاء هذا الإذن.

69- مراقبة الأشغال:

للمهندس الحق في كل وقت بالوصول إلى أماكن العمل ومراقبة التنفيذ، وعلى المتعاقد أن يقدم له كل التسهيلات التي تمكنه من إجراء كل معاينة، أو فحص أو تحقق لازم.

على المتعاقد أن يحضّر التقارير اليومية المتعلقة بسير العمل في الإلتزام بحسب النموذج المعتمد من قبل المؤسسة والتي تبّين:

- التاريخ
- حالة الطقس
- التجهيزات والآليات
- اليد العاملة بالتفصيل
- سرد الأعمال المنجزة وجميع الوقائع الحاصلة
- الملاحظات
- أية معلومات أخرى مفيدة

يمكن للمؤسسة أن تطلب إرفاق هذه التقارير بصور رقمية أو أي مستندات أخرى.

يوقع مهندس الملتزم ويسجل كل الكميات المنفذة على هذه التقارير التي يجب أن يقدمها المتعاقد دورياً إلى المهندس للتوقيع بالموافقة.

لا يجري تغطية أو حجب أي منشأة بدون موافقة المهندس. على المتعاقد إخطار المهندس خطياً في كل مرة تكون فيها الأشغال على وشك أن تصبح جاهزة للمعاينة وسيعمد المهندس بدون تأخير غير معلل إلى معاينتها وإجراء الكشف على هذه الأشغال وعلى كيولها.

يحتفظ المهندس بحقه في طلب كل التجارب التي يراها ضرورية لمراقبة المواد والأشغال. كل الأكلاف الناتجة عن هذه التجارب، بإستثناء أكلاف المختبر، هي على عاتق المتعاقد. يعين المهندس المختبر حيث ستجرى التجارب.

70- عوائق لحركة السير وأضرار على الأملاك المجاورة:

يجب أن تنفذ كل العمليات الضرورية لتنفيذ الأشغال ضمن النطاق الذي تسمح به موجبات الصفقة، بشكل لا يسبب عوائق للراحة العامة، أو لإستعمال الطرق العامة أو الخاصة التي تخدم الأملاك العائدة للمؤسسة أو للغير والوصول إليها.

على المتعاقد أن يؤمن على مسؤوليته وحسابه كل ما يلزم لسلامة وحسن سير تنفيذ الأشغال لا سيما الحراسة وجميع التدابير للدلالة على الأشغال، ويعتبر المتعاقد مسؤولاً مباشرة تجاه الغير عن كل حادث يحصل للأشخاص والمنقولات ولوسائل النقل من جراء الأشغال التي يقوم بها والمنشآت التي ينفذها والتحويرات التي يدخلها على اتجاهات السير والأتربة والمواد التي يضعها على موقع الورشة والطرقات المحيطة بها. يجب على الملتزم أن يشير إلى كامل الحفريات المقامة ليلاً ونهاراً، وذلك بواسطة لافتات وإشارات سير خاصة وبواسطة شريط متين يحمل شرائح من ورق بلاستيك حمراء

وبيضاء عاكسة للضوء وتحمل إسم مؤسسة مياه بيروت وجبل لبنان، ويثبت الشريط على أعمدة بالعدد اللازم على طول الحفريات غير المردومة بعد.

يجب وضع (3) ثلاث لافتات مكتوب عليها خفف السرعة – أشغال على بعد (200) مئتي متر ومائة متر وعند أول كل حفرية وفي كل إتجاه للسير ويجب أن تكون هذه اللافتات مطلية باللونين الأحمر والأبيض بطلاء عاكس للضوء.

يجب إضاءة إشارات وامضة كل خمسين متراً على طول كل حفرية إبتداءً من غروب الشمس وعلى الملتزم تأمين الحراسة الليلية الضرورية لحفظ وتشغيل الإشارات الضوئية وتشغيل الإنارة.

يجب على الملتزم أن يتقيد تماماً بالتعليمات المذكورة أعلاه وإلا سوف يتعرض للغرامات اليومية التالية والتي لا يعفى منها إلا بقرار من المدير العام للمؤسسة:

- عدم وجود حاجز 20.000.000 ل.ل. عشرون مليون ليرة لبنانية
- حاجز غير مطابق للمواصفات 10.000.000 ل.ل. عشرة ملايين ليرة لبنانية
- عدم وجود لافتات 10.000.000 ل.ل. عشرة ملايين ليرة لبنانية
- عدم وجود إشارات ضوئية 10.000.000 ل.ل. عشرة ملايين ليرة لبنانية

على المتعاقد أن يتخذ كل الإجراءات اللازمة والسريعة تفادياً لكل ضرر قد يلحق بالغير من منتفعين وأصحاب أراضٍ ومنشآت مجاورة.

يحق للمؤسسة في الحالات المستعجلة والضرورية أو لأسباب لها وحدها حقّ تقديرها، أن تطلب من المتعاقد أن ينجز فوراً العمل المتعلّق بقسم من الأشغال وإذا لم يمتثل المتعاقد يحق للمؤسسة أن تعمد فوراً وبدون سابق إنذار إلى إنهاء هذه الأشغال وذلك على نفقة المتعاقد ومسؤوليته وأن تسدد النفقات المترتبة عن هذا العمل من أصل إستحقاقاته لدى المؤسسة أو بواسطة سندات تحصيل وذلك دون أن يحق له الإعتراض على هذا التدبير أو التحفظ بشأنه.

يحق للمؤسسة بناءً على ملاحظتها الخاصة في كل مرة تعتبر فيها أن قسماً من الحفريات والمنشآت تشكل عائقاً أو خطراً أن تطلب من المتعاقد أن يعمد خلال مدة أقصاها ثلاثة أيام إلى إنجاز العمل في هذا القسم وإعادته إلى حاله السابقة وإذا لم يمتثل المتعاقد لأحكام هذا الأخطار فإنه يحق للمؤسسة أن تعمد فوراً وبدون سابق إنذار إلى القيام بهذه الأعمال وذلك على نفقة المتعاقد ومسؤوليته وأن تسدد النفقات المترتبة عن هذا العمل من أصل إستحقاقات المتعاقد لدى المؤسسة أو بواسطة سندات تحصيل وذلك دون أن يحق للمتعاقد الإعتراض على هذا التدبير أو التحفظ بشأنه.

71- وجود متزامن لتعهدات أخرى والعلاقة معها:

تحتفظ مؤسسة مياه بيروت وجبل لبنان بحق تنفيذ أي عمل غير ملحوظ أساساً في الأشغال الملزّمة إلى المتعاقد، بواسطة متعاقد آخر. ولا يمكن للمتعاقد أن يستفيد مما قد ينتج عن ذلك ليتهّرب من موجبات صفقته.

على المتعاقد، طيلة مدة تنفيذ العقد، أن يكون على صلة مع بقية المتعاقدين كلما أعلمته بهم المؤسسة لتسوية المسائل المتعلقة بتنفيذ الصفقة والتي تؤثر على الأشغال الملزّمة لهؤلاء المتعاقدين.

في حال وجود صعوبات أو خلافات يجب إعلام المؤسسة بها بسرعة ويجب على الجميع القبول بحكمها.

72- أشياء عثر عليها في الحفريات:

تحتفظ المؤسسة بحق ملكية المواد التي توجد في الحفريات وما يجري هدمه فيها على أن يعوّض على المتعاقد لقاء عناياته الخاصة. وتحتفظ المؤسسة كذلك بالقطع الفنية من كل نوع التي قد يعثر عليها على أن يعوّض على صاحب الحق.

73-حوادث - مسؤولية المتعاقد:

يكون المتعاقد مسؤولاً عن كل الحوادث والأضرار المسبّبة للغير من وجود الورشة.

لن تكون المؤسسة في أي حال مسؤولة عن الأضرار أو التعويضات القانونية التي تدفع في حالة الحوادث التي يمكن أن تصيب عمال ومستخدمي المتعاقد أو من يلزّمهم، يضمن المتعاقد المؤسسة ضد كل طلب تعويضات أو فوائد أو رفع ضرر وكذلك ضد كل مطالبة أو شكوى أو نفقة أو عبء ومصاريف من أي نوع كانت عائدة لهذه الحوادث.

وكذلك على المتعاقد الإتصال المباشر بالمراجع الرسمية المسؤولة عن تمديدات الهاتف والكهرباء وأي بنى تحتية في حال وجودها والقيام بالخطوات والمعاملات اللازمة كافة على نفقته ومسؤوليته للإطلاع بصورة كاملة على جميع أمكنة مرور مسالك هذه المنشآت ضمن مجال إلتزامه وذلك كي لا يعرّض تلك المنشآت للضرر أو للتعديل وإلا تعرّض هو بالتالي للمسؤولية ودفع الكلفة للقيام بما يتوجب لتصليحها وإرجاع الوضع إلى ما كان عليه أو تحويرها متحملاً كامل النفقات الناتجة عنها.

يجب على المتعاقد أن يقوم على نفقته بتصليح الأضرار المسببة من وجود ورشته، كذلك عليه أن يقوم بتصليح الطرق والأسوار والمنشآت والمزروعات المتضررة من عمل جهازه البشري أو سير آلياته ويزيل أي ضرر أو تلف ويفض أي خلاف ناشئ ويعوض الغير مباشرة دون تدخل المؤسسة أو إشراكها في الموضوع.

تحتفظ المؤسسة بحق تعويض الغير على نفقة المتعاقد المسؤول إذا رفض هذا الأخير القيام بذلك مباشرة.

74- أنظمة العمل والصحة والسلامة:

مع مراعاة تدابير المادة "قوانين وأنظمة" المذكورة أعلاه على المتعاقد التقيد بقانون العمل وأخذ كل تدابير الصحة والسلامة على الموقع وكذلك كل التدابير الإحترازية في نقل وحفظ وإستعمال المتفجرات والمواد الخطرة والقابلة للإشتعال في حال وجودها، وتأمين النظام والترتيب في صفوف العمال على الورشة.

75- وضع منشآت جزئية تحت تصرف المؤسسة:

تستطيع المؤسسة دون أن يحق للمتعاقد بأية مطالبة، أن تستلم مؤقتاً وبالتالي ان تتصرف بمختلف المنشآت أو بأقسام منها تدريجياً عند إتمامها ضمن المخطط العام للتنفيذ، شرط أن لا يؤدي ذلك إلى الحاق أي أذى بالمتعاقد.

76- إستعمال معدات أو منشآت أو مواد في حال فسخ الإلتزام:

في حال فسخ الإلتزام يمكن للمؤسسة دون أن يكون ذلك إلزامياً، أن تستعمل كل المعدات والمنشآت ومواد الورشة او جزءاً منها، والتي تقرر أنها مفيدة لإتمام الأشغال ولا يمكن للمتعاقد رفض التخلّي عن هذه المعدات والمنشآت والمواد للمؤسسة. في جميع الحالات على المتعاقد تفريغ الورش والمخازن والمواقع المفيدة للإلتزام في مهلة تحددها المؤسسة.

77- تنظيف مواقع العمل بعد إتمام الأشغال:

فور إتمام الأشغال، وقبل تقديم طلب الإستلام المؤقت، يقوم المتعاقد بتنظيف جميع مواقع العمل من الأنقاض وبقايا التدعيم والمعدات وجميع المواد الأخرى بحيث تترك هذه المواقع بحالة نظيفة ومرضية، وعليه كذلك تنظيف الأقنية ومجاري المياه وسطح الطريق وجوانبها من البقايا الناتجة عن أشغاله أو خلافها، وعليه رمي هذه المواد في مكبات قانونية. ولا يحاسب المتعاقد عن هذه العملية بإعتبار أن أكلافها تقع ضمن نفقات الإلتزام النثرية.

78- واجبات المهندس المشرف من قبل المتعاقد على الأشغال:

تتلخص مهام المهندس المشرف من قبل المتعاقد المفروضة لجهة الإشراف على سير تنفيذ الأشغال وإدارة الورشة، بما يلي:

- إشتراك هذا المهندس فعلياً في تنفيذ الأشغال بصورة دائمة إلى حين إنجازها واستلامها.
- تنظيم مخطط العمل وتوقيعه.
- مرافقة مندوبي الإدارة لدى تسليم مواقع العمل وتوقيع المحضر بهذا الخصوص.
- القيام بزيارة الورشة مرة في الأسبوع على الأقل وإثبات ذلك بتوقيع دفتر الأشغال اليومي في الورشة.
- تقديم تقرير شهري بسير الأشغال بالمقارنة لمخطط العمل العائد لها وملاحظاته بخصوص الأعمال المنجزة والتجهيزات واليد العاملة إلخ،...
- حضور عمليات أخذ الكيول وتوقيع دفتر الكشوفات.
- إعداد تحاليل الأسعار الجديدة للأشغال الإضافية غير الملحوظة أساساً.
- حضور عمليات الإستلام المؤقتة والنهائية للمواد والمعدات والأشغال.
- مرافقة مهندس ومندوبي المؤسسة في زيارة الورشة كلما طلبوا منه ذلك.

وإذا ثبت للمؤسسة غياب مهندس المتعاقد عن التنفيذ، أو التأخر عن الإشتراك فيه، حق للمؤسسة إتخاذ الإجراءات التي تراها مناسبة بحق المتعاقد.

CONSTRUCTION OF THE ESSENTIAL OPERATIONAL WORKS FOR GHINEH RESERVOIR

VOLUME 1
GENERAL SPECIFICATIONS

Part 1 – General Requirements
Part 2 – Civil works

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PART 1

GENERAL REQUIREMENTS

101 GENERAL requirements

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101GENERAL requirements

101.1 General Requirements and Particular Specification

These General Requirements shall form an integral part of the General Specifications. In addition to these General Requirements, the Contract contains a Particular Specification, to supplement and/or modify the General Specification as may be necessary in each particular case.

The provisions of the Particular Specification for any specific section or number of sections shall prevail over those of the General Specification. Whenever the term "Specification" without further qualification is used in the Contract Documents, it shall mean this General Specification together with the Particular Specification.

101.2 Requirements of Specification

The Contractor shall fulfil all requirements and obligations of all clauses of the Specification applicable to the construction work involved in the Contract. Neither the following clauses of this Specification nor the Bill of Quantities shall limit the obligations of the Contractor under the accompanying Conditions of Contract. Where items are not included in the Bill of Quantities for any such requirements or obligations the cost of such requirements or obligations shall be deemed to be spread over all the items of the Bill of Quantities unless otherwise stated.

101.3 ISO 9000 Certification

Imported manufactured products and equipment shall comply with their relevant international standards. The quality assurance of all imported goods shall be granted the ISO 9000 certification.

Locally manufactured products and equipment shall comply with US or Western European Standards. ISO 9000 certification for locally manufactured goods is not essential, however these good shall be subject to the approval of the Engineer.

101.4 Drawings, Records and Documents

101.4.1 Drawings

All works shall be performed in accordance with the drawings furnished with the Contract documents and any such additional drawings as may be issued by the Engineer from time to time during the progress of the work or any drawing furnished by the Contractor and approved by the Engineer. Additional drawings (if any) will be furnished to the Contractor in due time so as to enable him to perform the work shown thereon in its proper sequence and for any advance planning that may be necessary for the efficient performance of such work. The Engineer will decide in each instance whether additional drawings are required for advance planning of the works and determine the time required for same.

In all cases, detailed shop drawings for all components of the Works shall be prepared by the contractor, after the approval of all related equipment items. The design and the shop drawings shall be submitted to the Engineer who shall within 21 days approve, reject or ask the Contractor to revise or modify such documents and resubmit them for approval. All these documents shall be approved by the Engineer prior to commencement of the work. The structural design will be in accordance to the recommendations based on soil investigations.

101.4.2 Records and "As-built" Drawings

After the work has been completed, the Contractor shall furnish "as-built" drawings prepared whilst surveying during construction, showing the Works as constructed together with all other information that may either be required or be useful for the operation and maintenance of the Works in the future, such as alignment and depth of cover of pipelines, type of soil, type, dimensions and location of structures, size of pipelines and cables encountered during excavation.

Unless specific items are included in the bill of Quantities, the cost of preparing the shop drawings, "as-built" Drawings and Records shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately. The As-built Drawings shall be submitted, if required by the Engineer, on computer diskettes.

101.4.3 Ownership of Drawings and Documents

The Drawings and documents are issued to the Contractor for the purpose of the execution of the Works under the Contract and shall remain the property of the Employer to whom they are to be returned by the Contractor after completion of the work, as a precondition for the issue of the Certificate of Completion.

101.5 Borehole Information

The Contractor shall satisfy himself as to the nature of the strata underlying the sites of the works. He may carry out at his own expense borings, tests and investigations as he may consider necessary and utilize the information thus gained for the preparation of his tender.

Any subsoil information and test results provided by the Employer shall be given to the Contractor for his preliminary information only. Such information shall not relieve the Contractor in any way of his obligation to inspect the sites and of his sole responsibility for carrying out the works as specified and required by the Engineer and at the rates set out in the Bill of Quantities. No claims for additional payment and/or extensions of time shall be entertained in respect of data furnished to the Contractor by the Employer or the Engineer.

101.6 Meteorological and Hydrological Conditions

The Contractor's attention is directed to the meteorological and hydrological conditions prevailing in the project area and its vicinity. In his planning of the work and in his unit rates, the Contractor shall take these factors into account. No increase in prices and/or extension of time shall be granted due to rains, floods and/or other adverse climatological conditions in the project area and along the roads to it.

For information, the climatic conditions in Lebanon can be summarized as follows:

	Temperature (deg C°)						Relative humidity					
	Coastal zones		Mountanious zones		Bekaa Valley		Coastal zones		Mountanious zones		Bekaa Valley	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Summer	20	35	15	25	10	35	65	85	50	60	40	65
Winter	7	15	-5	10	-1	15	60	75	55	75	55	80

101.7 Bill of Quantities

101.7.1 Rates and Prices

The rates and prices inserted by the Contractor in the Bill of Quantities are to be the full and inclusive value of the work described. They are to cover all costs, expenses and general risks which may be involved, together with all liabilities and obligations set forth or implied in the Specification and other documents on which the Tender is based. They must include all plant, tools, materials, transport of men and materials, insurance and labour of every description. They must also take into account the conditions referred to in the general Conditions, and include time lost due to weather, payment of guaranteed minimum and holidays with pay. The cost of any travelling time subsistence and incentives such as overtime etc. must be included in the rates and prices. Where any special risks, liabilities and obligations, mentioned above or otherwise, cannot be dealt within the rates, then the price thereof is to be separately stated in items provided for the purpose or added by the Tenderer.

Any item left unpriced shall be held to have had its cost included in the unit rates for other items of work.

101.7.2 Provisional Items and Quantities

Care shall be taken to distinguish between "Provisional items" which represent work they may not be required, and "Provisional Quantities" which represent work that will be required but the quantity of which cannot be closely estimated in preparing the Bill of Quantities and details of which will be given on site.

101.7.3Methods of Measurement and Payment

The methods of measurement and payment for each trade are normally specified in the General Specification, provided that where a different method of measurement is indicated in the Bill of Quantities or specified in the Particular Specification, the Bill of Quantities and the Particular Specification, in that order, take precedence over the General Specification.

Where no method of measurement is specified in any of the foregoing documents, the work will be measured in accordance with the latest edition of the Standard Method of Measurement of Civil Engineering Quantities, published by the Institution of Civil Engineers of London, U.K.

101.8 Units

In this Specification, on the Drawings and in the Bill of Quantities the S.I. (Systeme International d'Unites) metric system of dimensioning has been employed.

Where dimensions are given in metric units for materials which are only available in Imperial dimensions, the Contractor may, subject to his obtaining prior approval of the Engineer, substitute suitable sizes of materials as are available in the Imperial system. Such approval shall not unreasonably be withheld, provided that there is no difficulty in making interface connections with any other parts of the Works.

101.9 Standards

For convenience and in order to establish the necessary standards of quality, reference has been made in the Contract Documents, to specifications issued by International Standards. Such specifications shall be defined and referred to hereinafter as "Standard Specifications" and shall be the latest editions of such Standard Specifications issued prior to the issue of Tender Documents together with such additions and amendments to such editions as may have been issued prior to the same date. Subject to the approval of the Engineer, any other internationally accepted Standard which specifies an equal quality of work may be used.

In reference to Standard Specifications, the following abbreviations have been employed:

B.S.	British Standard
A.S.T.M.	American Society for Testing Materials
D.I.N.	Deutsche Industrie Normen
I.S.O.	International Organization for Standardisation
A.A.S.H.T.O.	American Association of State Highway and Transport Officials
A.W.W.A.	American Water Works Association
N.F.	Normes Française
AFNOR	Association Française de Normalisation

101.10 Survey and Setting Out

101.10.1 Engineer's Benchmarks and Survey Markers

Prior to the commencement of the work, the Contractor will receive from the Engineer a number of benchmarks and survey markers on the Site. Before starting any work, the Contractor shall check the alignment and levels of the benchmarks and markers in the presence of the Engineer's Representative and shall correct any error or mis-alignment which may be discovered during such checking with the consent of the Engineer's Representative. Thereafter, the Contractor shall establish from these corrected benchmarks and markers all levels and lines necessary for the performance of the work.

The Contractor shall be responsible for the preservation of the benchmarks and markers during the entire period of construction, and shall at his own cost repair or replace any of them that may be damaged, destroyed, or removed by any cause whatsoever.

101.10.2 Setting Out

The Contractor shall appoint and employ the necessary qualified and experienced staff to set out the work accurately and shall establish and locate all lines and levels and be responsible for the correct location of all works.

Whether or not directed by the Engineer's Representative, the Contractor shall take such levels and dimensions as may be required prior to disturbance of the ground for the purpose of measurement and these shall be agreed between the Contractor and the Engineer's Representative in writing before any of the surface is disturbed or covered up.

The Contractor shall establish parallel survey lines or other points of reference at a safe distance, permitting the re-establishment of lines and points, wherever the original lines and points must inevitably be destroyed or removed during the progress of work.

101.10.3 Surveying for Measurement of Earthwork

All intermediate and final surveying necessary for the establishment of quantities of excavation and earthfill will be done by the Contractor, who shall establish elevation points and prepare cross-sections sufficient to permit an accurate calculation of the quantities of earthwork. The Contractor shall notify the Engineer's Representative at least three days in advance of his intention to perform such measurements. The cross-sections prepared by the Contractor and approved by the Engineer's Representative shall be basis for the measurement and payment of earthworks.

101.10.4 Payment

Unless specific items are included in the Bill of Quantities, the cost of all surveying, modifications to drawings, setting out, and measuring to be done by the Contractor and all other expenses incurred by him in complying with the requirements of this section shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.11 Programme of Works and Progress Reports

The time allocated for the performance and completion of all works under this Contract shall be as stated in the Appendix to Form of Tender (Volume 2 of Contract Documents).

The Contractor shall submit to the Engineer, before commencing work on site, a fully detailed programme showing the order or procedure and method by which he proposes to carry out the construction and completion of the Works, and particularly of the organisation and staff proposed to direct and administer the performance of the Contract.

The information to be supplied to the Engineer shall also include drawings showing the general arrangement of his temporary offices, camps, storage sheds, building and access roads, and details of Construction Plant and Temporary Works proposed.

The Contractor when preparing his programme shall take due account of the time required for the delivery of materials. The Engineer will check the proposed programme and will return same to the Contractor within 14 days of its receipt with his approval or comments and requirements for changes (if any). The Contractor shall make all requested corrections and changes not later than 7 days after having received the Engineer's comments. The programme as finally agreed to and approved by the Engineer will serve as the only basis for the carrying out of the Works.

After the commencement of each and any part of the Contract, the Contractor shall forward to the Engineer in triplicate, for each calendar month, a progress report and a chart showing the approved programme, the work completed to date and the progress made during the month. Such monthly progress reports and charts shall be submitted by the Contractor to the Engineer or his Representative not later than the 6th day of the month following that to which the report and chart refer.

101.11 Work Sites

101.12.1 Right of Way and Sites of Works

The Employer will provide all the necessary rights of way, lands and sites on which the Works are to be carried out and will designate the access roads to the sites which the Contractor will be permitted to use.

In no case shall the Contractor occupy lands, right-of-ways or way-leaves without the previous written permission of the Engineer.

101.12.2 Contractor's Work Area

The location of the Contractor's work area, i.e. the area or areas where the Contractor may set up his offices, stores, workshops, yards for mechanical plant, etc., and transport depots, shall be agreed beforehand with the Engineer and shall be such as to avoid obstruction and nuisance to the public. The Contractor shall provide, within his work area, a Site Office for the use of his agent where written instructions from the Engineer may be delivered.

The Contractor shall make his own arrangements for and pay all costs incurred in the use of such areas of land as he may require for work areas for the purpose of the Contract.

101.12.3 Access and Construction Roads

The Contractor shall at his own expense construct and maintain within the right of way any temporary access roads and construction roads on the work sites that he deems necessary for the proper performance of the works, but the routes of such temporary roads and the method of their construction shall be subject to the Engineer's approval.

The Contractor will be permitted the use of existing roads on the Site provided that such use is co-ordinated with other users.

The Contractor will be permitted to use public roads as access roads to the Works only after having obtained permission in writing from the relevant Authorities and from the Engineer. The Contractor shall strictly adhere to all requirements and conditions prescribed by the relevant Authorities and set out in Clauses 29 and 30 of the Conditions of Contract. The cost of preparation and maintenance of all access and construction roads and all costs incurred in complying with the requirements of this subsection shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.12.4 Existing Services

The Contractor shall make himself acquainted with the position of all existing works and services inter alia roads, sewers, storm water drains, cables for electricity and the telephone lines, telephone and lighting poles, and water mains, before any excavation is commenced.

The Contractor will be held responsible for damage caused in the course of the execution of the Works to such existing works and services and shall indemnify the Employer, the Engineer and their agents against any claims arising from such damage (including consequential damages). Any damage caused must be made good at the Contractor's own expense.

Where the works required the crossing of existing roads, railways, fuel pipelines and services, the Contractor shall obtain the prior permission of and shall make all necessary arrangements with the relevant authorities and/or owners of said utilities and shall obtain their consent to the time and manner of execution of all work connected with such crossings.

When crossing a road in public use the Contractor shall either leave half the width of the road free for traffic or shall construct a bypass, as may be required by the road authority. The length, width and shape of any such bypass and the mode of its construction shall be as directed by the Engineer, but shall at all times permit for the passage of traffic using the main road. The Contractor shall put up warning and traffic signs, and shall employ flagmen to direct the traffic and shall mark the road crossings and put up lights from sunset to sunrise.

The Engineer's Representative may order the Contractor to repair bypasses, strengthen any temporary structures, put up additional signs or lights and generally improve the arrangements as he may deem necessary, and the Contractor shall forthwith comply with such orders. Regardless of whether or not the Engineer's Representative orders any such repairs of improvements, the Contractor shall remain solely responsible for the proper performance of all work in connection with the erection, maintenance and subsequent removal of all temporary structures required under this Clause, to the complete satisfaction of the Engineer.

Where the Works cross existing pipes, sewers, drains, channels, telephone or power lines and cables, the Contractor shall be responsible for the preservation of all such utilities in a good and serviceable condition during the execution of the Works and shall see to it that any damage done to any of the services be immediately repaired. Inasfar as necessary, the Contractor shall construct temporary bypasses for such pipes, channels and cables and restore them to their original position after the work at the junction or crossing has been completed.

The Contractor shall construct all bypasses and do all repairs to roads, pipes, channels and cables in accordance with the requirements of the proper authorities and/or the owners thereof or shall bear the expenses of all such work done by them.

Existing access to lands, property and all other facilities shall be maintained by the Contractor during the continuance of the Works to the Engineer's satisfaction.
Where work is being carried out in the vicinity of overhead power lines the Contractor shall take special measures to ensure that all persons working in such areas are aware of the relatively large distance that high voltage electricity can "short" to earth when cranes or other large masses of steel are in the vicinity of power lines and that adequate safety precautions are being taken. The Contractor shall ensure that none of his employees commits any act which will cause damage from, or to, overhead power lines.

Unless specific items are included in the Bill of Quantities, the cost of all works required under this section shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.13 Water and Power for use in the Works

The Contractor shall be solely responsible for the location, procurement and maintenance of water supplies adequate in quality and quantity to meet his obligations under the Contract.

The Contractor shall be responsible for the supply of all electric power to meet his obligations under the Contract and for the distribution thereof.

All costs associated with the supply of water and power shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.14 Building Regulations

All buildings erected by the Contractor upon the Site and Work Area shall comply with all Laws and local By-laws insofar as they are applicable.

101.15 Works in the Dry

All parts of the Works are to be carried out in the dry, and shall be kept free at all times from surface or groundwater from whatever source it may come to the satisfaction of the Engineer. Keeping the Works dry shall include all pumping and diversion of water that may be necessary in carrying out the Works, also provision and filling-in of sump holes, installation and operation of drains, pumps, well points etc., in a manner and with equipment and materials satisfactory to the Engineer.

The Contractor shall, at his own expense, make such provision for the discharge of any water from the Works as shall be satisfactory to the Engineer and to any person having rights over the lands or watercourses over or down which such water is discharged. He shall hold the Employer indemnified against any claim that may be made through non-compliance with this section. In the event of any interference with existing land or road drains due to the construction of the Works or to the dumping of spoil, etc., within or without the limit of the Works, the Contractor shall take immediately steps to restore the drainage to the satisfaction of the Engineer and the Owners, occupiers, or Authority concerned.

Unless specific items are included in the Bill of Quantities, the cost of keeping the Works dry as specified in this section, shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.16 Watching, Fencing and Lighting

The Contractor shall employ competent watchmen and guard the Works by day and night.

From the time that any portion of the Works shall be commenced, until the end of the works, the Contractor shall be responsible for protecting the public and his workmen from anything dangerous to persons or property and for the safe and easy passage of pedestrian, animal and vehicular traffic.

Any excavation, material dumps, soil dumps or other obstructions likely to cause injury to any person or thing shall be suitably fenced off and at night protected by red warning lights. The Contractor shall, at his own expense, and immediately upon completion of any part of the Works, fill up all holes and trenches, and level all mounds and heaps of earth which have been excavated or made in connection with the Works. The Contractor shall be responsible for the payment of all costs, charges, damages and expenses incurred or sustained on account or in consequence of any accident which may happen by reason of holes and trenches being dug and left or placed in improper locations.

Fencing shall consist of at least three 15 mm diameter hemp ropes or 4 mm diameter wires, or more, if required, stretched tightly between poles, standards, etc., securely planted in solid ground, well clear of the excavation and enclosing the spoil from the excavation. The poles, standards, etc., shall not be more than 15 m apart. If circumstances require it, they shall be placed closer and the ropes or wires shall be stretched tight, approximately 0.40 m, 0.80 m and 1.20m, respectively, above the ground.

Banks of spoil of suitable height and form may be accepted by the Engineer in lieu of fencing.

Fences and spoil banks shall be clearly marked at the ends, all corners and along the length at intervals of not more than 15 m, by means of white lime-washed boards, discs, stones or oil drums during the day and by red lamps kept burning at night. Markers shall be freshly lime-washed at regular intervals to ensure that they are white and clean.

The Contractor shall detail a man to trim and fill the lamps during the day and they shall be lit at least one half hour before sunset and not extinguished until at least one half hour after sunrise.

If a road is closed, or partly closed, to traffic, temporary traffic signs and barricades shall be erected by the Contractor, to the satisfaction of the Engineer and the Police, to give proper warning to traffic and to the public. Road signs shall be not less than 1.20 m x 0.80 m in size, surmounted by a red circle. Lettering shall be black, on a yellow ground and shall incorporate reflective material. The signs shall be adequately illuminated at night. The Contractor shall be solely responsible for the proper control of all traffic.

The cost of watching, fencing and lighting and all other costs incurred in complying with the requirements of this section shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.17 Preservation of Trees

No trees shall be cut down without prior permission of the legal public authority and the Engineer who will limit the removal of trees to the minimum necessary to accommodate the Permanent Works.

If trees are cut down or damaged by the Contractor or his employees and without approval, then the Contractor shall replace such trees at his own expense with trees of not less than two years of age obtained from a reputable nursery and of species to be approved by the Engineer. The Contractor shall plant, water and ensure that the replacement trees are properly established all at his own expense.

All costs incurred in complying with the requirements of this section shall be deemed to be included by the Contractor in his unit rates for the various items on the Bill of Quantities and shall not be paid for separately.

101.18 Works Executed by the Employer or by Other Contractors

The Employer reserves the right to execute on the Site works not included under this Contract and to employ for this purpose either his own employees or another Contractor whose contract may be either a sub-contract under this Contract, or an entirely separate Contract. The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operations of the Employer or his Contractor employed on such Works and the same obligations shall be imposed on the Employer or other Contractor in respect of work being executed under this Contract.

101.19 Materials

101.19.1 General

All materials shall be of the best quality throughout. Materials delivered to the Works shall be equal in all respects to the samples approved by the Engineer. The methods of stocking, mixing, transporting, fixing, placing and applying all materials shall be in compliance with the specifications and to the approval of the Engineer, who shall be kept advised of any change of plan. Materials failing to comply with the Specifications shall be immediately removed from the Works, at the Contractor's expense.

All goods and materials used in the execution of the Contract shall comply in all respects with ISO 9000 Standards or other equivalent standards approved by the Engineer.

101.19.2 Approval of Materials

Before entering into any sub-contract for the supply of any material or goods, the Contractor shall obtain the Engineer's approval in writing of the manufacturers and/or suppliers from whom he proposes to obtain such materials or goods. If requested, the Contractor shall submit to the Engineer samples of such materials and shall have them tested in approved laboratories. Such tests shall be carried out at least seven days prior to the inclusion of such materials in the Works. The cost of all samples and tests shall be borne by the Contractor.

Should the Engineer, at any time, be dissatisfied with such material or goods or with the methods of production or operation carried out at the manufacturer's or supplier's works or place of business, he shall be empowered to cancel his previously given approval of such supplier and to specify any other supplier whom he may choose for the supply of such material or goods. The Contractor shall then obtain such said material or goods from such other supplier and shall bear any additional costs thereof.

Materials which, in the opinion of the Engineer, do not comply with the Specification, shall be classified as rejected materials and shall be cut out and removed from the Works and replaced as directed by the Engineer, at the Contractor's own expense.

101.19.3 Alternative Materials

Where brand names or products of a specific manufacturer are specified in the Contract, the Contractor may, subject to the Engineer's approval (which shall not be unreasonably withheld) supply alternative materials, having similar characteristics and showing performance and quality at least equal to those specified.

Whenever the Contractor wishes to propose an alternative material he shall submit detailed information concerning the type of material and/or product, the Vendor's name, drawings if required, test certificate, etc. If the alternative material is not approved by the Engineer, the Contractor shall supply the material originally specified in the Contract.

If the price of the approved alternative material is in excess of the material specified in the Contract, the Contractor shall not be entitled to extra payment over the rates in the Bill of Quantities.

101.19.4Supply by Contractor

Pursuant to Clause 36 of the Conditions of Contract, all materials required in the Works, except as otherwise provided for in the Contract, shall be supplied by the Contractor and the cost thereof shall be included by the Contractor in his rates in the Bill of Quantities.

The Contractor's Tender shall be construed as an undertaking that all the materials and equipment to be provided by the Contractor are in his possession, or readily available and will be delivered to the Site in accordance with the Time Schedule.

101.20 Maintenance of Works

During the period of maintenance the Contractor shall maintain the Works and make all repairs, as defined in clauses 49 and 50 of the Conditions of Contract.

After the commencement of the Period of Maintenance, the Contractor shall do nothing which might endanger the safety of the Public and he shall carry out all instructions of the Engineer or other duly authorised person or authority in this regard. Throughout the Period of Maintenance the Contractor shall notify the Engineer what work or operations it is intended to be carried out on the Site and he shall carry out any instruction which the Engineer may give as to times and manner of working so that any inconvenience to the Public is kept to a minimum.

The Engineer will give the Contractor due notice of his intention to carry out any inspections during the Period of Maintenance and the Contractor shall upon receipt of such notice arrange for a responsible representative to be present at the times and dates named by the Engineer. This representative shall render all necessary assistance and take note of all matters and things to which his attention is directed by the Engineer.

101.21 Works Log Book

The Engineer's Representative will keep a Works Log Book on the Site.

To assist the Engineer's Representative in keeping the Log Book, the Contractor shall supply daily to him full details in writing on the following:

1. The number of workmen of the various trades and grades employed in carrying out the Works.
2. Quantities of the various materials brought to or removed from the Site.
3. Quantities of the materials incorporated by the Contractor in the Works.
4. Constructional Plants and Contractor's equipment brought to and removed from the Site.
5. The use of Constructional Plant in the Performance of the Works.
6. Other details as requested by the Engineer's Representative.

The Engineer's Representative may, if he so desires, use the above data to conduct the Log Book. However, such data shall not bind the Employer or the Engineer in any manner whatsoever.

The Log Book will be signed by the Engineer's Representative, and a signed copy of the daily entries will be handed to the Contractor or his authorized representative, who within 48 hours from the receipt of said copy, may object to any of the entries therein by written notice to the Engineer's Representative. Such objections by the Contractor shall be recorded in the Log Book. If the Contractor or his authorized representative has not made any such objection within 48 hours as aforesaid, he shall be deemed to have confirmed the correctness of the data entered in the Log Book.

The Contractor may enter in the Log Book his remarks regarding the performance of the Works. However, such remarks shall not bind the Employer or the Engineer.

Entries in the Log Book, except those to which the Contractor has objected in writing as described above, shall serve as evidence between the parties as to facts included therein; however, they shall not in themselves from the basis for a demand for any payment under the Contract.

101.22 Resident Engineer's Office

101.22.1 Construction

The Contractor shall, within 4 weeks of the issuance the order to commence of works, hand over to the Engineer a fully completed, furnished and equipped Engineer's office. The Contractor shall provide suitable temporary office space for the Engineer until the office is completed.

All facilities provided for the Engineer and/or Employer's staff shall be provided upon issuance the order to commence of works and shall remain available until the end of the defects liability period or until such earlier time as the Engineer may instruct.

The Contractor shall provide prefabricated portable or demountable offices or other as may be approved by the Engineer for the sole use of the Engineer and his staff, comprising:

2 offices size of each approximately 4 m x 4 m
1 pantry
1 toilets

Entrance area with space for desk

Offices are to be of proprietary manufacture, with hard-wearing, easy-clean surfaces and robust and secure fittings. Submit full details to the Engineer for approval before delivery to the Site and erection.

101.22.2 Furnishings

Each office shall contain:
2 desks with lockable drawers and swivel chairs
2 lockable steel filing cabinets
2 office chairs
1 drawing hanger for 10 sets
2 shelves
1 pin boards
2 waste paper baskets.
1 reference table

KITCHEN FURNITURE AND EQUIPMENT
1 refrigerator 14 cu. ft. capacity
1 water filter and 20 liters water cooler/hot/cold
1 electric boiling rings
1 stainless steel sink and drainer
1 heat resistant worktop
1 set of storage cupboards
1 set of crockery and cutlery for each member of the staff
1 large waste basket with cover.
and all necessary consumables for the making of beverages for the duration of the contract

LAVATORY FURNITURE AND EQUIPMENT
1 w.c. suite

1 toilet roll holder
1 wash hand basin
1 mirror
1 paper towel holder
1 soap dispenser
1 waste basket with cover.
and all necessary consumables.

and, in addition, the following shall be provided:
1 secretary's desk and swivel chair
2 large lockable sheet filing cabinets
1 photocopying machine similar to FT500 I with duplex, sorter and document feeder + consumables + all photocopying papers pin boards, shelves and waste paper baskets.

SERVICES: The Contractor shall provide and maintain the following minimum services:
- heating and air-conditioning
- electric lighting and power
- water supply
- drainage system
- fire fighting appliances
- cleaning facilities and general attendance including all personal.
- All bills and charges related to the services shall be paid by the Contractor.

TELEPHONES: The Contractor shall provide a three separate telephone connection (one cellular) and one regular phone line and one dedicated Facsimile service for the representative's offices, with PABX, extensions and telephone set for each office, secretary and conference room and shall pay all charges.

At the end of the project all the above equipment shall remain the property of the Contractor.

101.22.3 Miscellaneous Facilities and Services

The Resident Engineer's office shall be cleaned daily and provided with clean towels (every other day), soap, glasses and at all times with a fresh and adequate supply of drinking water. The cost of these services shall be paid for by the Contractor.

The Contractor shall be responsible for the security of all plans, papers, books, instruments from theft or fire during the continuance of the Contract and his insurance policies shall cover the office of the Resident Engineer.

The Contractor shall provide a complete set of all ASTM, AASHTO, BS EN and other Standards, Materials Manuals and Codes of Practice referred to in this Contract, or relevant thereto, shall be provided to the Engineer by the end of the mobilization period.

The Contractor shall provide all ladders, access lighting facilities and assistance etc. required by the Engineer to inspect any part of the Works.

The Contractor shall provide for the use of the Engineer when required by the Engineer, one total station surveying equipment, all of approved type and make, complete with accessories and all instruments, tapes, staffs, poles, pegs, stagings, moulds, templates, profiles, and all other requisites for checking and setting out and measurement of the Work. The Contractor shall also provide, when required by the Engineer, the services of two experienced chainmen.

101.22.4 Maintenance and Removal

The Contractor shall fully maintain the Resident Engineer's office throughout the Contract Period and effect all repairs, painting etc. required during that period.

At the end of the Contract, the office with all its furnishings and facilities will revert to the Contractor who, upon receiving the Engineer's instructions to do so, shall dismantle the office and remove it, leaving the Site neat and tidy to the Engineer's satisfaction.

101.22.4.1 Payment

Unless specific items are provided in the Bill of Quantities, the cost of the use by the Engineer and his staff of the office, its furnishings and all facilities and the cost of their maintenance etc., all as specified in this Section, shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

101.23 Dayworks

When Dayworks are authorized by the Engineer all equipment, labour and materials shall be paid for at the rates listed in the Schedule of Dayworks in the Bill of Quantities.

All major materials for Dayworks authorized by the Engineer but not included in the Schedule of Dayworks shall be paid for on a Prime Cost basis. The Contractor shall be paid on the basis of paid invoices showing cost of materials less any discount, paid receipts for transportation and handling charges and paid receipts for insurance on materials and delivery of materials. Before authorizing the use of materials in Dayworks the Engineer may require the Contractor to supply estimates of the costs of the materials.

The Contractor shall be compensated for his expenses, overhead, labour and profit involved in procuring and delivering the materials by an amount equal to a percentage of the actual cost of the Prime Cost Sum.

101.24 WATER SAMPLES AND ANALYSES

101.24.1 Procedure

Water samples shall be out from the well. For the physico-chemical analyses, it is advisable to take a minimum of 2 liters of water. Whereas for the dosage of heavy metals and trace elements, it is necessary to take a minimum of 5 liters of water. Water will be sampled according to the indications of the laboratory and/or of the Engineer, in one or several small polyethylene flasks, with an eventual adjunction of certain substances.

The Contractor will install a regulating valve on the upper part of the pipe. The regulating valve will be fixed at a minimum height of 0.50 m above the ground. The flask in which water is sampled will be rinsed 3 times with pumped water before being filled. Each flask will be hermetically sealed and carefully labeled.

Water samples for bacteriological analyses will be taken in sterilized flasks of 250 to 500 ml. The regulating valve should be imperatively previously sterilized. Sampling flasks should not be exposed to direct sunlight and kept at a temperature of + 4 °C, before being transported to the laboratory within a maximum delay of 24 hours.

Physico-chemical and bacteriological analyses should be carried out by a laboratory approved by the Engineer.

101.24.2Water analyses

Water analyses will be carried out and defined according to the French regulation method (decree N° 89.3 of January 3, 1989).

The required analyses are defined in accordance with:

- The origin of water: Ground or surface
- The treatment performed (if any)

- The sampling point.

At each well head, a sample of raw water will be taken to undergo a complete analysis. According to the sampling point:

- First analysis before starting works: Type P2P - C3 + B3
- Second analysis upon completion of works: Type P1 - C2 + B2.

101.24.3 Essential elements, measurements and criteria for each type of analysis (Tables 1, 2 and 3).

Table 1: Bacteriological analysis

BACTERIOLOGICAL ANALYSES		
Limited (B1)	Summary (B2)	Completed (B3)
Thermoduric coliforms. Fecal streptococci	Thermoduric coliforms. Fecal streptococci. Count of aerobic bacteria revivable at 22 °C et 37 °C.	Thermoduric coliforms. Fecal streptococci. Coliforms. Count of anaerobic bacteria revivable at 22 °C et 37 °C. Spores of sulfite-reducing anaerobic bacteria.

Table 2: Standard analyses defined in accordance with the sampling point.

Site	**Source**		**Production**				**Distribution**	
	At point of withdrawal, treatment performed (R)		After treatment and prior to discharge, or at the point of withdrawal if no treatment is performed (P)				In network (D)	
	(R.P.)	(R.S.)	(P1)	(P2)		(P3)	(D1)	(D2)
Origin of the water	Ground water	Surface water	Ground water and surface water	Ground water (P2P)	Surface water (P2S)	Ground water and surface water	Ground water and surface water	Ground water and surface water
Standard Analyses	B1 - - - - C3 - -	B1 - - - - C3 C4a C4c	- - B3 - C2 - - -	- - - - - C3 - -	- - - - - C3 C4a -	- - - - - - C4a C4c	- B2 - C1 - - - -	- - - - C2 - - C4b

Table 3: Types of physico-chemical analyses

PHYSICO-CHEMICAL ANALYSES						
	Limited physico-chemical analyses (C1)	Summary physico-chemical analyses (C2)	Complete physico-chemical analyses (C3)	Specific physico-chemical analyses (C4)		
				C4a	C4b	C4c
Organoleptic parameters	- Appearance (qualitative): odour, taste, colour - Turbidity	- Appearance (qualitative): odour, taste, colour - Turbidity	- Appearance (quantitative): odour, taste, colour - Turbidity			
Physico-chemical parameters Natural structure of the water	- pH - Conductivity	- Temperature - pH - Conductivity - Nitrates - 3 of the following parameters: nitrates, ammonium, chlorides, sulfates, permangante value,, metyl orange alkalinity or total hardness.	- Temperature - pH - Conductivity - Chlorides - Sulphates - Silica - Calcium - Magnesium - Sodium - Potassium - Aluminium - DS - Dissolved oxygen - Free carbon dioxide (marble test) or calculation of carbonate balance - Carbonates - Hydrogen-carbonates.			
Parameters concerning undesirable substances	- Residual chlorine or any other parameter relating to the disinfection treatment	- Residual chlorine or any other parameter relating to the disinfection treatment	- Nitrates -Nitrites - Ammonium - Permanganate value, hot, in acid medium - Hydrogen sulphide - Iron - Copper - Zinc - Manganese - Phosphorus - Fluorine - Residual chlorine or any other parameter relating to the disinfection treatment.	- Kjeldahl nitrogen. - Dissolved hydro-carbons - Surface agents - Phenol index	- Iron - Copper - Zinc.	
Parameters concerning toxic substances					-Cadmium - Lead - PAH	- Arsenic - Cyanides -Chromium - Mercury - Selenium.
Other parameters						- Pesticides - Volatile halogenated organic compounds.

101.24.4 Interpretation of analyses (Potability)

The results will be compared to the values set by:

- EEC directives/No/ 80/779/EEC-Official Journal of the European Communities, August 30, 1980. This directive groups together 62 admissible value parameters (guide level and maximum admissible concentration).

- WHO recommendations (Geneva 1986). Grouping parameters into five categories.

- French regulations (Decree No. 89.3-Official Journal of January 3, 1989). This decree groups analyses types and tables of admissible physico-chemical and bacteriological parameters relating to the definition of water potability.

These analyses will be given to the administration for the interpretation of data and the follow up.

101.24.5 Interpretation of analyses (corrosion)

During its transportation or use, water may cause various changes to the materials with which it is in contact. The most frequent deterioration is metal corrosion.

- Effects of aeration conditions (O_2H):
  - Corrosion in a non aerated place: corrosion caused by hydrogen
  - Corrosion in an aerated place: corrosion caused by oxygen.

The iron-water equilibrium potential in the absence of oxygen, and the oxygen and hydrogen electrodes equilibrium potentials will be controlled according to the pH value of the water.

- Effects of the mineralization influence (T.D.S.-T.A.C.)
  - The global mineralization of water increases its conductivity and decreases its resistance to corrosion. In particular, the concentration of chloride shall be verified (RYZNAR index).

- Effect of temperature variation

In conclusion, the approved laboratory should confirm, according to total mineralization and pH, the action of water and temperature on the different metals.

PART 2

CIVIL WORKS

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201 EARTHWORKS

201.1 General

201.1.1 Scope

Earthworks under this Specification include excavation and backfill for pipelines, excavation for ponds and open canals, excavation and backfill for structures, excavation from borrow areas, construction of embankments, compacted fill and surfaces and other earthworks and works related thereto, as required in the Works.

201.1.2 Classification of Excavation

Unless specific items for Rock Excavation are included in the Bill of Quantities, earthwork will not be classified in accordance with the hardness of the excavated material and all excavation will be deemed to consist of Common Excavation, as defined hereafter, regardless of the actual hardness of the excavated material.

Where excavation is classified according to hardness of excavated materials, the following definitions shall apply:

- Rock excavation shall include hard and solid rock that cannot be broken up by mechanical excavating equipment, including a heavy tractor equipped with a rooter, but which necessitates the use of pneumatic tools or blasting for its loosening and removal. Rock excavation shall also include detached boulders exceeding one half of a cubic metre in volume.

- Common excavation shall include all material other than rock as defined above and also detached boulders less than one half of a cubic metre in volume.

No material, except the aforesaid, will be defined as rock and classified as such for the purpose of payment, whether actually loosened by blasting, pneumatic tools or otherwise.

The decision as to the classification of any excavation into "rock" or "common" shall be at the sole discretion of the Engineer's Representative, subject only to Clause 2 of the General Conditions of Contract.

Where specific items for Rock Excavation are included in the Bill of Quantities, the Contractor shall not be entitled to be paid for excavation in rock unless, at the time the excavation is open and visible, the Contractor shall give notice in writing to the Engineer's Representative that he claims to be paid for excavation in rock. After giving such notice the Contractor shall not fill in the excavation or otherwise prevent it from being inspected by the Engineer's Representative for the purpose of classification and determination of payline in respect of same.

201.1.3 Natural Ground Levels

The natural ground levels, as marked on the Drawings, shall form the basis of measurement for payment for excavation, fill and all other works where the site levels have bearing and no field surveys will be made. Natural ground levels at intermediate points shall be checked on the field by the Contractor.

The Contractor shall check the natural ground levels before the commencement of earthworks, and such checking shall be made by the Contractor at his own expense, in the presence of the Engineer. The results, approvals in writing by the Engineer, shall thereafter prevail.

The cost of checking natural ground levels shall be borne by the Contractor alone, whether checking is carried out at the Engineer's request or at the Contractor's own request. No allowance will be made for normal bulking or shrinking of the soil and the Contractor shall make allowance for this in his rates.

201.1.4 Dewatering, Supporting and Fencing of Excavations

The Contractor shall, during the whole period of construction, keep the work area and all excavations dry and protected from the influx of water from any source whatsoever (rain and seepage water, water from surface and subsurface streams, groundwater, etc.) and shall provide and operate all pipes, pumps, well points and other apparatus and materials and all labour required for this purpose. The Contractor shall, throughout the period of construction, prevent structures and/or pipelines from flotation either by keeping the work area dry or by temporarily filling the structure and/or pipeline with water, all as approved by the Engineer.

The provisions that the Contractor shall make for the discharge of any water from the Site of the Works shall be satisfactory to the Engineer and to any persons or authorities having rights over the lands through which such water is discharged. The Contractor shall keep the Employer indemnified against any claim or damage that may be caused by non-compliance with the requirements.

The sides of excavations shall be supported whenever necessary or directed by the Engineer's Representative by means of timber, steel or other type of struts, walling, boards, sheeting or any other approved system. No support work shall be removed without the approval of the Engineer.

Every precaution shall be taken by the Contractor against slips, falls, or subsidence in the excavations, but if any slips, falls, or subsidence should occur the Contractor must at once make good the same including all surface restoration and reinstatement, all at his own cost. Should any such fall, slip or subsidence disturb or weaken any foundation or support to the Works or to any adjacent structure or facility, or create empty spaces and gaps near the new works, the Contractor shall carry out such additional works as the Engineer may require in consequence thereof, such as filling the gaps so caused with concrete or other suitable material as the Engineer may direct, all at the Contractor's own expense.

Steel sheet piling may be used by the Contractor in his supporting, bracing and dewatering operations, as specified above, of his own choice or at the direction of the Engineer, or where shown on the Drawings as a permanent part of a structure. The sizes and types of sheet piles used for temporary supporting and bracing shall be determined by the Contractor but will be subject to the Engineer's approval. Where sheet piles form a permanent part of a structure, their sizes and types shall be as shown on the Drawings or as directed by the Engineer.

The Contractor shall take all the necessary precautions during the excavation to protect his workmen and the publics. This may include, but shall not be limited to the supporting of the sides of the excavations, fencing the areas, providing warning lights and providing watchmen.

The Contractor shall be entirely responsible for the proper dewatering, supporting, fencing, lighting, watching, etc. of excavations, trenches and pits and shall not be relieved of his responsibilities under the Contract even though no objection has been raised by the Engineer to the conditions of the work.

Unless specific items are included in the Bill of Quantities, the cost of dewatering, supporting, bracing and timbering (including steel sheet piles), fencing, lighting, watching, etc. of excavations, trenches and pits and any extra earthworks and labour, materials and apparatus required for them shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

201.1.5 Use of Explosives

The Contractor shall use explosives only with the written express permission of the Engineer's Representative and related legal authority and all blasting shall be carried out by properly licensed and qualified workmen under experienced supervision. When using explosives, the Contractor shall abide by and conform to all the Laws pertaining to the

purchase, transportation, storage and handling of explosives and shall obtain all required licences from and make all necessary arrangements with the relevant authorities prior to commencing blasting operations.

When blasting operations are in progress, all precautions shall be taken to protect all persons and livestock, the Works, and any other property from injury or damage.

The Engineer's Representative shall have the power to regulate, restrict or prohibit blasting if in his opinion it is necessary to do so for the safety of persons or property, or to safeguard the foundations or sides of the excavation, and the Contractor shall have no claim against the Employer in respect of such regulations or prohibitions. Explosives shall not be used within 20 metres or any other distance as the Engineer's Representative may direct, of concrete in permanent structures.

Notwithstanding anything said in this Sub-Section, the Contractor shall be held solely and entirely responsible for any injuries to persons and livestock and damage to public or private property.

201.1.6 Programme and Methods of Work

In addition to the information furnished by the Contractor with his Tender, the Contractor shall, after award of Contract but no later than two weeks prior to commencement of Works, submit for the Engineer's approval detailed proposed methods of excavating, transporting and placing earthfill material, watering and compacting and any subsequent modifications thereof, together with a detailed list of quantities and type of plant to be used for all these operations. Amendments shall be made by the Contractor in accordance with any instructions issued by the Engineer before commencement of works and from time to time.

201.1.7 Excavated Materials - Handling and Disposal

As far as practicable and as determined by the Engineer's Representative, all suitable materials from excavations shall be used in the permanent construction required under the Contract.

The Contractor's operations in excavations shall be such as to yield the maximum of suitable materials for construction purposes, and shall be subject to the approval of the Engineer's Representative. Where practicable, and as determined by the Engineer's Representative, suitable materials shall be excavated separately from those considered unsuitable, and the suitable materials shall be segregated by loads during the excavation operations and shall be placed in the designated final locations either directly from the excavation, or shall be placed in temporary stockpiles for later placing in the designated locations, all as directed by the Engineer's Representative.

Excavated materials that are considered unsuitable or are in excess of those required for permanent construction, shall be removed from the Site. The Contractor shall be entirely responsible for the removal of all surplus excavated material from the Site to such disposal areas as he shall have obtained at his own cost and responsibility and shall keep the Employer indemnified against any claims, charges or proceedings arising out of the transportation and disposal of such surplus excavated material.

Spoil heaps shall be located where they will not interfere with the progress of the Works, or with the flow of water in natural streams or drainage courses, and where they will neither detract from the appearance of the completed project and environment, nor interfere with access to the structures. Spoil heaps shall be levelled and trimmed to reasonable regular lines, as determined by the Engineer's Representative.

The cost of complying with all requirements of this Sub-Section shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

201.1.8 Earthworks in Urban Areas (Not Applicable)

201.1.9 Restoration of Waterways and Pipelines

The Contractor shall clean out and restore to their original condition all waterways or pipelines which may have been cut by the excavation or in any way damaged or silted up as a result of his operations.

Unless specific items are provided in the Bill of Quantities the cost of all additional work involved in crossing under or cutting through any waterways and pipelines and reinstating to their original condition shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

201.1.10 Restoration of Surfaces

The Contractor shall be responsible for the temporary and permanent restoration of all surfaces of roads, fields, paths, gardens, verges etc. whether public or private which are affected by his operations.

Temporary restoration shall be carried out immediately after the excavations have been refilled by returning the excavated material to the position from which it was removed and adding such suitable materials as may be required and consolidating the various materials as the work proceeds in order to provide a surface that is adequate for the purpose that the original surface fulfilled. Temporary surfaces shall be maintained in a condition satisfactory to the Engineer and responsible Authority until the permanent reinstatement is made.

The Contractor shall be responsible for the permanent reinstatement of all surfaces already described including asphalt surfaced public roads as specified in Section 201.3.11.

Should, at any time, any trench become dangerous, the Engineer will be at liberty to call upon the Contractor to restore it to a proper condition at three hours notice and, should the Contractor fail to carry out the work, have it done at the Contractor's expense.

The Contractor shall include in his rates for all materials and labour which he may have to employ in reinstating the trenches and surfaces to the satisfaction of the responsible Authority concerned.

Restoration shall be deemed to be included by the Contractor in his various unit rates for earthworks and shall not be paid for separately, except where specific items have been provided in the Bill of Quantities.

201.1.11 Equipment for Earthworks

Generally, equipment for earthworks, shall be of a modern type and of a design suited for each specific purpose. Only equipment and machinery approved by the Engineer shall be used in the Works.

Grading equipment shall be of any type of earthmoving equipment the Contractor may desire or has at his disposal, provided the equipment is in a satisfactory condition and of such capacity that the programme can be maintained. The Contractor shall furnish, operate and maintain such equipment as is necessary to control uniform layers, section and smoothness of grade for compaction and drainage.

Compacting equipment shall be of a design, weight and quantity so as to obtain the required density.

Pneumatic Roller shall consist of pneumatic tires arranged in a manner so as to provide a satisfactory compacting unit. The roller shall have an effective rolling width of at least 150 cm. and shall give a compression of at least 130 kg. per cm. of width of tread when fully loaded. The tires shall be uniformly inflated.

Smooth Roller shall be self-propelled or power roller and shall weigh at least 10 tons and may be of the tandem or three-wheel type. The wheels of the roller shall be equipped with adjustable scrapers.

Other equipment, such as vibrating machines, may be used for compacting and consolidating the embankments, subgrades, and other areas, upon approval of the Engineer. Such equipment shall be routed over the area being compacted and shall be operated until the required density is obtained.

Watering shall be carried out by means of tank wagons, tank trucks, or distributors equipped with a suitable sprinkling device. Satisfactory equipment shall be maintained on the site at all times when embankment construction is in progress.

201.2 Clearing and Stripping

201.2.1 Clearing

The areas upon which new construction is to take place, the rights-of-way along which pipelines are to be laid and all other such areas as may be designated by the Engineer and/or indicated on drawings as required for auxiliary purposes, (site offices and workshops, transport and machinery yards, borrow pits, stockpile sites, etc.), shall be cleared of all vegetation, shrubs and small and large trees, together with their roots, and from all other foreign and deleterious matter that may affect and interfere with the progress of the Works.

Trees and shrubs shall be cut or burnt down under strict control to ground level, the roots grubbed up to a depth of not less than 1.0m and removed from the area. All other scrub, vegetation, rubbish, etc., shall be cleared or burnt down to ground level and removed from the area to any distance.

All trees shall remain the property of the Employer and the Contractor shall collect these trees and store them until required by the Employer. All trees near to and about the Works except such as are to be removed, shall be carefully protected from damage by the Contractor during the period of maintenance and no trees shall be removed without the prior consent of the Engineer.

The Contractor shall take particular care at all times to prevent erosion on every site and elsewhere on land which may be affected by his operations and the Engineer may impose such reasonable limitations and restrictions upon the method of clearance and upon the timing and season of the year when clearance is carried out as the circumstances seem to him to warrant.

Unless otherwise specified in the Contract, clearing shall be measured by square meters. The unit rate shall include for all operations required under this Sub-Section, including removal of trees (see also Sub-Section 201.2.2 hereafter).

No clearing shall be carried out without prior written approval of the Engineer's Representative and only such areas approved or ordered to be cleared shall be measured and paid for.

201.2.2 Removal of Trees

Clearing as defined in Sub-Section 201.2.1 shall include the removal of small and of large trees. Trees of a girth of 40 cms. or less when measured at a height of 1.0m above ground shall be classified as small trees. Trees of a girth exceeding 40 cms when measured at a height of 1.0m above ground shall be classified as large trees and shall be removed only at the express order of the Engineer's Representative.

The removal of large trees, except where a specific item is provided in the Bill of Quantities, and the removal of small trees will be deemed to be included in Clearing and will not be paid for separately.

Where a specific item is included in the Bill of Quantities for the removal of large trees, they will be measured for payment by number.

201.2.3 Stripping

Areas on which compacted fill is to be placed and areas of excavations from which material for fill is to be extracted, including borrow areas, shall be stripped of top soil containing organic or otherwise deleterious and objectionable matter to a depth of at least 15 cm. or to such greater depth as may be determined by the Engineer. The stripped soil shall be stored in separate dumps for subsequent re-use in covering the slopes of embankments or the borrow areas after excavation therein has been finished, or shall be otherwise disposed of as directed. Under no circumstances shall such stripped material be used as compacted fill.

Stripping shall not be carried out unless the Contractor is able to proceed immediately with the further earthworks upon the stripped areas. Overstripping shall be backfilled and compacted, at the Contractor's own expense, to the satisfaction of the Engineer.

Stripping shall be measured in cubic metres, computed by multiplying the area stripped by the depth of stripping. The unit rate shall include for all excavation, stacking-re-spreading and running excess to spoil.

No stripping shall be carried out without prior written approval of the Engineer's Representative and only such areas approved or ordered to be stripped shall be measured and paid for.

Unless otherwise specified, stripping of borrow areas shall not be measured for payment and the cost of such stripping shall be deemed to be included by the Contractor in his unit rates for earthwork in the Bill of Quantities.

201.3 Excavation and Backfill for Pipelines

201.3.1 Surface Excavation to Reduce Levels

Where shown on the Drawings or required or approved by the Engineer, the Contractor shall execute surface excavation in advance of trench excavation, to the lines and grades shown on the Drawings or ordered by the Engineer.

Any surface excavation not shown on the drawings and not ordered by the Engineer that the Contractor may wish to execute for the convenience of his work shall be subject to the Engineer's approval, but shall be done entirely at the Contractor's expense.

Surface excavation shall be measured in cubic metres according to the dimensions, lines and levels shown on the Drawings or directed by the Engineer. The unit rate shall include also for hauling the excavated material to fill areas, at any distance, and spreading them in layers of thickness not exceeding 20 cm. after compaction and disposal of the surplus material, all in accordance with the Drawings or as directed by the Engineer.

201.3.2Trench Excavation for Pipelines

Pipe trenches shall be excavated to the typical cross-sections shown on the Drawings, and in no case shall the trench width up to the level specified exceed that shown on the Drawings. The Contractor shall ensure that at any point the width of the pipe trench is sufficient to permit the pipeline to be laid, jointed, bedded/surrounded and backfilling to be placed and compacted around the pipeline to the Engineer's satisfaction.

The trench invert shall, at any location, be at the proper level and trench width of the proper dimensions to allow for sand and/or concrete bedding or surrounds as shown on the Drawings and directed by the Engineer. Where pipes are laid directly on the bottom of the trench, the latter shall be straight and even so as to provide a good support for the pipe over its entire length and shall be free of roots, stones, lumps and other hard objects that may injure the pipe or its coating.

Where welding or jointing of pipes and/or accessories is required to be done in the trench, the same shall be widened and/or deepened to form bell-holes of sufficient size as directed by the Engineer's Representative so as to easily permit

the proper execution of all welding, connecting and fixing works in all their stages, all necessary repairs to the pipe and coating, and for the thorough inspection of all these operations.

The length of trench to be kept open at one time shall be determined by the Engineer and shall in no case be exceeded. Should there by any danger that trenches may erode, then sections shall be left unexcavated for as long as possible and the laying and backfilling of pipelines shall follow excavation as soon as possible.

The excavated material shall be placed alongside the trench in such a manner as not to interfere with the work and to prevent its falling into same.

Should any part of a trench be excavated, in error, deeper than required, the extra depth shall be filled up with concrete, solely at the Contractor's expense.

Trench formations shall be in undisturbed ground. Where in the opinion of the Engineer, the formation is unsuitable for bearing, extra excavation shall be carried out under the direction of the Engineer and the level made up again with sound soil material carefully compacted or with concrete. This work shall be paid for by the Employer provided that the unsuitability of the formation is not due to the method of working of the Contractor, in which case the Contractor shall carry out the work at his own expense.

Trench walls excavated in rock shall be as nearly vertical as possible, and the Contractor shall consolidate the walls wherever they have been loosened by blasting or other reasons, and shall remove all loosened material. If rock occurs at a level higher than the required level of the trench bottom, the clearance between the pipe and the trench sides and bottom shall, where in rock, be made to the dimensions shown on the Drawings or directed by the Engineer, to allow for sand or concrete bedding or surround.

In confined areas, where the passage of excavating equipment is impossible, or where the Engineer's Representative deems the use of such equipment impracticable or undesirable for any reason whatsoever, trench excavation shall be done by hand. All requirements specified above shall apply to trench excavation by hand. No extra payment shall be made for works in confined areas. All excavation, whether in confined or unconfined areas, shall be paid for at uniform rates as specified hereafter.

If, in the opinion of the Engineer, there is undue delay in testing the pipelines; removing surplus material; general tidying up of areas where pipes have been laid; partial restoration of maintenance of surfaces; or similar operations, then the Engineer may order that no further trenches shall be opened until the outstanding work has been carried out to his satisfaction and the Contractor shall have no ground for a claim against the Employer on this account.

No work will be started on the laying of pipes or bedding in any section of trench, until the trench formation of that particular section has been approved by the Engineer.

Once the pipeline section has been tested and the bedding and surround approved by the Engineer, the trenches shall be backfilled by layers as specified hereafter. Each layer shall be separately compacted and any subsidence resulting from insufficient compaction shall be the Contractor's liability and he shall forthwith add the necessary extra material which shall then be thoroughly compacted.

Unless otherwise specified, items for trench excavation shall apply to all kinds of soil, including rock, and the excavation will be measured for payment in linear metres measured along the centreline of the pipeline, classified by pipe diameter and for each section by average depth to invert of pipes. The average depth of a section shall be the average between adjacent manholes or as directed by the Engineer's Representative. The cost of trench excavation shall be deemed to include for excavation, drilling and blasting, to the required width and depth to underside of pipe barrel, finishing the trench bottom as specified, digging boreholes where required, removing excavated material and storing it alongside the trench for backfilling whenever permitted, removal of material that may result from land slides, removal of loosened earth or rock, removal and disposal of all excess spoil to any distance, timbering and dewatering as and where required if no specific items have been provided in the Bill of Quantities.

201.3.3General Backfill

The excavated material or selected material which can be classified as suitable for backfilling shall be in accordance with the requirements of Section 201.5.

Where necessary, excavated material shall be sieved or sorted to remove large stones, rocks, or other particles which, in the opinion of the Engineer's Representative, may impede compaction.

201.3.4 Type A Fill

Type A fill shall be good hard well graded material screened and crushed as necessary to lie within the grading envelope given in Table 1.1. The material shall have a CBR greater than 25%.

The liquid limit should not be more than 25% and the plasticity index should not exceed 6%.

The minimum value of the sand equivalent should be 50%. The maximum value of abrasion test should be 40%.

Table 1.1: Grading Envelope for Type A Fill

Sieve Size	% by Mass Passing
75 mm	100
37.5 mm	85 - 100
10 mm	45 - 100
5 mm	20 - 65
600 microns	8 - 45
75 microns	20

201.3.5 Type B Fill

Type B fill shall be clean hard fill free from deleterious material and free from stones greater than 150mm in size. The material shall have a CBR greater than 15%. The liquid limit should not be more than 40% and the plasticity index should not exceed 10%.

201.3.6 Hardcore

Hardcore shall consist of broken stone or other suitable hard material. It shall be free from clay, dust or other deleterious matter, shall not contain pieces exceeding 100mm and not more than 5% of the material shall pass through a 20mm sieve.

201.3.7 Beddings and Surrounds - Sand and Granular Material

(i) Sand Bedding and Surrounds for Concrete, A.C. and Metal Pipes -

Where shown on Drawings, pipes shall be laid in sand bedding or surround.

The bedding and surrounds material shall be fine, uniformly graded sand (sand comply with BS 882 grading zone c), clean and free of stones, rubbish, clay or organic matter. Free draining, incompressible, fine granular material may be used instead of sand, subject to written approval of the Engineer.

The beddings and surrounds up to 30 cm above the pipe shall be wetted and thoroughly compacted in layers not exceeding 15 cm in thickness after compaction. Special care shall be taken to obtain proper compaction under and around the pipe.

Sand beddings and surrounds at any depth shall be measured in linear metres of trench in which surround has been placed, classified by diameter of pipe. The unit rates inserted in the Bill of Quantities for surrounds shall include the additional excavation in trench bottom, supplying the necessary materials, spreading, levelling and compacting the materials.

(ii) Granular Material Beddings and Surrounds for P.V.C. and G.R.P. Pipes

All P.V.C. and G.R.P. pipes shall be laid in suitable granular material bedding or surround. Suitable bedding and surround material shall be broken stone or gravel from 3/8" (9.5 mm) to 3/16" (4.8 mm) size, sand (as specified in Section 201.3.7(a)) or other material having a compaction factor not exceeding 0.1. The compaction factor shall be obtained by the following test:

Equipment

1. Open-ended cylinder 225 mm long and 150 mm internal diameter (a pitch fibre or P.V.C. pipe is suitable).
2. Metal rammer with striking face 40 mm diameter and weighing 0.9 to 1.1 kg.
3. Rule.

Method

Obtain a representative sample more than sufficient to fill the cylinder viz. about 11.5 kg. It is important that the moisture content of the sample should not differ materially from that of the main body of material at the time of its use in the trench.

Place the cylinder on a firm surface and gently pour the sample material into it, loosely and without tamping. Strike off the top surface level with the top of the cylinder and removal all surplus spilled material. Lift the cylinder up clear of its contents and place on a fresh area of flat surface. Place about one-quarter of the material back in the cylinder and tamp vigorously until no further compaction can be obtained. Repeat with the second quarter, tamping as before, and so on for the third and fourth quarters, tamping the final surface as level as possible.

Measure from the top of the cylinder to the surface of the compacted material. This distance divided by the height of the cylinder (255 mm) is referred to as the Compaction Factor.

Interpretation of Values

Compaction Factor	Suitability for Use
0.1 or less	Material suitable
Over 0.1	Material unsuitable

For each batch of material, three (3) Compaction Factor tests shall be made and the average value used. Material sufficient for the surround of two hundred linear metres of pipe shall be considered to comprise one batch.

The granular material bedding and surround shall be wetted and thoroughly hand-tamped in layers not exceeding 15 cm in thickness after compaction. Special care shall be taken to obtain proper compaction under and around the pipe.

Granular material beddings and surrounds for pipes, at any depth, shall be measured for payment in linear metres of pipe, classified by diameter. The rates shall include additional excavation in trench bottom, supplying the necessary material, spreading, levelling, compacting and carrying out Compaction Factor tests.

201.3.8 Beddings and Surrounds - Concrete

Where required, pipes shall be bedded on or surrounded by concrete, to the dimensions, lines and levels shown on the Drawings or determined by the Engineer. All concrete used for bedding and surround of pipelines shall comply, in all respects, with the provisions of Division 202 hereafter. Plain concrete and reinforced concrete shall be of Grade C20P.

Pipes shall be supported and jointed at the correct level, clear of the trench bottom upon two blocks of precast concrete of suitable height, each supporting one end of the pipe. Concrete shall then be poured and rammed beneath and around the pipes in one operation and finished off to the level and dimensions shown on the drawings.

The precast blocks shall first be properly set on the trench bottom and boned to the correct position and level. The pipes shall then be laid on the blocks and properly centred, socketed and finally brought to the correct gradient by the application of wooden wedges one on each side of the pipe and between the pipe and the concrete blocks. These wedges shall remain left-in whilst the pipes are jointed and tested, as herein specified and during the pouring of the concrete beneath and around the pipes. Where the concrete while being poured would otherwise cause the pipes to float, pipes shall be effectively anchored to prevent such flotation.

The Contractor may, according to his own choice, pour concrete either with or without forms. Whatever the Contractor chooses; the concrete for payments shall be measured as per Drawings and no extras shall be paid for dimensions in excess of those required according to the Drawings.

Concrete beddings and surrounds shall be measured for payment in linear metres, classified according to diameter of pipe and according to type of bedding and surround. The rates shall be valid for any depth and shall include all additional excavation in trench bottom, concrete, reinforcement, formwork, materials, labour, etc.

201.3.9 Backfilling of Pipe Trenches

Backfilling of pipe trenches (except at joints) shall be done as soon as practicable after the pipes have been satisfactorily laid in position and jointed and in no case shall more than five pipe lengths be left uncovered after laying. Where shown on Drawings, the first stage of the backfill, up to 30 cm above the crown of the pipe, shall consist of selected material. Selected material shall be granular, free from stones, rubbish, clay and organic matter. It shall be free-draining and readily compactable. This backfill shall be spread in layers not exceeding 15 cm in thickness after compaction, and compacted at least to 92% of modified A.A.S.H.T.O. density as defined in Part 2 Section 201.7.

The remainder of the pipe trench (from 30 cm above the crown of the pipe to the sub-base coarse of the road or to the top of the trench) shall be backfilled, after the completion of testing, by one of the following methods:

(i) Where the pipeline crosses or runs underneath roads or pavements, backfilling shall be of type B, type A will be used when directed by the Engineer or shown on the Drawings, and shall be placed in layers not exceeding 15 cm after compaction, wetted as necessary and compacted at least 90% of modified A.A.S.H.T.O. and the last 60 cm below the road sub-base course shall be compacted at least 95% of modified A.A.S.H.T.O. density as defined in Section 201.7.

(ii) In open areas, where the requirements of para. (a) do not apply, the second stage backfill may be done with excavated material dumped into the trench by means of a bulldozer or similar equipment, provided that the fill material does not contain any large stones, that the trench is completely filled without leaving any voids, and the fill is finished with a neat mound raised to about 30 cm above the trench edges to allow for future subsidence.

All joints and other accessories shall be left uncovered until after the pipeline shall have passed any pressure or leakage tests that may be prescribed by the Specification.

Where the backfill cover over the pipes is less than 70 cm, the travel of the tracks or wheels of heavy equipment thereon will be strictly prohibited, and the Contractor shall use suitable small compactor, and shall be responsible for any damage caused to the pipe by non-compliance with this requirement.

The Contractor shall be responsible for any subsidence of trench backfill and shall make good any damage to road or structures caused thereby during the Period of Maintenance.

Where lengths of trench are excavated partly in rock, stony ground, or in other material unsuitable for backfilling, there may not be sufficient suitable material available from the excavation for backfilling as specified above and in such cases the Contractor shall transport suitable material from other parts of the work or from borrow areas.

The Contractor shall make arrangements for sites for tipping the spoil and shall include in his rates for excavation the cost of haulage and tipping of spoil and all expenses in connection with the obtaining of suitable backfilling material.

Backfilling of pipe trenches will be measured for payment in linear metres along the centreline of the pipeline, classified by pipe diameter and for each section by average depth to the top of surrounds material which is placed to 30 cm above the top of the pipe. The average depth of a section shall be the average between adjacent manholes in case of gravity pipelines, and the average between adjacent stations in case of pressure pipelines. The cost of trench backfilling shall be deemed to include supplying of material and compaction in layers not exceeding 15 cm after compaction.

201.3.10 Cased Borings

Where shown on the Drawings or instructed by the Engineer, pipes shall be installed in casings inserted into horizontal borings across embankments at existing installations or in road crossings. The casing pipe shall be of sufficient strength to withstand the forces acting on it during insertion in the bore and the external pressure of the earth, and shall have a nominal diameter as shown on Drawings but at least 6" larger than that of the line pipe. Where the soil is sufficiently cohesive and stable, the casing may be pushed into a bore previously drilled through the embankment to a diameter slightly larger (by 2-3 cm) than the external diameter of the casing. Where the nature of the soil does not permit such a procedure, the casing shall be jacked through the embankment or under the road with simultaneous drilling and removing the material from the interior of the casing pipe. In both cases, the casing pipe may be inserted in successive sections welded to each other as the work proceeds. The Contractor shall choose the most suitable and efficient method for drilling and casing and shall submit the procedure proposed by him for the Engineer's approval. Drilling and casing shall be done at the exact locations and to the lines and grades shown on the drawings or determined by the Engineer. After the casing has been installed in position and approved by the Engineer, the line pipe shall be installed therein. To protect the line pipe and especially its coating against abrasion and other injury or damage during installation and thereafter, the Contractor shall use specially designed spacers of timber or plastic or shall produce such spacers. The distances between spacers of either kind shall not exceed 3.00 m. After the line pipe has been installed in its final position, the annular space at each end of the casing shall be filled with a mixture of bitumen and sand to seal off the interior of the casing against the entry of water, mud, small animals, vermin and other foreign bodies.

Cased borings shall be measured, separately for each diameter of casing, in linear metres by the actual length of cased boring through embankment as approved by the Engineer.

The unit rates for cased borings shall include: open-cut excavation and preparation of work area at both ends of boring, drilling through embankment, supply of casing pipe, welding of casing pipe sections, inserting of casing pipe in bore, installation line pipe in casings, supply and placing of spacers and sealing of openings at the ends, supply, transport and removal from Site of boring equipment and backfill of open-cut excavation connected with boring.

201.3.11 Road Reinstatement

a) Cutting into Paved Areas

Where pipes have to be laid under existing paved areas such as roads or sidewalks, cutting into the pavement shall be done with appropriate tools, to ensure straight and neat cuts. The

trench shall be vertical and its width across the top edges shall not exceed the following values:

MAXIMUM WIDTH OF THE TRENCHES AT THE TOP IN PAVED AREAS
(IN m)

Depth of trench from paved surface to pipe invert (m)	Maximum width of trench at the top in paved areas (m)
≤ 1.50	O.D(*) + 0.55
1.51 - 2.50	O.D(*) + 0.85
2.51 - 3.50	O.D(*) + 1.15
3.51 - 4.50	O.D(*) + 1.45
4.51 - 5.50	O.D(*) + 1.85
5.51 - 6.50	O.D(*) + 2.25
6.51 - 7.50	O.D(*) + 3.00

(*)O.D = Outer diameter of pipe barrel.

The Contractor shall take all necessary measures, such as shoring, bracing, etc. to keep the width of the trenches within the limits given in the table.

Cutting into paved areas will be measured for payment in linear metres of cut pavement.

b) Reinstatement of Surfaces

All surfaces whether public or private which are affected by the Works shall be reinstated in two stages, the first stage shall be carried-out in the first instance, and when the ground has consolidated fully the Contractor shall proceed with the second stage at the order of the Engineer.

First stage and second stage reinstatement of all surfaces, affected by the operations of the Contractor shall be carried out and maintained to the satisfaction of the Engineer and the responsible authority or owner.

First stage reinstatement shall be carried out immediately the trenches are backfilled.

Second stage reinstatement shall not be carried out until the ground has consolidated completely. The Contractor shall inform the Engineer before carrying out this work. In the event of further settlement occurring after the completion of the second stage reinstatement the Contractor shall forthwith make good the reinstatement to the approval of the Engineer or responsible authority.

For the purposes of first and second stage reinstatement in bitumen and surfaced roads the surface width of trenches shall be increased by recutting 15cm on each side of the trench for a depth of 8 cm to provide a solid abutment for the surfacing material.

Reinstatement of surfaced roads shall be carried out to the approval of the relevant authority.

The responsible authority shall have the right to carry out final reinstatement at the Contractors expense.

Trenches in open ground shall be reinstated to the condition in which the ground was before excavation was commenced. The final surface of the trench shall be flush with the surrounding ground.

In verges and other grass surfaces and after the backfilling has been thoroughly consolidated the topsoil shall be relaid rolled and planted with grass or other vegetation as-directed by the Engineer as may be necessary and watered until the

grass has become well established. Should the planting fail it shall be replanted as required until a satisfactory growth is obtained.

If at any time any reinstatement deteriorates the Contractor, shall restore it to a proper condition immediately.

Should the Contractor not remedy the defect to the Engineer's satisfaction forthwith any remedial work considered necessary may be undertaken by the Employer and/or the responsible authority at the Contractor's expense.

All trees, shrubs and plants shall be carefully transplanted and shall be returned to their original location after the refilling of the excavations. Return of old or mature trees may be waived in cases where the age of the tree makes return impracticable.

Top soil shall be carefully set aside and replaced at the surface of the backfilling.

The trenches shall be refilled and rammed solid as specified in the Contract and shall not be topped up above the original surface level to allow for settlement.

If any trench becomes dangerous the Engineer may call upon the Contractor for its reinstatement at three hours' notice and failing this to have the work done by others at the Contractor's expense.

c) Safety of Excavation in Roads

Where the surface of the road (other than that which lies immediately above the trench) is damaged either by the concentration of traffic caused by an open trench, by subsidence or other causes arising from the operations of the Contractor, he shall permanently reinstate the whole of the surface so damaged to its original condition.

The Contractor shall ensure that trenches and reinstatement are maintained in a safe condition and shall take immediate action to remedy any deterioration which renders the works unsafe. If in the opinion of the Engineer any excavation or reinstatement is in a dangerous condition the Contractor shall immediately remedy the defect. Should the Contractor fail to carry at the reinstatement promptly the work may be carried out by others at the Contractor's expense.

d) First Stage Reinstatement

In all paved roads the trenches shall be refilled and compacted to the underside of the sub-base layer of the road at 48 cm below the road finished level.

A sub-base layer of 20 cm thick shall then be laid consisting of approved free draining granular material conforming to section 218.1.3 requirements.

A base layer of 20 cm thick shall then be laid consisting of approved crushed limestone material conforming to section 218.1.3 requirements.

Prior to application of the first stage reinstatement the surface of the road foundation shall be cleared of all dust, debris and other deleterious matter and shall then be primed with one application of prime coat MC-70 or similar approved. All joints with adjacent road surfacing shall be cut straight and vertical and primed.

The road surfacing of the first stage consists of 5 cm thick of finished asphalted concrete layer.

The surface shall be maintained with the end of the period of Maintenance or until instructions are given for the final reinstatement to be carried out.

f) Reinstatement of unmade roads

In all unmade roads the trenches shall be refilled and compacted as specified in the Contract to within 15 cm of the surface.

The trench shall be surfaced with 15 cm compacted thickness of base layer material as specified above.

The surface shall be maintained until the end of the Period of Maintenance and shall not be topped up above the level of the original surface to allow for settlement.

e) Second Stage Reinstatement

Second and final reinstatement consists of a wearing course of 4 cm compacted thickness of 14 mm nominal size dense wearing course macadam. The laying and finishing of the coated macadam shall be carried out so as to achieve a dense, smooth and even surface using a roller of not less than 12 tonnes mass.

201.4 Excavation for Ponds and Canals

Excavation for ponds and canals shall be carried out and finished to the lines, grades and dimensions shown on the Drawings and to the tolerances specified hereafter.

Excavated material shall be used for earthfill in embankments and in other locations, as shown on Drawings, except for material rejected by the Engineer as unsuitable, which shall be run to spoil. Under this Section, suitable material shall be excavated, moved to fill areas, dumped and spread, as specified. The Engineer shall be entitled to designate the earthfill where individual loads of material shall be deposited.

The Contractor shall take all necessary precautions to prevent excavation beyond and below the lines and levels indicated on Drawings. Any damage to the work due to the Contractor's operations, including shattering of the material beyond the required depths and lines, shall be made good by the Contractor at his own expense. Any and all excess excavation for the convenience of the Contractor or any overexcavation performed by the Contractor for any purpose or reason, except as may be directed by the Engineer in writing, shall be at the expense of the Contractor. Where required to complete the work, all excess excavation and

overexcavation shall be refilled, consolidated and made good with materials provided by the Contractor at his own expense, as directed by the Engineer's Representative.

Unless otherwise specified, items for excavation for ponds and canals shall equally apply to all kinds of soil, including rock, and excavation shall be measured by cubic metres of excavated material, to the lines and levels shown on the Drawings or as directed by the Engineer. The unit rate shall include for excavation, drilling and blasting, stacking, hauling excavated material in fill areas, and disposal of spoil material, all as specified in this Section.

201.5 Excavation and Backfill for Structures

All excavation for structures shall be carried out to the dimensions, lines and grades shown on the Drawings or directed by the Engineer.

Excavations on or against which concrete or compacted fill is to be placed, shall be clean and free from stones, clods, debris and other loose material. Where the bottom of an excavation does not provide a solid basis for casting concrete, it shall be consolidated by tamping and/or watering as necessary until the required density is obtained.

Any over-excavation in the bottom of the structure shall be cleaned and backfilled with concrete or selected backfill compacted to the density of the adjacent natural soil. Over-excavation in rock shall be backfilled with the concrete of the structure or with dry stone pack, as directed by the Engineer. Any and all excess excavation for the convenience of the Contractor for any purpose or reason, except as may be directed by the Engineer in writing, and all refilling of such over-excavation as specified, shall be at the expense of the Contractor.

Where possible, concrete foundations and blocks shall be cast against the undisturbed sides of the excavation. Where over-excavation beyond the lines of the structure is unavoidable due to the nature of the ground, because of the shape of the structure or for any other reason, the space between the structure and the faces of the excavation shall be backfilled to the original ground level (whether natural or reduced) as specified hereafter for backfilling.

Excavated material, to the extent that it is required and suitable, shall be put aside for use in backfill. Surplus excavated material shall be either used for backfill in other locations on the site, or shall be otherwise disposed. Wherever required, the Contractor shall obtain suitable material for compacted backfill from borrow areas.

Backfill shall be carried out to the lines and grades shown on the Drawings. The backfill material shall be placed in horizontal layers not exceeding 15 cm in thickness after compaction. The backfill material shall completely and firmly fill the spaces between the excavation lines and the structure without leaving any voids, and shall be compacted to the density of the adjacent natural earth. The sides and bottom of the excavation shall be moistened before backfilling and so shall the backfill material, in order to obtain the moisture content necessary for the required compaction. Every layer shall be compacted by pneumatic tampers approved by the Engineer.

Unless otherwise specified, items for excavation and backfill for structures shall equally apply to all kinds of soil, including rock.

Excavation shall be measured by cubic metres to the neat lines and dimensions of the structures, as shown on the Drawings or described in the Specification, with no allowance
whatsoever so actual side-slopes, working space, etc. The unit rates for excavation shall include for excavation, drilling and blasting, stacking, hauling of excavated material to any distance, spreading and compacting and running surplus to spoil.

Backfill will be measured for payment by cubic metres, and the unit rates for backfill shall include for supplying of material, spreading and compaction of material in layers not exceeding 15 cm after compaction.

201.6 Excavation from Borrow Areas

Wherever required or directed by the Engineer, the Contractor shall obtain suitable material for compacted fill from borrow areas. Such suitable borrow material shall be excavated, moved to fill areas and spared as specified. The locations and boundaries of the borrow areas as well as the depths and slopes of excavation therein shall be as determined or approved by the Engineer's Representative. Before commencing to extract filling material from any borrow area, the Contractor shall strip its surface as specified in Sub-Section 201.2.3 above and shall also remove therefrom all material which is, in the Engineer's opinion, unsuitable for filling. The surface of the borrow shall be left in a reasonably smooth and even condition, as approved by the Engineer's Representative.

No excess borrow material shall be brought to fill areas. Unnecessary material shall be rejected and dumped and shall not be measured for payment.

Measurement for payment of excavation in borrow areas shall be made only for excavation of borrow material actually used as fill, to the lines and dimensions prescribed by the Engineer's Representative. Measurement shall be by cubic metres and the unit rate shall include for stripping (which shall not be measured and paid for) and for removing unsuitable material, hauling to fill areas at any distance. All materials from borrow pits placed in embankments and compacted backfill will again be included for payment under the applicable rates of the Bills of Quantities for compacting such earthwork. Provided always that the cost of borrowed material has not been specified to be included in those relevant pay items for which the same borrowed material is to be supplied.

201.7 Embankments and Compacted Fill

201.7.1 General

Wherever the term "embankment" is employed it shall also mean "compacted fill", unless the distinction between those two terms is clearly emphasized.

Embankments shall be constructed to the lines and grades shown on the Drawings. Where grassing is required, a compacted fill embankment shall be constructed up to the underside of the layer of top soil, as shown on the Drawings.

No brush, roots, sod, or other perishable or unsuitable materials shall be placed in the embankments. The suitability of each part of the foundation for placing embankment materials thereon and of all materials for use in embankment construction will be determined by the Engineer. The Contractor shall maintain the embankment in an approved manner until the final completion and handing over of all the Works.

The embankment operations shall be so conducted and the various soil strata shall be placed so as to produce a soil structure as shown on the typical cross sections, or as directed by the Engineer. The slopes of the division lines between zones and/or portions of the embankment are tentative and shall be subject to variation, at any time prior to or during construction, and the Contractor shall be entitled to no additional allowance above the unit rates in the Bill of Quantities, by reason of such variations. The embankment for each portion shall be maintained approximately level throughout the entire length of each layer from abutment to abutment. All openings through the embankment required for construction purposes shall be subject to approval, and such openings shall be constructed so that the slope of the bonding surface between embankment in place and embankment to be placed is not steeper than 1:4. The bonding surface of the embankment in place shall be prepared as provided for embankment foundations.

The Contractor shall be responsible for the stability of all embankments made under the contract and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

Where excess spoil, or other material for which compaction is not specified, is dumped and spread, the Contractor shall route his equipment, both when loaded and when empty, to travel over the entire area of the above mentioned material. No payment will be made for this operation, and its cost shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities.

When the state of the weather is such that it would adversely affect the placing of fill, all embanking shall be stopped. In particular, embanking work will not be permitted during rain nor for such time afterwards as the Engineer may judge to be necessary to allow the upper layers in the embankment to dry to their correct moisture content as directed by the Engineer.

At all times during dry weather, whether embanking is taking place or not, the surface of the embankment is to be watered everywhere as directed by the Engineer, or protected to his satisfaction to prevent undue cracking of the surface. Watering is to be done by means of tankers, sprinklers or other methods approved by the Engineer.

Any material not complying with the specified density or moisture content shall be replaced in the embankment at the Contractor's own expense notwithstanding the fact that it may be overlaid by more recently placed material.

201.7.2 Preparation of Foundation

No material shall be placed in any section of the embankment until the foundation for that section has been suitably prepared and approved by the Engineer's Representative.

All excavation made for test pits or other subsurface investigations, and all other existing cavities found within the area to be covered with earthfill which extend below the established lines of excavations for the embankment foundations shall be filled with compacted earthfill. The foundation for earthfill, where in clayey soil, shall be scarified, wetted and compacted as specified for the earthfill to be placed thereon. Where the foundation is granular material it shall be compacted by vibrating rollers to a depth of not less than 30 cm to the same density as specified by the overlaying earthfill. Surfaces upon or against which the earthfill portions of the embankment are to be placed shall be cleaned of all loose and objectionable materials in an approved manner by hand-work or other effective means immediately prior to placing
the first layer of earthfill. The surfaces of each portion of the foundation, immediately prior to placing the earthfill, shall have all water removed from depressions and shall be properly moistened and sufficiently clean to obtain a suitable bond with the earthfill. Where compaction of fill is to be started, or continued after the previous layer has been in place for over 6 hours, the area shall be harrowed to a depth of 20 cms, wetted and compacted to the required degree of compaction.

201.7.3 Compaction Control

Compaction shall be controlled by field density and field moisture tests, or by such other tests as prescribed by the Engineer.

The densities of the compacted earth materials shall be defined as follows:

(i) Modified A.A.S.H.T.O. Density shall mean the maximum dry density obtained from the compaction test in accordance with the A.A.S.H.T.O.-T-180-61 (method D) test or the (identical) A.S.T.M.-D-1557 (method D) test.

(ii) Relative Density shall be defined by the following formula (in accordance with the U.S. Bureau of Reclamation Earth Manual Designation E-12):

$$D_d = \frac{Y_d \text{ max } (Y_d - Y_d \text{ min})}{Y_d (Y_d \text{ max} - Y_d \text{ min})} \times 100$$

where

D_d = Relative density
$Y_d$max = greatest dry density obtained by laboratory
$Y_d$min = least dry density obtained by laboratory
Y_d = the dry density at which the soil is to be placed or the inplace dry density

The field density of compacted material in place shall be determined by the A.A.S.H.T.O.-T-191-61 method or by the identical A.S.T.M.-D-1556-64 method. Field moisture content shall be determined by the A.S.T.M.-D-2216-63-T method.

Samples of all fill materials, both before and during placement, shall be taken for testing at frequent intervals. The following tests shall be performed:

(i) Tests to determine the maximum dry density and the optimum moisture content. The number of samples for these tests shall be as determined by the Engineer but not less than one sample per 1,000 m^3 of fill shall be taken.

(ii) Field density tests. The number of samples for these tests shall be as determined by the Engineer, but not less than one sample per 1,000 m^3 of compacted fill or one sample per day, whichever is larger.

For the performance of all the above-mentioned tests, the Contractor shall provide a fully-equipped field laboratory and the necessary trained personnel for sampling and testing, all subject to the Engineer's prior approval. All costs for providing the field laboratory and the necessary personnel and for sampling, testing, transportation, etc., shall be deemed to be included by the Contractor in his unit rates for the various items of earthworks in the Bill of Quantities and shall not be paid for separately.

201.7.4 Placing and Compacting - General

Embankment materials shall be deposited in horizontal layers over the entire width of the embankment and compacted to the required densities as shown on the Drawings or as specified.

Embankments shall be formed of satisfactory materials. The thickness of each layer shall not exceed the thickness shown on the Drawings or as specified. In the construction of embankments, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, layers shall be constructed approximately parallel to the finished grade line.

The material in the layers shall be brought to the optimum moisture content before rolling is started to obtain the prescribed compaction. Wetting or drying of the material and manipulation to secure a uniform moisture content

throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankments thus affected shall be delayed until the material has dried to the required moisture content. Sprinkling shall be done with sprinkling wagons, pressure distributors, or other approved equipment that will sufficiently distribute the water. Sufficient equipment to apply the required water shall be available at all times.

The optimum moisture content shall be determined by the Engineer and the actual content shall not vary from the required one by more than plus 4 or minus 2 percent. This optimum moisture content, determined by the Engineer as required for compaction purposes, shall be uniform throughout each layer of the earth-fill prior to and during the compacting.

The distribution of materials shall be such that the compacted fill be homogeneous and free from lenses, pockets streaks or other imperfections.

The number of successive passes of the compacting equipment over each and every point in any layer shall be not less than six (6). The overlapping of two adjacent passes shall be not less than 30 cm. The Engineer's Representative shall have the right to test every layer. However, the Contractor shall not be permitted to start work on the successive layers without the Engineer's Representative's permission, irrespective of whether tests have been made or not.

Where due to small width of required fill or any other reason, compaction of material in horizontal layers by sheeps foot rollers or pneumatic rollers will in the Engineer's opinion be impracticable, the Engineer may permit the use of other equipment and procedures such as compaction by mechanical tampers or spreading the material in small quantities in layers parallel to the slope and compacting same by cylindrical rollers applied along the slopes, or otherwise. Compaction shall be carried out to the Engineer's satisfaction and to the specified density.

After compaction has been completed as specified, all surfaces and slopes shall be trimmed and smoothed to accuracy specified hereafter. The cost of such trimming and smoothing shall be deemed to be included in the various rates for construction of embankments.

201.7.5 Compaction of Clayey and Silty Materials

Clayey and silty materials shall be deposited in horizontal layers of thickness not exceeding 15 cm, after compaction. The excavating and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability. Prior to and during compaction, the materials shall have the optimum moisture content as determined by the Engineer, and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the Engineer's Representative, moistering of the material shall be performed at the site of excavation, but if necessary shall be supplemented by sprinkling at the Site. Should the actual moisture content not be within the limits prescribed in Subsection 201.7.4 above, compacting operations shall not proceed until the layer has been brought to optimum moisture content, whether by wetting or scarifying and drying. No additional payment shall be made on account of any operation by the Contractor in drying or wetting the materials or on account of delays occasioned thereby.

When the filling material has been conditioned as specified, it shall be compacted by tamping with sheeps foot rollers having staggered and uniformly spaced knobs and of sufficient weight for proper compaction, by tyre rollers, by hand or power tampers, or by other compacting equipment approved by the Engineer. When tamping rollers are used, the tamping knobs and cleaner bars shall be properly maintained and the space between the tamping feet shall be kept clear of anything which may impair the effectiveness of the roller. Unless otherwise specified, the dry density of the soil fraction in the compacted material shall not be less than 92 percent of the Modified A.A.S.H.T.O. Density as defined in Subsection 201.7.3 above.

201.7.6Compaction of Cohesionless Free-Draining Materials

Cohesionless free-draining materials, such as sand and gravel, shall be deposited in horizontal layers of not more than 15 cm if compacted by tampers or rollers, not more than 30 cm if by treads of crawler-type tractors, surface vibrators or similar equipment and not more than the penetrating depth of the vibrator if compacted by internal vibrators.

Unless otherwise specified, the relative density of the compacted materials, as defined in Subsection 201.7.3 above, shall be not less than 70 percent.

201.7.7 Compaction of Intermediate Soil Types

Unless otherwise specified, in borderline cases between clayey and silty soils and those that fall under the definition of cohesionless free-draining materials, the density shall be either 92 percent of the Modified A.A.S.H.T.O. Density or 70 percent relative density, whichever value is the higher.

201.7.8 Pipelines and Structures in Embankments and in Compacted Fill

Where pipelines are to be laid in embankments or in compacted fill, the embankment or fill will first be constructed to the lines and levels shown on the Drawings, to a height of 1.5 m above the crown of the pipe or to the top of the embankment or fill. After the embankment or
fill have been constructed to the height specified above, the Contractor shall excavate in the compacted fill a trench to the Typical Trench Cross Sections; shall lay, joint, etc., the pipes in it; shall backfill the trench, as specified, to the top of the embankment and shall complete all other operations of constructing and covering the pipeline. After all the above operations have been completed, the Contractor shall resume, where necessary, the construction of the embankment or fill and its compaction.

Where steel pipes are to be laid in compacted embankments, the work shall be carried out as specified above, except that the embankment shall be completed to a level of 50 cm above the crown of the pipes.

Where structures, such as manholes, chambers, channels, etc., are to be constructed in compacted embankments or fill, the embankment or fill will first be completed to the lines and levels shown on the Drawings. The required excavation for the structures shall then be made and the structures constructed in it. After the completion and testing of such structures, the excavation shall be backfilled and compacted to the specified density.

201.7.9 Methods of Measurement and Payment

The supply of fill material, including its hauling and spreading and running of surplus to spoil, shall not be paid for separately and shall be deemed to be included in the relevant pay items for excavation, whether from borrow areas or form excavations for pipelines, structures, etc.

Compaction of Embankments shall be paid for separately and measured by cubic metres of the volume of compacted fill in place. No payment shall be made for additional material required to be added due to Settlement, and the Contractor shall make due allowance for this in his rates. The unit rate shall include wetting and compacting and the performance of all field and laboratory tests as specified. The unit rate shall also cover all additional costs of scarifying, harrowing, etc., where and when needed and trimming and smoothing of surfaces.

No additional payment shall be made in case of stockpiling of excavated materials and later rehandling of such material if directed by the Engineer in order to produce the specified embankment structure and the cost thereof shall be deemed to be included by the Contractor in his unit rates for the various items in the Bill of Quantities and shall not be paid for separately.

201.8 Tolerances of Finished Earthworks

All earthworks shall be finished to the dimensions and elevations shown on the Drawings. Unless otherwise specified, the following variations shall be acceptable:

(i) Embankment width - not more than 20 cm over the specified widths and not more than 10 cm less than the specified widths. Embankment elevations - not more than 5 cm.

(ii) Elevations of bottoms of ponds - no more than 5 cm.

(iii) Channel invert elevations - not more than 3 cm, provided a continuous slope is maintained in the direction of flow so as to prevent the formation of puddles on bottom of channel.

(iv) Irregularities in surfaces of all earthworks - not more than 1.5 cm when checked by a straight edge.

201.9 SOIL INVESTIGATIONS

The Contractor shall carry out soil investigations according to BS 1377 (Methods of test for soil for civil engineering purposes) at the stations, buildings, reservoirs and water towers construction site, whenever he is requested to do so by the Contract and as directed by the Engineer's Representative. These investigations shall comprise various boreholes (according to the nature of the soil) as well as reports determining the specifications of the layers, the bearing capacity of the soil, the nature of foundations and the retaining structures if needed.

201.9.1 Borings

According to the nature of the soil or rocks, one of the three following borings shall be carried out:

a) Alluvial soils

(loose soils or slightly to fairly consistent)

Borings shall be:

- Either, penetrometric borings performed by a penetrometer ≥ 100 KN, static-dynamic with a measurement of the cone resistance and the lateral friction.

- or, core-borings ∅ ≥ 76 mm performed with core samplings and in-situ-SPT. The number of borings is conditional upon the area of the structures, and shall be carried out at the rate of one boring for every 200 m^2, with a minimum of two borings. Depths shall be conditional upon the nature of the soil and the loads, and shall be fixed according to each site but shall not, in principle, exceed 15m.

In case underground water was found at a slight depth, a piezometer shall be installed. Moreover, in some cases, a trench shall be dug with a mechanical shovel down to 1 to 2 m beneath the aquifer and a permeability test performed by pumping shall be carried out (watertable drawdown and recovery).

b) Calcarous rocks

Destructive soil investigation shall be carried out with a measurement of the rate of drilling progress and the pressure exerted on the bit. These borings aim at locating the fractures and fissures in rocks, since these fissures and not the hardness of the r ocky matrix limit the bearing capacity of the foundations. Borings shall reach 5 m beneath the level of the foundation.

The number of borings shall be conditional upon the surface of the structures and shall be carried out at the rate of one boring every 100m^2, with a minimum of five borings. In case borings show cavities or considerable cracks, supplementary and closely distributed borings shall be carried out after the beginning of earthworks.

In case groundwater was found, a piezometer shall be installed.

c) Extremely consolidated soils or very soft rocks (Sandstone, marl, clay)

Continuous core samplings shall be performed with a double core-driller. The diameters of borings shall be 76mm as a minimum.

A representative sample of each layer and boring shall be taken from the core-samples and shall undergo unconfined compression tests. Some samples shall eventually undergo free swelling tests.

The number of borings shall be conditional upon the surface of the structures, and shall be carried out at the rate of one boring every 200 m^2, with a minimum of two borings.

The depths shall be conditional upon the nature of the soil and the loads, and shall be fixed according to each site, but shall not in principle, exceed 15m.

In case underground water was found, a piezometer shall be installed.

201.9.2 Report

After carrying out borings and taking measurements, a report shall be drawn. It shall treat of the following issues:

- Opening and stability of excavations and the drainage methods.
- Treatment of the foundations soil, if need be.
- The permissible constraint exerted on the soil, in terms of the nature of foundations and differential settlements.
- Special recommendations concerning problems such as drainage, etc...

201.9.3 Methods of Measurement and Payment

The soil investigation shall be measured for payment by linear metre of borehole depth, the unit rate shall include mobilisation and demobilisation of equipment, labor, boreholes, tests, report, etc...

202- CONCRETE WORKS

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202 CONCRETE WORKS

202.1Standards, Grades, Composition AND TYPES

202.1.1 General

This division describes the quality of materials and workmanship of concrete and reinforced concrete works cast in situ in all parts of structures below or above ground in all site locations.

The Specification shall apply to concrete prepared on site as well as ready mixed concrete and small precast concrete elements. Generally, it is based on CP 110 Part I 1972 and on BS 4881, 5328 and 5337.

In case of discrepancy or contradiction, the requirements of this Specification shall rule over any standard.

202.1.2 Standards and Codes

The current ruling Standards and Codes of Practice, detailed below, are made by reference part of this Specification.

BS	12	Portland Cement (ordinary and rapid hardening)
BS	146	Portland - Blastfurnace Cement
BS	410, 1796	Test Sieves and Test Sieving
BS	882, 1201	Aggregates from Natural Sources
BS	1305	Batch Type Concrete Mixers
BS	1370	Low Heat Portland Cement

BS	1881	Methods of Testing Concrete
BS	1926	Ready-Mixed Concrete
BS	3148	Tests for Water for Making Concrete
	4027	Sulphate Resisting Portland Cement
BS	4251	Truck Type Concrete Mixers
BS	4449	Hot Rolled Steel Bars for the Reinforcement of Concrete
BS	4461	Cold Worked Steel Bars for the Reinforcement of Concrete
BS	4466	Bending Dimensions and Scheduling of Bars for the Reinforcement of Concrete (Plain round mild steel or high yield steel)
BS	4482	Hard Drawn Mild Steel Wire for the Reinforcement of Concrete
BS	4483	Steel Fabric for the Reinforcement of Concrete
BS	5075	Concrete Admixtures
BS	5135	Metal Arc Welding of Carbon and Carbon-Manganese Steels
BS	5328	Methods for Specifying Concrete Part 1 to Part 4
PD	6440	Accuracy in Building
BS	6588	Portland Pulverised - Fuel Ash cement
BS	8007	Design of Concrete Structures for Retaining Aqueous Liquids
BS	8102	Protection of Structures against Water from the Ground
BS	8110	CP 110 Part 1 and Part 2 Structural use of Concrete
ASTM Standard C309		Liquid Membrane Forming Compound for Curing Concrete
ASTM Standard C260		Air Entraining Admixtures for Concrete

In case of discrepancy or contradiction, the requirements of this Specification shall overrule any standard.

202.1.3 Classification and Composition

Concrete of all grades shall consist of coarse and fine aggregate, cement, water and additives. Generally, the grades of concrete shall be detailed as described in the following table. However, other grades may be required in the Particular Specification.

Table 2.1 Concrete grades and Classifications

Grade/Class of Concrete Per B.S. 5328	Characteristic Compressive Strength (Kg/cm^2)	Minimum Cement Content (Kg per m^3) of Ready Concrete	Characteristic Use
C 7P	70	150	Lean Concrete
C10P	100	200	Non-Reinforced
C15P	150	200	Concrete
C20P	200	280	
C25P	250	280	Reinforced
C30P	300	280	Concrete
C40P	400	300*	Prestressed
C50P	500	300*	Concrete and
C60P	600	300*	Concrete for Special Purposes

* For prestressed concrete the following maximum cement contents shall not be exceeded:

Grade C40P - 375 kg per 1.0 m^3
Grade C50P, C60P - 450 kg per 1.0 m^3

The relationship between grade of the concrete and its characteristic strength shall be as given in BS 5328. The grade of concrete to be used in particular locations shall be as given in Table 2.2 unless noted otherwise on the Drawings.

Table 2.2 Concrete strength requirements

Location	Maximum Coarse Aggregate Size (mm)	Grade of Concrete (BS 5328)
Blinding Concrete - General Structures - Liquid Structures	 20 or 40 20	 C15P C20P
Blinding concrete - Sulphate Condition	 20	 C25P
Substructures thickness less than 400 mm	 20	 C25D
Substructures, walls and slabs more than 400 mm	 20	 C25D
Superstructures normal concrete	20	C25D
Liquid retaining structures	20	C35D
Fine concrete	10	C25D
Precast concrete	10 or 20	C30D

In the above table suffix P means a prescribed mix, D means a designed mix and A means a design mix complying with the requirements of BS 8007.

The specific grades of concrete to be employed in the different structures or parts of structures shall be as shown on the Drawings or indicated in the Specification Bill of Quantities. The quantity of cement in the ready concrete shall in no case be less than the minimum quantities detailed in the above table.

The Contractor shall have trial mixes for the various structures designed by an approved laboratory. The mixes shall be designed with the objective of producing concrete having suitable workability, density, impermeability and required strength.

Proportions shall be determined in accordance with the "Design of Normal Concrete Mixes" published by the United Kingdom Department of The Environment and obtainable from:

Building Research Establishment and Bookshop
Garston
Watford
WD2 7JR
ENGLAND

or other approved methods, for the requirements set out in this Specifications.

The amount of water used in the concrete shall be changed as required to secure concrete of the proper consistency and to adjust for any variation in the moisture content or grading of the aggregates as they enter the mixer. Addition of water to compensate for stiffening of the concrete before placing will not be permitted. The mix to be used in every part of the Work shall be subject to the Engineer's approval and the Engineer shall have the right to demand the mix proportions and water-cement ratio to be changed during the progress of the work if in his opinion such changes shall be necessary to secure the required quality of the concrete as detailed above.

The mix proportions shall be selected to ensure that the workability of the fresh concrete is suitable for the conditions of handling and placing, having regard to the structural element being constructed, the disposition of reinforcement, and taking full account of the environment to which it will be subjected.

The minimum cement contents and maximum water/cement ratios of designed mixes shall be as given in Table 2.3. In the event of sulphate exposure precautions requiring lower cement content than those required for normal conditions the latter requirements shall prevail.

Table 2.3 Minimum cement contents
Normal Conditions

Type of Structural Element	Exposure Conditions (BS 8110)	Minimum Cement Content (kg/m³) Maximum Aggregate Six			Maximum Water/Cement Ratio
		40 mm	20 mm	10 mm	
Liquid Retaining Structures, Shafts and Tunnel Linings	Severe	295	325	356	0.55
All Foundations and Buried Structures	Moderate	270	300	340	0.60
Building Super-Structure	Moderate	270	300	340	0.60

Additional requirements when exposed to sulphate conditions (all structural concrete)

Concentration of Sulphates		Type of Cement	Minimum Cement Content (kg/m3) Maximum Aggregate Size			Maximum Water/Cement Ratio
In Soil (Total SO_3)	In Ground Water Parts per 100,000		40mm	20mm	10mm	
< 0.2	< 30	OPC	NORMAL CONDITIONS			
0.2 - 0.5	30 - 120	OPC SRPC	300 250	330 280	370 320	0.50 0.55
0.5 - 1.0	120 - 250	OPC SRPC	Not Permitted 300	330	370	- 0.50
1.0 - 2.0	250 - 500	OPC SRPC	Not Permitted 340	370	410	- 0.45
> 2.0	> 500	SRPC	Ditto but with protective coating			0.45

202.1.4 Types of Concrete

a) Ready-Mixed Concrete

The use of ready-mixed concrete will be permitted provided the production, transportation, sampling and testing of the ready-mixed concrete shall conform to the requirements of B.S. 1926 and that the concrete meets the requirements of this Specification as to strength, cement content, impermeability and other properties. The methods and equipment used and the speed required for transporting concrete shall be such that concrete having the required composition and consistency will be delivered into the work, without objectionable segregation, loss of slump, and delay.

The Contractor shall notify the Engineer of the supplier from whom he intends to purchase the ready-mixed concrete and shall obtain the Engineer's approval in writing of such supplier. Prior to the commencement of concrete production, the Engineer shall be given notice to enable him to check the composition and cement content of the concrete about to be produced at the supplier's plant. However, the Engineer's approval of the supplier and his inspection of the concrete production shall not relieve the Contractor of his sole responsibility for the quality concrete, and the Contractor shall make good any damage and shall indemnify the Employer against losses caused by concrete not meeting the requirements of the Specification. The Engineer may at any time and at his own discretion prohibit the use of any ready-mixed concrete which in his opinion does not meet the requirements of the Specification, and in such an event the Contractor shall discontinue the use of such ready-mixed concrete and shall at no extra cost to the Employer supply concrete mixed on the site, or ready-mixed concrete from another source meeting the Engineer's approval.

b) Lean, Blinding and Cyclopean concrete

Concrete shall be proportioned to 200 kg of cement per 1 m^3.

Stones for cyclopean concrete shall be wetted and cleaned from any deleterious matter prior to batching. Stones with a maximum size of 20 cm and covered with concrete shall be added to fresh concrete.

The proportion of concrete shall not be less than 60% of the total volume. Stones shall not be in contact with one another, nor with the formworks or trenches sides. The minimum distance between two stones or between one stone and the side of the formwork is 5 cm. Aggregates shall not form honeycombing in the surface of concrete. Should such defect be found after the removal of formworks, the concerned parts shall be demolished and cast anew at the expense of the Contractor. Cyclopean concrete surfaces shall be thoroughly finished. The location of these types of concrete shall be indicated on the drawings. In all cases the Engineer must give his written approval for concreting.

c) Porous Concrete

Porous concrete is made of single-core coarse aggregates and practically no-fines. It produces a low slump and has a low water/cement ratio; just enough cement is used to bind the aggregates into a mass resembling popcorn. The ratio of aggregate to cement shall be 8:1 by volume or 10:1 by mass.

It is characterized by 20% to 35% of voids, and a high permeability allowing a free water flow.

Porous concrete will be used in hydraulic structures where drainage is desired. It is also used to allow the recharge of groundwater by water penetration through concrete.

To maintain the required permeability properties, concrete surfaces should not be stopped nor sealed. No finishing work even with a trowel shall be required. The compressive strength of the various mix proportions vary from 3.5 to 27.5 Mpa. Drainage velocity ranges between 100 and 900 liters/mn/m^2.

The concrete shall be mixed by machine or by hand to a uniform color and consistency before placing. The quantity of water used shall not exceed that required to coat all of the aggregate particles without forming excess grout.

d) Shotcrete concrete

Shotcrete concrete shall be mortar or concrete conveyed through a hose and pneumatically applied using either the dry mix process or the wet mix process.

The dry mix process shall consist of thoroughly mixing a proportional combination of dry fine aggregate and portland cement; conveying the mixture through a delivery hose to a special nozzle where water is added and mixed with the other materials immediately prior to its discharge from the nozzle. The wet mix process shall consist of premixing by mechanical methods a proportional combination of portland cement, aggregate, and water required to produce mortar or concrete; conveying the mortar or concrete through the delivery hose to the special nozzle where additional compressed air is added at the nozzle prior to discharge.

Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in finished in place hardened shotcrete meeting the required strength.

The surfaces on which shotcrete is to be placed shall be finely graded to the lines and grades shown on the drawings. The surfaces shall be thoroughly compacted and shall be uniformly moistened so that water will not be drawn from the freshly placed shotcrete.

e) Chuted concrete

Chuted concrete is a plain concrete to which is added at the end of mixing a superplasticizer giving it a flowing consistency (slump at Abram's cone test = 20 to 24 cm). This concrete is especially used for heavily reinforced reservoirs or those having complex shapes. However, the following precautions should be taken:

- Check beforehand the efficiency of the superplasticizer (plasticity modification, effect on strength, duration,...)
- Mix concrete as close as possible to its final position, since this type is more prone to segregation than plain concrete.
- Use resistant formworks because chuted concrete transmits pressures (height of concrete in formworks) better than plain concrete (reduced internal friction).

f) Fibre concrete

General
Fibre concrete contain appropriate quantities of metallic fibres as to form a composite and homogeneous mixture and shall be designed according to British Standard.

The main characteristics of metallic fibre concrete are:

- Strong cohesion which gives a high strength to shocks.
- Important ductility with small cracks (< 8mm) which reduces construction cracks.
- Resistance to rupture.

Materials
Metallic fibres are machined directly from the steel slab. They are triangular, twisted, curved and have a smooth side and a rough side.

Fibres shall be stored in a dry place.

The percentage of fibres shall vary between 20 and 40 kg per cubic meter of concrete.

Cement shall be chosen according to BS 12.

Granular materials shall comply with BS 882.

Sand shall be graded 0 to 3mm or 0 to 5mm and contain 15% of fines (≤ 0.315mm). Grading shall be continuous as far as practicable with a maximum grain size of 25mm.

The water shall comply with BS 3148.

Addition of water on site shall not be permitted.

The admixtures permitted to be used with fibre concrete are:

Super Plasticizer
Super Plasticizer are used to increase the workability of fibre concrete, at the time of placing without addition of water.

Plasticizers-water reducers
They are used to increase the plasticity of concrete (especially pumped concrete) at a constant quantity.

Prior to adding fibres, concrete shall have an ultimate bending-tensile strength equal to 3.4 MPa, in order to allow the good anchoring and performance of fibre.

Concrete fluidity shall be measured by the Abram's cone (slump test).

Fibres decrease greatly the workability of concrete. Therefore, fluidizers shall be added directly on site in the truck mixer in order to facilitate placing while the water/cement ratio is kept constant.

Two types of concrete may be used:

1) Chuted concrete

This is the best solution.
Slump:

i) Prior to adding fluidizers : 4 to 6 cm
ii) After adding fluidizers : 15 to 18 cm
iii) After adding fluidizers and fibres: 10 to 14 cm

Chuted concrete allows to decrease the quantity of water ($0.4 \leq W/C \leq 0.5$), and, therefore, develops good mechanical resistances and ensures a considerable workability.

Fluidizers shall be added on site.

2) Plasticized concrete

Slump:

i)	Prior to adding fibres	:	9 to 12 cm
ii)	After adding fibres	:	6 to 8 cm

Plasticized concrete requires no addition of water on site. Given its low workability, it is difficult to place this type of concrete.

The performance of metallic fibre concrete is measured by the ultimate tensile bending strength test after 28 days. The average common performances are tabulated hereunder:

Proportion	**20 kg/m³**	**25 kg/m³**	**30 kg/m³**	**35 kg/m³**	**40 kg/m³**
Performance MPa (maximum stress)	4	4.5	4.9	5.2	5.5

Placing

Fibres shall be mixed directly with concreted without forming "urchins".

No "dosing-untangling" device shall be needed.

Placing shall be done:

- either, in the truck mixer on site, with an additional mixing of 6mm at 14 r.p.m.
- or, at concrete factory with aggregates or, at the end with an additional mixing of 4mm.
- or, in the concrete mixer on site, with an additional mixing of 6mm.

The concrete should be adequately consolidated. The vibration method is conditional upon the type of concrete.

- Chuted concrete requires almost no vibration. It is placed by means of vibrating rulers or even without any external vibration (eveness is controlled by a laser level).

Chuted concrete allows concreting large surfaces without any construction joints.

- Plasticized concrete or admixtures free concrete shall be consolidated by means of a vibrating ruler.

In the event of fair-faced concrete surfaces, fibres shall be properly integrated in concrete though adequate mechanical or manual troweling.

No particular precautions are required for other traditional finishings (sprinkling, incorporated or added finish). A curing product shall be applied to the finished surface of concrete slab to prevent rapid desiccation.

Should surfaces be painted, concrete may be cured by sprinkling with water.

Joints shall be formed in fibre concrete. However, given the plasticity and coherence of this type of concrete, it is preferable to place it continuously and, then, form contraction joints by sawing.

Joints are formed each 8m x 8m outdoors or in non covered surfaces (at the time of execution) or each 10m x 10m, and even 12m x 12m indoors. In the latter case, the proportion of fibres shall be 30 kg/m³).

1. Construction joints
   They shall be either keyed or dowelled, with or without angle iron. However, chuted concrete allows the concreting of large surfaces without needing to form construction joints.

2. Contraction joints
   Joints are sawn over ¼ of the thickness minimum.

3. Separation joints
   Joints shall be formed around hard zones: stringers, footings, columns.

4. Expansion joints
   Expansion joints shall be avoided, as far as practicable, in covered slabs where no major temperature variations are observed.

Design of concrete pavement

According to each case, the Engineer shall determine the sizing of works.

- Westergaard modulus of subgrade reaction
- Exact definition and location of applied loads.

The maximum strengths used for calculation of concrete are conditional upon the proportion of reinforcing fibres and tabulated hereunder:

Proportion	20 kg/m³	25 kg/m³	30 kg/m³	35 kg/m³	40 kg/m³
Allowable σ (MPa)	2.8	3.2	3.5	3.7	3.9

Controls

The user of metallic fibre concrete shall establish a self-control procedure concerning the following:

1) Taking over of support ground

The user shall take over the foundation ground in order to make sure that the slab is homogeneous and true to the adopted assumptions.

(Westergaard modules > 30 MPa/m = 3 bar/cm)

A membrane may be placed to prevent contamination with fine particles especially in silty soils or saturated with water.

It may be necessary to insert a polyethylene sheet (150 microns minimum thick) between the foundation ground and the slab to:

i) separate the slab from the foundation ground and facilitate sliding
ii) avoid infiltration of water or laitance into the foundation ground.
iii) avoid rising of underground water

2) Concrete quality

The user shall check the composition of concrete at the time of manufacture in the batching-mixing plant or when delivered on site, and make sure that grading curves are consistent with the present technical specifications document.

The user shall check the workability of the various types of concrete mentioned above through a slump test prior to and after placing of fibres.

According to the placement method, the user shall carry out a self control on the quantity of used fibres with regard to the volume of placed concrete, and verify that concrete is free of "urchins".

3) Mechanical strengths

Verifications shall be performed according to "the Professional Rules for Pavement Works". The user shall namely verify:

- Quality of plain concrete (tensile bending strength ≥ 3.4 MPa)
- Mechanical strength of concrete; the performances level defined above being checked out.
- Tests shall be carried out on prismatic samples 4cm x 14cm x 56cm
- Such verifications shall be carried out:
- at the concrete factory during the self control. The proportion of added fibres shall be determined on the delivery notes.
- and, on site, by the Contractor, prior to placing concrete as per the Technical Specifications.

Workmanship

The works shall be carried out by the Contractor. The Contractor shall comply with the technical specifications and the Special Specifications provided by the manufacturer.

The pavement slab shall not be used before:

48 hours after placing concrete for light pedestrian traffic
7 days after placing concrete for light traffic
28 days after placing concrete for normal traffic.

All workmanship details shall be in accordance with the requirements of all concrete sections mentioned in these specifications.

202.2 Materials for Concrete -

202.2.1Cement

Cement shall comply with one of the following sub-Clauses (i) to (iv) below:

i) BS 12 (Ordinary and rapid-hardening Portland cement).

ii) BS 146 (Portland-blastfurnace cement).

iii) BS 4027 (Sulphate resisting Portland cement).

iv) BS 6588 (Portland pulverised-fuel ash cement) provided that sub-Clause (vii) below is complied with.

v) A mixture of BS 12 (Portland cement) and BS 3892: Part 1 (Pulverised-fuel ash for use in structural concrete) provided that the amount of pulverised-fuel ash is not less than 15% nor more than 35% by weight of the total cement and sub-Clause (vii) below is complied with.

vi) A mixture of BS 12 (Portland cement) and BS 6699 (Ground granulated blastfurnace slag for use with Portland cement) provided that the amount of slag is not more than 65% by weight of the total cement.

vii) The pulverised-fuel ash used shall have a maximum colour index of 6 (Colour Comparator disc reference No. 296570) when measured using the Lovibond Colour Comparator system as recommended in BS 3892: Part 1 Appendix H, Clause H8.

The Concrete Cement used for Concrete Structure in contact with wastewater shall be Sulphate resisting Portland Cement and in accordance with BS 4027.

Consignments of any cement shall be used in the order in which they are received. Any cement stored on the site over three months may be rejected by the Engineer. Should the quality of the cement be adversely affected by dampness or any other cause the cement shall be removed from the site.

Each shipment of cement shall be stored so that it may readily be distinguished from other shipments. The cement shall be free form lumps and shall be otherwise undamaged when used in concrete.

Sacked cement shall be delivered to the Site in the sound original bags of the manufacturer and shall be stored in a watertight and weatherproof shed on a floor raised at least 15 cm from the ground. Stacking cement bags to excessive heights they may cause damage to cement or is otherwise undesirable, as determined by the Engineer, will not be permitted.

Bulk cement shall be stored in weatherproof bins or silos to be approved by the Engineer. The bins shall be emptied and cleaned at reasonable intervals as directed by the Engineer.

The quality of each consignment of cement shall be verified by manufacturers' certificates showing the results of tests, as per B.S. 12, appropriate for cement to be used in tropical climates. Where the Engineer so orders, the Contractor shall perform at his own cost additional tests on samples selected by the Engineer, all in accordance with B.S.12.

202.2.1.1 Water

The water used for mixing concrete shall be of potable quality, free form harmful materials such as clay, loam, acids or trade effluent. River water may be used after its suitability is ascertained beyond doubt by tests according to B.S. 3148. Periodic tests shall be carried out to keep a continuous check on the suitability of such water. The source of the water shall be subject to the Engineer's approval.

202.2.1.2 Admixtures

Usually the water proof concrete specifications are written aiming to achieve a watertight concrete structures.
But practically the concrete can sometime be very difficult to place.

If agreed by the Engineer, the contractor will be permitted to use concrete with more plastic consistency helping to produce a smoother and denser floor and wall finishes requirements.

In heavy reinforced structures, a good and long workability is also important.

It is impossible to meet the water/cement ration > 0.5 and a good workability requirements at the same time unless concrete admixtures are used.

Contractor may use admixtures and shall use if required by the Engineer admixtures such as:

- Retarder
- Accelerator
- Plasticizer or super plasticizer
- air entraining agent
- water proofing admixtures
- Fluid admixtures

- Anti freeze admixtures

Plasticizer and super plasticizer gives good workability and correct consistency (even for pumped concrete with extended working times) to enable the concrete to be compacted as fully as possible in as short a time as possible with a high reduction in the water/cement ratio.

Retarder
- By the use of suitable retarder the Contractor must obtain that the start of the setting process be delayed from a few hours to a day or more.
- This will permit to fresh concrete to be transported, poured and vibrated over longer periods of time.
- The controlled retardation of the initial set, must not be in no way slow down the subsequent hardening process.
- The period of time during which the concrete can still be vibrated is known as the retardation time.
- The choice of retarder dosage will be made by referring to the dosage chart of the furnisher, preliminary trials may be asked by the Engineer to acertain the correct dosage for planned retardation.
- Dosage can varies with the type of structure (foundation slab or walls...) and with temperature (ambient air and/or concrete) the Contractor must consult with the Engineer to either avoid construction joints (cold joints) or to work out a concreting schedule where entire mass of concrete is required to set simultaneously.

Water proofing concrete admixture
A concrete admixture in liquid or powder form can be used by the Contractor as highly efficient water proofing principal agent with a secondary function as plasticizer.

The dosage will correspond to % of the weight of cement.

The admixture must be compatible with the type of cement.

The admixture will be dispensed directly into the mixing water (liquid admixture) prior to its addition to the aggregates /or/ added directly to the dry mixed aggregates.

Other Admixtures
The Contractor will relate to the technical specifications of the admixtures Supplier. Admixtures that contain chlorine will be forbidden.

Admixtures used shall be furnished by the Contractor and the cost of the materials and all costs incidental to their use shall be deemed to be included by the Contractor in his unit rates for concrete and shall not be paid for separately.

202.2.1.3 Aggregates

Fine and coarse aggregates shall be as defined by and be of the quality and nature required by BS 882 and BS 1201 whichever is applicable. In addition they shall be chemically inert to alkali reaction.

Prior to acceptance of an aggregate as inert to alkali reaction the report of a qualified geologist, appointed by the Engineer on the suitability or otherwise of materials shall be obtained following examination of all types of material that the proposed sources will yield during the course of the contract. The Engineer may require that samples be taken from boreholes and for large contracts or contracts extending over a long period then more than one report is to be obtained.

Aggregates shall conform to the requirements of the "Acceptance Standards" of Table 2.4.

Table 2.4 Sampling, Testing and Acceptance Standards

Materials	Test	Site Sampling	Testing	Accepted Standards	Remarks
1	2	3	4	5	6
CEMENT	Ordinary Portland Rapid Hardening Sulphate Resisting		 BS 4550	BS 12 BS 12 BS 4027	Manufacturer's Test Certificates
AGGREGATES	Description and Classification		BS 812 Section 2	BS 882	Whichever is applicable
	Particle size	BS 812 Sec.1	BS 812 Sec.3	BS 882	)
	Particle Shape	BS 812 Sec.1	Visual & BS 812 Sec.3		) Mix Design
	Sp. Gravity	BS 812 Sec.1	BS 812 Sec.3		) Requirements
	Density	BS 812 Sec.1	BS 812 Sec.3		)
	Voids	BS 812 Sec.1	BS 812 Sec.4		)
	Absorption	BS 812 Sec.1	BS 812 Sec.4	BS 8007 Cl. 6.2.2.	See Freeze-thaw Test in this Table
	Organic Impurities	BS 812 Sec.5			
	Moisture Content	BS 812 Sec.5			For adjustment of added water for concrete making
	Mechanical Properties	BS 812 Sec.6	BS 882		Ten per cent fines value
WATER	Suitability	BS 3148	BS 3148	BS 2138	Not required for potable water
CONCRETE	Compacting Factor	BS 1881	BS 1881 Pt 103		) Workability Test
	Slump	Pt 101	BS 1881 Pt 102		)
	Crushing		BS 1881	BS 5328, BS 8110	Cube test
	Water Absorption		BS 1881 Pt 122	BS 340 Para 19 (b)	Precast concrete Cl. 3.8
	Freeze-thaw	BS 1881			Durability test for aggregate not complying with moisture absorption requirements of BS 5337 Cl. 21.2
	Electrolytic Efflorescence				As required for salt containing aggregate or saline water
	Cores	BS 1881 Pt 6 BS 1881	BS 1881 Pt 6 BS 1881	BS 1881 Pt 120 with strength specified on drawings	
ADMIXES with cement	Compatibility by Laboratory	As required			Tests to be carried out by independent Laboratory as required.

(a) General:
Aggregates for concrete shall be fine aggregate and coarse aggregate and shall be supplied by the contractor from approved sources, but the approval of any source by the Engineer shall not be construed as approval of all materials taken from that source, and the Contractor will be held responsible for the specified quality of all materials used in the work and for their being equal to the approved samples.

The Engineer, at the Contractor's expense, will test the aggregates and the Contractor shall provide such facilities as may be necessary for procuring representative test samples. The Contractor shall submit, for preliminary tests and approval, representative samples of 100 kg each of fine aggregate and of each size of coarse aggregate proposed for use in the work at least 30 days before the aggregates are required for use.

Should the Engineer reject any sample furnished by the Contractor, the Contractor shall immediately supply a sample or samples from some other source until all samples are approved by the Engineer.

Those samples which have been finally approved by the Engineer as meeting the requirements of the Specification shall be kept on the Site until the completion of all concrete work and all aggregates brought to the Site shall be compared with such approved samples.

Any aggregate rejected by the Engineer shall be immediately removed from the Site, unless the Engineer shall permit its use after undergoing further treatment by washing and or screening in order to bring it up to standard.

The aggregates shall be brought to the Site in separate loads, each containing aggregates of one size. The aggregates shall be stored in such a way as to prevent aggregates of different sizes from being mixed together in storage. Aggregates mixed either in transport or on Site will be rejected.

(b) Fine Aggregate:
Fine aggregate for concrete shall be natural sand (but not beach sand) or a mixture of natural sand and fine crushed stone. It shall meet the requirements of B.S. 882 and its grading shall be within the limits of one of grading zones 1, 2 or 3 given in Table 2 of B.S.882. In addition, it shall have a specific gravity of not less than 2.5, shall not contain more than 5 percent by volume of shells or shell fragments. The fine aggregate delivered to the batching plant shall have a uniform and stable moisture content.

When necessary, or when required by the Engineer, all fine aggregate shall be washed in clean water, before being incorporated in the Works.

(c) Coarse Aggregate:
The coarse aggregate for concrete shall be natural gravel or crushed stone. It shall consist of hard, dense, durable uncoated rock fragments and shall meet the requirements of B.S. 882.

Coarse aggregate for reinforced concrete shall be either graded aggregate or made up of a number of single size aggregates, with the largest particles not exceeding the following sizes:

(i) 40mm, or
(ii) 1/3 of the smallest thickness of concrete members, or
(iii)3/4 of the smallest space between reinforcement bars, whichever is the smallest.

Coarse aggregate for non-reinforced concrete may contain particles up to 3"

The grading of coarse shall lie within the limits given in Table 1 of B.S. 882. The exact sizes of the coarse aggregate and the grading to be used shall be determined as part of the mix design in accordance with Subsection 202.1.3.
All aggregates shall be approved by the Engineer.

202.3 Batching and Mixing

202.3.1.1 Batching

The Contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the amount of each separate ingredient entering
the concrete. For concrete Class C20P and higher, the amounts of sand, bulk cement and each size of coarse aggregate entering each batch of concrete shall be determined by weighing, and the amount of water shall be determined by weighing or volumetric measurement. Where sacked cement is used, the amount of cement entering the mixture shall be determined on the basis of integral sacks of cement and the use of cement from torn bags shall not be permitted.

For concrete Class C15P and lower, the Engineer may permit volumetric measurement of aggregates.

All weighing equipment shall be subject to the Engineer's approval. An accuracy to within 0.4 percent of the scale capacity will be satisfactory, and the equipment shall be capable of ready adjustment for compensating for the varying weight of any moisture contained in the aggregates and for effecting changes in concrete mix proportions. The Contractor shall make such adjustments, repairs, or replacements as may be necessary to meet the specified requirements for accuracy of measurement. Each dial, indicator and other measuring device shall be in full view of the operator.

Where batching by volume is permitted by the Engineer, only precisely dimensioned gauge boxes approved by the Engineer shall be used for the sand and different sizes of aggregates. After filling the box the aggregate shall be struck off level with the brim. Sand shall be poured or shovelled into the gauge boxes without compacting. All gauge boxes shall bear marks in red oil paint showing the kind and size of aggregate for which each box is to be used. No boxes similar in shape and appearance but different in volume from the approved gauge boxes shall be kept on the Site.

202.3.1.2 Mixing

The materials shall, unless otherwise directed by the Engineer, be mixed in approved mechanical batch mixers. In each case, the number and capacity of mixers employed shall be sufficient for the concreting operations being undertaken, shall allow for sufficient reserve capacity at all times and shall be subject to the approval of the Engineer.

The mixing shall continue until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall the mixing be for less than 2 minutes after all the ingredients are in the mixer. Water shall be added prior to, during and following the mixer-charging operations. Overmixing requiring the addition of water to preserve the required concrete consistency will not be permitted.

No dry material shall be introduced into a mixer until all material from the previous batch has been removed and the interior of the mixing drum has been cleaned of encrustations of concrete or mortar. Remixing of concrete or the addition of water to a mixture that has already begun to set or that is otherwise unsuitable for casting shall not be permitted and such concrete shall be wasted. When a concrete mixer has been out of use for more than 20 minutes, or when the type of cement is changed, the mixer shall be thoroughly cleaned before a fresh batch of concrete is made in it.

The Engineer may in exceptional cases permit hand mixing of lean and other non-reinforced concrete. No hand mixing shall be done unless authorised in writing by the Engineer. The batches in hand mixing shall not exceed 1/6 of a cu.m. Hand mixed concrete shall not be used until the mixing of the whole batch has been completed and the concrete is of uniform
colour and consistency. Hand mixing shall be done twice on dry aggregate, and at least twice wet, on a clean and even surface, which will prevent the loss of water during mixing. The water added shall be measured in order to prevent the use of an excessive quantity of water.

When mixing by hand, the quantity of cement shall be increased by 10% above that specified above in Section 202.3.

202.4 Placing and Curing

202.4.1.1 Preparations for Placing

No concrete shall be placed until the Engineer has approved the formwork and reinforcement. The Contractor shall give at least 48 hours notice to the Engineer of the times he proposes to concrete and no concreting shall take place unless either the Engineer or his Representative is present.

Concrete shall be placed only in the presence of the Engineer or his duly authorized Representative, unless written permission has been given by the Engineer to place concrete without himself being present or represented. The Contractor shall give the Engineer not less than 48 hours notice before the day on which he intends to commence placement of concrete in any structure or substantial part thereof.

No concrete shall be placed until all reinforcement, formwork, parts to be embedded, and preparation of surfaces involved in the placing have been approved.

All surfaces of forms and embedded materials shall be clean and free from dried mortar which may have encrusted them from previously placed concrete.

All surfaces of foundations and areas upon or against which concrete is to be placed shall be free from standing water (except for concrete required to be placed under water), mud, debris, oil, objectionable coatings and loose, semi-detached or unsound fragments. Absorptive surfaces shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. On surfaces of rock upon or against which concrete is to be placed, a 2 cm layer of 1:3 cement mortar shall be spread immediately prior to placing concrete and shall be well worked into the surface with the aid of brushes. Care shall be taken that the mortar does in no case set before concrete is placed on it. The cost of such mortar and its spreading shall be deemed to be included in the rates for concrete.

202.4.1.2 Transporting and Placing

The methods and equipment used and the speed required for transporting concrete shall be such that concrete having the required composition and constancy will be delivered into the work, without objectionable segregation, loss of slump, and delay. Except as otherwise specified for ready-mixed concrete, the time elapsed between the first wetting of concrete ingredients and the completion of placing the concrete in the work shall in no instance exceed 30 minutes. Re-tempering of concrete will not be permitted. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted.

Concrete shall be deposited as far as practicable directly in its final position and shall not be placed in a manner permitting or causing segregation. The Contractor shall provide suitable openings in the formwork and/or drop chutes and baffles to confirm and control the falling of concrete, and to limit its free drop to a maximum of 1.50 meters.

Except as intersected by joints, all formed concrete shall be placed in continuous approximately horizontal layers, the depths of which shall not exceed 60 cm, in such a manner that no layer of concrete will begin setting before the next layer is placed on top of it. In no case shall the delay between the placing of any two adjacent layers be such that the vibrating unit will not readily penetrate of its own weight the concrete placed before the delay.

Concreting shall be carried out continuously between and up to joints, the position and arrangement of which shall be predetermined and no interruption of placing other than at these joints will be permitted. To this end, the Contractor shall take all necessary measures, such as preparing a sufficient stock of materials, stand-by equipment, shift-work, lighting for night-work, etc.

In the event of unavoidable stoppage in positions not predetermined, the concrete shall be terminated on horizontal planes and against vertical surfaces and construction joints shall be prepared according to Subsection 202.5.1. Where required the Contractor shall also provide keyways, dowels, and/or waterstops to ensure a perfect bond and/or watertightness at the joint.

Where the concrete abuts against earth or any other material liable to become loose, the greatest possible care shall be taken to avoid falls or run of such or other materials upon the surface of the concrete, and if any such falls or runs occur the surface of the work soiled thereby shall be removed until a new and clean surface shall have been obtained, and all spaces left by such falls or runs beyond the prescribed dimensions of the work, or caused by the negligence or for the convenience of the Contractor, shall be built up with concrete at the dimensions of the work, or caused by the negligence or for the convenience of the Contractor, shall be built up with concrete at the discretion of the Engineer, and the additional cost so incurred shall be held to be included in the Contractor's rates in the Bill of Quantities for work within the original Contract limits.

No concrete shall be placed in water, except with the written permission of the Engineer, and the method of depositing the concrete shall be subject to his approval. Concrete shall not be placed in running water and shall not be subjected to the action of running water until after the concrete has hardened.

Surfaces of rock upon or against which concrete is to be placed, shall be prepared and cleaned as specified and placing of concrete shall be carried out as detailed below for construction joints.

No concrete shall be placed when the ambient temperature at the time of placing and/or 2 hours thereafter is expected to be below 4°C. The temperature of the concrete when being placed shall not exceed 32°C.

In hot weather when the temperature of the concrete is liable, in the opinion of the Engineer, to rise above 32°C, the Contractor shall, at his own expense, employ effective means, to the satisfaction of the Engineer, for reducing the temperature in the mix, such as sprinkling of water on the aggregate, protection of the water lines from the sun, painting of mixers and water tanks with light-reflecting paint and/or placing them in shadow, or by adding crushed ice to the water in a proportion not exceeding 50% of the water. The addition of ice will be permitted only if it has been proved to the satisfaction of the Engineer's Representative that all other means for the reduction of temperature are insufficient.

1) Hot weather concreting

Heat accelerates the hydration reaction of cements, thus it increases the heat of hydration and accordingly, shrinkage and cracks are likely to occur. It is necessary to abide by the following measures:

a) Use concrete as compact as possible.
b) Use cement of low heat of hydration.
c) Reduce the cement dosage as far as practicable according to the requested characteristics of concrete.
d) Use a water reducing plasticizer in order to reduce the quantity of mixing water (0.5 to 0.75 in weight of cement).
e) Use a setting retarder which increases the heat of hydration time.
f) Cool concrete constituents. This is an expensive method, but gives the best results.
g) moisturize the hardened concrete on which fresh concrete shall be placed in order to avoid loss of water.
h) Cover the structures after concreting, in order to prevent water evaporation from fresh concrete.
i) Use Antisol-E which protects concrete from desiccation (suppress the use of damp coverings, watering, etc...).

2) Cold weather concreting

When concreting in cold weather, and in order to prevent having a frozen and porous concrete, plasticizers and water reducing admixtures shall be used to reduce the quantity of mixing water, while preserving the workability of fresh concrete at an acceptable degree.

Low temperature slows down the reaction of hydration of cement and therefore, delays formworks removal. The following precautions shall be taken:

a) Use a quick setting cement
b) Increase the C/W ration (plasticizer - water reducer)
c) Heat the materials (water + aggregates). However, the temperature of concrete shall not exceed 30°C.
d) Use isolating formworks (wood, panels coated with expanded polystyrene, etc..)
e) Protect fresh concrete with thick dry covers.
f) Heat concrete eventually (hot formworks).
g) Use antifrost products (1% in weight of cement).

No concrete shall be placed when the ambient temperature is -0°C.

Placing concrete at a temperature below + 5°C is allowed provided that the above mentioned precautions are respected and upon the prior approval of the Engineer.

3) Concreting under water

When fresh concrete is to be placed under a water in motion (currents, waves,...) adequate measures shall be taken to prevent the washing out of concrete and carrying away of mortar.

Concrete shall be conveyed via a tight chute avoiding the contact of concrete with water and placed inside an underwater formwork. In this way, only the upper section of concrete shall be wasted out and it is removed once hardened by a pneumatic drill.

While concreting, the Contractor shall control the height of concrete at the bottom of the formwork and in the chute as well as the length of chute entering in the poured concrete mass in order to prevent any sudden depositing of concrete which might cause water intrusion and stoppage of work. Throughout concreting works, the chute shall be raised progressively.

4) Concreting under sea water (Not applicable)

202.4.1.3 Consolidation of Concrete (Vibration)

Each layer of concrete shall be consolidated to the maximum practicable density, so that it is free from pockets of coarse aggregate and closes snugly against all surfaces of forms and embedded materials.

Concrete Class C15P and less may be consolidated by spading, hand-tamping, or by mechanical vibration as described below. All concrete Class C20P and higher shall be consolidated by power-driven immersion ("needle") type vibrators having a frequency of not less than 9000 oscillations per minute. The vibrators shall be inserted into the concrete at intervals not exceeding 50 cm and shall be allowed to penetrate and revibrate the concrete in the upper portion of the underlying layer.

On slabs not exceeding 25 cm in thickness the use of flat surface tamping vibrators with a frequency of not less than 5000 oscillations per minute will be permitted, provided that it is supplemented by immersion vibrators adjacent to the forms and to concentrations of reinforcement bars.

On walls not exceeding 20 cm in thickness external vibrators, fixed to the forms, will be permitted. External vibrators shall be raised in lifts as the filling of the forms proceeds each lift being not more than the height of concrete visibly affected by the vibration. They shall be placed horizontally, at distances not greater apart than the radius through which the concrete is visibly affected.

The types, sizes and numbers of vibrators shall be subject to the approval of the Engineer.

At least one stand-by unit of each vibrator type and ample spare parts for all types employed shall be available on Site during placing of concrete to ensure continuous placing with no stoppage due to breakdowns.

The vibrators shall be applied in each position for as long as required for the concrete to become uniformly plastic and shall be withdrawn as soon as water appears on the surface. Systematic spacing of insertion of the vibrators in the concrete shall be established to ensure that no concrete remains unvibrated. Care shall be exercised to avoid contact of the vibrating heads with the surfaces of the forms and the reinforcing bars or other embedded material. The vibration shall everywhere be supplemented by hand spading. Vibration shall never be used to cause concrete to flow in a lateral direction, as this will lead to segregation.

The cost of all consolidation shall be deemed to be included in the Contractor's rates for concrete.

202.4.1.4 Finishing of Concrete Surfaces

Formed concrete surfaces, i.e. surfaces cast against forms, shall receive the required smoothness and texture by the use of appropriate forms as specified under Section 202.10. After removal of forms and the specified curing all fins and offsets caused by misaligned or defective form boarding shall be removed. Tie wires shall be cut back to at least 15 mm below the concrete surface and the resulting depressions as well as the holes left after the removal of tie rod fasteners shall be filled with non-shrinking cement mortar and finished flush with the surrounding areas.

Where the concrete surfaces will be permanently exposed to view, the ground and filled areas shall have the same colour, texture and degree of smoothness as the surrounding concrete surfaces. Honeycombed areas and other major defects in concrete shall be repaired as specified in Section 202.7 hereinafter, and the repaired areas given the required finish.

Unformed concrete surfaces that are to be covered shall require no other finishing than sufficient levelling and screeding to produce an even uniform surface. Unformed concrete surfaces that are to remain permanently exposed shall be given a floated surface, unless a trowelled finish as described below is required. Floated finish shall consist of levelling and screeding to even and uniform surfaces followed by floating without the addition of any topping as soon as the screeded surface has stiffened sufficiently. Floating shall be done to the minimum required to produce a surface that is free from screed marks and is uniform in texture. The finish shall be given a final touch-up with a wooden float at an appropriate time after completion of the initial floating.

Trowel finish shall be applied to uniformed concrete surfaces that will be in contact with liquids and elsewhere as shown on the Drawings or ordered by the Engineer. When the surface screeded and floated as described above has hardened sufficiently to prevent excess of fine material to be drawn to the surface, steel trowelling shall be started. Steel trowelling shall be performed with firm pressure, such as will flatten the sandy texture of the floated surface and produce a dense uniform surface, free from blemishes and trowel marks. Where required, trowelling shall be done with the addition of a certain amount of cement as specified in the Particular Specification or Bill of Quantities.

Unless otherwise specified or shown on the Drawings, all exterior angles shall be chamfered to the approval of the Engineer. The cost of Floated Finish, Trowel Finish and Chamfers shall be deemed to be included in the unit rates for concrete work and shall not be paid for separately.

202.4.1.5 Curing of Concrete

From casting until the end of the specified minimum curing period, the concrete shall be kept constantly moist and adequately protected against damage due to fluctuation in surface temperatures. Immediately after casting, the exposed surface of the concrete shall be covered to prevent drying and to minimize temperature variations, until the commencement of curing at an age of not more than 20 hours. Curing of formed surfaces shall commence as soon as the formwork is removed. During curing the concrete shall be kept suitably moist by:

1. Direct application of water at ambient temperature, e.g. by spray or by ponding, or,
2. Covering with absorptive material, e.g. sand or hessian, kept constantly damp. Ventilation of any gap between the material and the concrete should be prevented so as to maintain nearsaturated conditions in the air within the gap, or
3. When specifically permitted in writing by the Engineer, by sealing the surface of the concrete, before it has lost any of its original water by evaporation, by means of a sealing membrane which will effectively prevent any loss of water from the concrete. The sealing compound shall be white-pigmented and shall conform to Standard Specification for Liquid Membrane forming Compound for Curing Concrete, ASTM Designation C309 latest edition, or to another standard acceptable to the Engineer. The type and make of sealing compound and its form of application and use shall be subject to the approval of the Engineer. Membrane curing shall not be used on surfaces upon or against which concrete is to be cast or which are to be plastered or painted.

The cost of curing shall be deemed to be included by the Contractor in his unit rates for concrete and shall not be paid for separately.

202.5 Contraction and Expansion Joints

202.5.1 Contraction Joints

The position of construction joints will be as specified in the drawings by the designer. If there is a need on site to revise any specified position /or/ to have additional construction joints the proposed positions should be agreed with the Engineer.

Full structural continuity must be assumed in design at a construction joint. Reinforcement will be fully continuous across the joint, and the concrete is taken to be as nearly monolithic as possible.

The concrete at the joints should be bonded with the one subsequently placed against it, without provision for relative movement between the two.

Concrete should not be allowed to run to a feather edge, and vertical joints should be formed against a stop end. Particular care should be taken when framing the joint.

The surface of the first pour should be roughened to increase the bond strength and to provide aggregate interlock.

With horizontal joints, the joint surface should be roughened without disturbing the coarse aggregate particles, by spraying the joint surface approximately 2h to 4h after the concrete is placed, with a fine spray water and/or brushing with stiff brush.

Vertical joints can be treated similarly, if the use of a retarder on the top is authorised, to enable the joint surface to be treated after the stop end has been removed.

If the joint surface is not roughened until the concrete has hardened, the larger aggregate particles near the surface should be exposed by sand blasting or by applying a scaling hammer or other mechanical advice.

Care should be taken that the joint surface is clean immediately before the fresh concrete is placed against the old one. It may need to be dampened prior to the new concrete being placed, to prevent excessive loss of mix water into it by absorption.

Particular care should be taken in placing of new concrete close to the joint to ensure that it has adequate fines content and is fully compacted and dense.

N.B. When instructed by the Engineer in designing construction joints for retaining aqueous liquids it is necessary to incorporate waterstops in properly constructed joints.

Construction joints shall be formed only in the positions shown in the drawings or indicated by the Engineer and concreting shall be carried out continuously between and up to joints.

All intersections of construction joints, permanently exposed, shall be made absolutely straight and level or plumb and matching with adjacent members.

Construction joint shall be formed at right angles to the axis of the member concerned, by the insertion of rigid stopping-off forms in the case of horizontal or inclined members.

The upper surface of lifts of concrete in walls and columns shall be horizontal.
The surface of the stopping-off form /or/ the horizontal surface shall be indented to produce a key the old and new work.

The face of the horizontal joints brushed and roughened shall be rendered with a 1.0 to 1.5 cm thick layer of cement-sand mortar having the same relative proportions of cement and sand (without coarse aggregate) and the same water-cement ratio as the concrete to be placed upon it, and the new concrete shall then be laid immediately upon it and thoroughly punned in.

Where joints will be permanently visible, the mortar shall be kept back at least 25mm from the exposed face.

In the case of vertical joint the face shall be rendered with a coat of neat cement placed immediately before each fresh lift of new concrete.

NB : No Day Joints /or/ Stopping-off joints will be permitted in water retaining structures.
Pouring operations shall be continuous between joints as shown in the drawings.

The Contractor shall have sufficient materials and standby equipment to meet these requirements.

Where due to accident or breakdown it is impossible to continue concreting, the Engineer /or/ his Representative shall be immediately notified and his verbal instructions which shall be confirmed in writing as soon as possible, regarding either the making of a construction joint /or/ the taking out of new concrete back to the last construction joints, shall be complied with immediately.

Construction joints in wall

Where the wall is designed to be monolithic with the base slab, a kicker should be cast at the same time as, and integrally with the slab.

The height of the kicker should be at least 75mm to enable the next lift of formwork to fit tightly and to avoid leakage of cement grout from the newly deposited concreted.

The joint in this position will be a construction joint, and although it is recommended that wall panels are cast in one lift, any necessary extra horizontal joints will be construction joints when approved by the Engineer on site.

Circular Structures retaining liquid

One of the predominant forces from the liquid pressure is horizontal hoop tension (circular tension). For structural design purposes the horizontal reinforcement should be completely continuous at vertical joints.

A central waterstop should be used together with sealing compounds on both faces, whether or not any attempt is made to achieve concrete continuity.

Joints in roof

Roof slab when designed as flat slab has generally all interior joints treated as construction joints so that the slab is structurally monolithic and early thermal effects and subsequent temperature effects should be considered.

If the roof is connected monolithically to the wall the subsequent temperature effects may be disregarded.

If provision is made by means of sliding joints for movement between the roof and walls, correspondence of joints in roof and walls is not to be considered eventually.

202.5.2Expansion Joints

For concrete structures retaining aqueous liquid, all eventual expansion joints are designed to accommodate repeated movement of the structure without loss of liquid.

The joint is designed to suit the characteristics of the material available and should also provide for the exclusion of grit and debris that would prevent the closing of the joint.

Detailing of places where the joint changes direction /or/ intersects with another joint should be uncomplicated.

The expansion joint:

At an expansion joint the Contractor shall provide a complete discontinuity in both reinforcement and concrete.

An initial gap should be provided between adjoining parts of the structure to accommodate the expansion /or/contraction of the structure.

Waterstop, joint fillers and joint sealing compounds are essential.

The Joint Filler

An elastic joint filler material cut in sheets of the thickness specified and/or shown on the drawings, shall be:

- either placed in the forms before the first placed concrete is cast.
- or, may be attached to the first placed concrete surface means approved by the Engineer.

The elastic filler materials shall be of a quality approved by the Engineer and shall conform to US Federal Specification H-H-F-341a, or to a similar approved standard.

Where the exposed sides of the joint are filled with an elastic joint sealant approved by the Engineer, sheets of foamed polystyrene may be substituted for the above described elastic filler.

The sheet of filler material, shall be cut to fit the entire contact surfaces of the complete side of the joint.

Where a waterstop is installed in the joint, the filler materials shall be placed on both sides of the waterstop so as to fit snugly about the bulb of the waterstop.

Except where a groove for joint sealant is to be formed, the edges of the filler materials shall be placed flush with the finished surface of the concrete /or/ the bottom of the chamfers.

Joints in the filler shall be made tight so that mortar from the concrete will not seep through to the opposite concrete surface.

N.B.: Joint sealing compound cannot be expected to provide a liquid-tight seal for more than a proportion of the life of the structure and waterstops should always be provided in movement joints by the Contractor and installation must follow the recommendations of the manufacturer.

202.5.3 Elastic Joint Sealant

Where shown in the Drawings, the groove formed on the exposed side of contraction or expansion joints shall be filled with an elastic joint sealant meeting the requirements of ASTM Designation D-1850. The joint sealant is supplied in two components, base and accelerator, which are mixed together only immediately before use. Flow type sealant shall be used on horizontal or nearly horizontal surfaces, and heavy type on inclined and vertical surfaces. If required by the manufacturer, a suitable primer shall be applied on the joint surfaces prior to the filling of the groove and the time elapsing between the application of the primer and the placing of the joint sealant shall not exceed the maximum prescribed by the manufacturer. Care shall be taken that the mixed compound is used before the expiry of its pot-life as indicated by the manufacturer.

Prior to the application of the primer (if any) and the placing of the joint sealant, the groove shall be thoroughly cleaned, flushed with a jet of water and finally cleaned and dried with compressed air. The joint sealant shall be placed immediately after mixing of the two components, by means of a caulking gun so as to fill the joint groove completely and tightly, without leaving any depressions, voids or air bubbles. The joint filling shall be finished neatly and flush with the concrete surfaces by means of a spatula or similar tool.

202.5.4Payment for Joints

Unless specific items are included in the Bill of Quantities, the cost of all work and materials for making construction, contraction and expansion joints shall be deemed to be included in the rates for the concrete work and shall not be paid for separately.

202.6 Tolerances for Concrete Structures

The maximum permitted variation from the design dimension shown on the Drawings or ordered by the Engineer shall be as follows :

1. Variation from the plumb :
   a- In the lines and surfaces of columns, piers, walls and arises — In any storey or
   5 m maximum ..... 10 mm
   15 m or more ..... 25 mm

   b- For exposed corner columns, construction-joint grooves, and other conspicuous — 1/2 of the above amount

2. Variation from the level or from the

	grades indicated on the Drawings :	
	a- In floor and beam soffits	In 3 m ..... 5 mm In any bay or 5 m maximum ... 10 mm In 10 m or more ..... 20 mm
	b- For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines	..... 1/2 of the above amount
3.	Variation of the building lines from established position in plan and related position of columns, walls and partitions	In any bay or 5 m maximum .... 5 mm In 10 m or more ..... 20 mm
4.	Variation in the size and location of sleeves, floor openings and wall openings	10 mm
5.	Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ..... 5 mm Plus ..... 5 mm
6.	Footings :	
	a- Variation of dimensions on plan	Minus ..... 10 mm Plus ..... 10 mm
	b- Misplacement or eccentricity	2 percent of the footing width in the direction of misplacement but not more than ..... 50 mm
	c- Reduction in thickness	Minus ..... 5 percent of specified thickness but not more than ..... 50 mm
7.	Placing of Reinforcement Steel :	
	a- Variation of protective cover	With cover up to 8 cm ..... 5 mm 8 cm and more ..... 10 mm
	b- Variation from indicated spacing, provided that average spacing and total quantity of steel are not affected	..... 25 mm

202.7 Repair of Concrete

202.7.2.1 General

Repair of concrete where permitted by the Engineer shall be performed. The Contractor shall correct all imperfections on the concrete to the satisfaction of the Engineer.

202.7.2.2 Concrete Repairs in "Rehabilitation Works" (Not Applicable)

202.7.2.3 Concrete Repairs in News Concrete Works

Any concrete which in the opinion of the Engineer fails to comply entirely with this specification shall be declared defective and shall be cut out, removed from the site and replaced, and any steelwork reinforcement or other material damaged by the cutting and shall be replaced, all at the Contractor expansion.

The Contractor will submit to the Engineer, details of his proposal for rectifying the defects, and shall comply with the Engineer's instructions, regarding the procedure of carrying out the work.

Notwithstanding the Engineer approval, should the remedial work prove unsatisfactory, the Contractor shall make good the work and bear the whole cost occasioned by the defective work.

Immediately after the forms have been removed, all fins and projections and all timber works at joints shall be removed and rubbed smooth with a carborandum block.

All holes and honeycombing in the surface shall be cleaned out and roughened up to give a good key. These holes shall then be filled with 1:2 cement/sand mortar and after it has thoroughly hardened, the surface shall be rubbed down with a carborandum stone to an even finish.

Concrete filling shall be used for holes extending entirely through the concrete, for holes in which no reinforcement is encountered, and which are greater than 0.20 m^2 and deeper than 10 cm and for holes with reinforcement concrete which are in area greater than 0.05 m^2 and which extend beyond reinforcement.

Plastering of smooth concrete surfaces will not be permitted.

All mortar and concrete filling must be non shrinkable and shall be kept constantly moist and protected from drying due to surface temperature and natural ventilation.

All materials, procedures and operations used in the repair of concrete shall be subject to the Engineer direction. All fillings shall be bonded tightly to the surface of the holes and shall be sound and free from shrinkage cracks and drummy areas after the fillings have been cured and dried.

All repairs of concrete executed by the Contractor shall be deemed to be included in the unit rates for concrete work in the Bill of Quantities and shall not be paid separately.

202.8 Testing of Concrete

202.8.2.1 General

Prior to the commencement of work, trial mixes shall be prepared and preliminary tests for workability, compressive strength and impermeability (where required) will be made at an authorized laboratory. The results of these tests will be used in specifying the mix design to be used by the Contractor. During the progress of work, daily slump tests will be made to ensure that the concrete is dense and of an adequate workability.

With the commencement of concrete placement and on each day concreting, samples shall be taken for testing for compressive strength at the ages and frequencies as prescribed hereafter. Where required, samples shall be taken for impermeability tests. The Engineer shall determine the elements from which concrete samples shall be taken for testing.

202.8.2.2 Slump Tests

The slump measured in accordance with B.S. 1881 shall not exceed 5 cm in concrete for foundations and horizontal or inclined slabs and shall not exceed 10 cm in other parts of the structures, unless otherwise specified or directed by the Engineer. Slump tests shall be made as directed by the Engineer.

202.8.2.3 Compressive Strength Tests

For testing the compressive strength of concrete, samples of fresh concrete shall be taken and used for preparing test cubes. The cubes shall be tested for compressive strength after 7 days and 28 days. The dimensions of the cubes and the methods of sampling and testing shall be in accordance with B.S. 1881. The cubes shall be marked and dispatched to the laboratory according to the instructions of the Engineer and at such intervals as may be specified by him.

Unless otherwise specified or directed by the Engineer, at least three samples shall be taken from different batches on the same day of casting. Out of every sample, at least two test cubes shall be prepared for testing at 7 and 28 days, respectively. The number of samples taken from hardened concrete which for any reason was not taken while the concrete was fresh or of which the strength obtained did not meet the requirements, and taking and testing of such samples shall be in accordance with B.S. 1881.

The average strength of the cubes or more tested at each age may be taken as the works cube strength of the concrete. This works cube strength may be accepted as complying with the specified requirement for works cube strength, if none of the compressive strengths of any of the cubes is below the specified works cube strength, or if the average strength is not less than the specified works cube strength and the strength of the weakest cube is not less than that listed in the following table. The table details the required cube strengths of work cubes and trial mixes for the various grades of concrete.

Compressive Strength Requirements (for all types of Concrete)

Grade	Characteristics compressive strength (kg/cm^2)	Cube strength at 28 days (kg/cm^2) **		
		Works cubes *		Trial mixes *
		Average	Weakest Cube	Average
C10	100	133	85	
C15	150	200	128	215
C20	200	275	170	315
C25	250	325	213	365
C30	300	375	255	415
C40	400	475	340	515
C50	500	575	425	615

* Strength requirements may be adjusted in accordance with CP110, if and as detailed in the Particular Specification.

** Concrete may be provisionally accepted on the basis of the days' cube strength, provided the average strength is at least 70% of the required 28 days strength and provided 28 days' cubes will be tested and will meet the requirements.

If for any part of a structure the works cube strength does not reach the required values at the age of 28 days, or if the concrete has hardened and samples have not been taken while the concrete was still fresh, the Engineer may permit the cutting of at least six cylinders out of the same part of the structure, and the cylinders shall be tested in accordance with the requirements of B.S. 1881. The concrete shall be deemed to comply with the specification if its strength, as deduced from the cylinder tests, meets the compressive strength requirements detailed in the above table and the results of the previous samples shall not be taken into account. Should the concrete also fail to meet the requirements in the testing of the cylinders as above, all the concrete from which the samples have been tested will be considered defective. In such a case, the Engineer may at his own sole discretion, order the carrying out of additional tests by any method he may deem fit, and if such additional tests show the concrete meeting the requirements he may accept it. Should the concrete not meet the strength requirements in the test of samples as above, or in the additional tests that the Engineer may have permitted, then it shall be dealt with according to one of the following two methods, chosen at the sole discretion of the Engineer.

a) The Contractor shall demolish and re-construct the part of the structure made of the defective concrete.
b) The Engineer will accept the defective concrete but reduce its price as defined hereinafter. This provision shall apply only to concrete in which the average compressive strength of the samples taken is not less than the Characteristic Compressive Strength listed in the table. In such an event, the Engineer may accept the concrete, but reduce 2% of the unit rate per cubic meter of the defective concrete for every kg/cm^2 of the difference

between the required strength and the average strength. (For example: C130 concrete was required. The strengths of all samples were above 255 kg/cm² but the average strength of the samples was 367.5 kg/cm² instead of 375 kg/cm². In this case the Engineer may, at his sole discretion, accept the concrete and reduce its unit rate by 15%).

Concrete that has not met the requirements as stated above and concrete that the average compressive strength of the samples of which is below the nominal strength shall be rejected in every case. The part of the structure made of the rejected concrete shall be demolished and re-built by the Contractor at his own cost.

202.8.2.4 Impermeability Tests

Where required on the Drawings or the Specification, or where directed by the Engineer, the concrete shall be tested for impermeability. Samples for the impermeability tests shall be in the form of 20x12 cm plates and shall be prepared, cured and tested in accordance with DIN 1048. Unless otherwise stated in the Particular Specification or elsewhere in the Contract, the requirement for impermeability shall be that, when a water pressure of 2 kg/cm² is applied to one side of the test specimen, no moisture shall appear on the other side.

202.8.2.5 Payment for Tests

The costs of sampling and performing the tests in accordance with this Section, including all labour, equipment, transportation and ancillary works, shall be deemed to be included by the Contractor in his unit rates for concrete and shall not be paid for separately, unless specific items for testing are included in the Bill of Quantities.

202.9 Steel Reinforcement

202.9.2.1 General

Reinforcement steel for concrete shall meet the requirements of the relevant British Standards listed in Subsection 202.1.2 of this Specification.

The Contractor shall supply the Engineer with certificates from the makers of the steel showing that it has complied under test with the appropriate Standard Specification, stating the process of manufacture and if required the chemical analysis, and such test sheets shall be forwarded to the Engineer one week before the dispatch of such steel to the Works.

The steel shall be stored off the ground and kept scrupulously clean and free from loose mill scale, loose rust, oil and grease or other harmful matter. Any bar adversely affected by storage or for any other reason shall be cleaned or removed from the Site and replaced by the Contractor at his own expense.

202.9.2.2 Bar Schedules

Where reinforcement bar schedules are shown on the Drawings to assist the Contractor in preparing and placing the steel reinforcement, the Contractor shall carefully check such bar schedules for compliance with the structural drawings and shall correct the bar schedules as necessary. Where no bar schedules are incorporated in the Drawings, the Contractor shall prepare such schedules at his own cost and responsibility. In any case, the Contractor will be solely responsible for the correct preparation and placing of steel reinforcement in accordance with the Drawings. Any bars bent and prepared according to incorrect schedules, and not suitable for placing in the structure will be rejected and will not be paid for.

202.9.2.3 Bending Reinforcement

All bending shall be done cold, by an approved bending machine, in a manner that will not injure the material. Welded joints shall not be permitted in any bar. Only experienced steel benders, to the approval of the Engineer, shall be employed in bending. All bending shall be in accordance with British Standard 4466. The internal radius of all cranks and bends shall be at least three times the diameter of the bar. Heating of mild steel bars only to facilitate bending, especially of large diameter bars, will be permitted, provided the temperature of the steel does not exceed 850°C (cherry-red heat) and provided further that the cooling rate is low and uniform (normal still-air cooling). Quenching of hot-bent bars in water will not be permitted. Reinforcement bars depending on cold working for their strength, such as cold drawn or twisted bars shall not be bent hot.

202.9.2.4 Placing Reinforcement

The number, size, form and position of all steel bars, ties, links etc.. shall be in exact accordance with the Drawings and in the placing and fixing the function of each bar shall be borne in mind.

The greatest care shall be taken to ensure that the steel is laid out correctly in accordance with the Drawings and fixed rigidly within the forms. Sufficient temporary ties of annealed iron wire shall be provided to prevent any displacement before or during the placing of concrete and to ensure that the specified amount of cover is everywhere maintained. Concrete shall be rammed firmly with spatulas around the steel and compacted against it and against the shuttering.

No pieces of metal or blocks or wood shall be used on the bottom surface or against the sides of formwork to keep the reinforcing bars in position. For this purpose specially prepared precast concrete blocks shall be used of a thickness equal to the concrete cover specified hereafter. The use of plastic spacers is also accepted.

Unless otherwise shown on the Drawings or directed by the Engineer, the cover reinforcement, including cover stirrups and distribution bars, shall be at least equal to the diameter of the principal reinforcement bars plus

- at least 1 cm in the case of solid interior slabs, or
- at least 1.5 cm in all other cases, or
- at least 1 cm in addition to the above in the case of elements exposed to climatic influences.

In any case, all parts of a structure in direct contact with the earth or water shall have at least 3 cm cover over reinforcement, including stirrups and distribution bars.

The minimum cover stipulated above shall be increased, if necessary, up to 5 cm wherever a structure is particularly liable to danger of corrosion or abrasion, and up to 8 cm where concrete is placed directly against earth, without formwork.

Bars, generally, shall be of the required lengths and the lapping of main bars will not be permitted, except as indicated on the Drawings. Where bars are required or permitted to be lapped, the parts along the lap shall have a clear space between them equal to 1cm or the diameter of the bar, whichever is the greater. The minimum length of overlap will be 40 times the diameter of the bars for hooked bars and at least 60 times the bar diameter for bars without hooks. Laps of adjacent parallel reinforcement bars shall be staggered. Ends of ties shall be cut back 1.5 cm from face and covered with mortar. Fabric reinforcement shall be lapped at least 40 diameters or two squares, whichever is the greater.

All laps of bars are to be tied tightly with six laps of 1.5 mm annealed iron wire at intervals of ten diameters of the bars. All crossings of steel are to be secured with three laps of wire. Splicing of bars by butt welding will be permitted, provided that the resulting joint is not inferior in strength to the rest of the bars. Bars depending for their strength on cold drawing or twisting shall not be spliced by welding. Crossings of steel bars may be secured by tack welding instead of tie-wires, provided that burning or other damage to steel at tack-welds is prevented. All welds shall be done in a thoroughly workmanlike manner by qualified welders either by the oxy-acetylene method to BS 693 or by the metal arc method to BS 5135. Splices of bars having a diameter of 26 mm and more shall be done by butt-welding only.

The Contractor shall not pour any concrete before the Engineer has inspected and approved the placement of reinforcement. Such approval shall, however, not affect the Contractor's responsibility for the correctness of the

reinforcement in accordance with the Drawings, reinforcement schedules, Specifications and/or directions given by the Engineer.

202.10 Formwork

202.10.1General

The Contractor shall design, supply and fix all necessary formwork, together with its attendant scaffolding, timbering, shoring, strutting, etc.., required for the placing of the concrete.

The Contractor will be permitted to use timber boarding as formwork or forms lined with plywood, hardboard of approved manufacture or steel sheets. Where timber boarding is used, the formwork surfaces coming in contact with wet concrete shall be made of properly seasoned timber. Full size plywood or hardboard sheets shall be used except where otherwise required or where smaller pieces will cover the entire area. Forms shall be so placed that markings shall be symmetrical.

All formwork shall be of sufficient strength to resist movement of men or equipment and the pressure of the wet concrete while it is being placed and vibrated, without distortion. Where plywood, hardboard or steel lining is used, particular care shall be taken to ensure that the forms are adequately braced and stiffened.

The formwork for successive vertical lifts must make such perfect contact with concrete in the preceding lift that there shall be no excrescences, bulges, tears or other outward signs of faulty junction. The formwork must be constructed so that there shall be no leaked of mortar. Whenever it is unavoidable, the Contractor shall prevent leakage of any kind through open joints by means of suitable caulking.

The repeated use of forms of all descriptions will be at the discretion of the Engineer, who will require the forms to be reconditioned or surfaced from time to time. After repeated use, the old forms will be replaced with new ones at the direction of the Engineer.

All exposed concrete shall have the external angles chamfered 20 mm or as directed by means of moulding strips fixed to the formwork. Interior angles on such surfaces and edges at formed joints will not require bevelling unless requirement for bevelling is indicated on the Drawings.

The height of all erected at any one time shall be subject to the approval of the Engineer.

The surface of the forms shall be free from encrustation of mortar, grout, or other foreign material. Before the form panels or boards are erected in place, the surfaces of the forms shall be oiled with an approved commercial form oil that will effectively prevent sticking and will not stain the concrete surfaces.

202.10.2Types of Forms

The surfaces of formwork to give a desired finish of formed concrete will be classified as follows :

a) Unwrought Formwork of unwrought timber will be permitted in formwork for concrete surfaces or portions thereof which will receive plaster or other facing, or which will be covered up below ground level.

b) Wrought Formwork (for Smooth Internal and External Surfaces) made of new plywood or new steel sheets or timberboarding planed on both sides to equal thickness, shall be used on all exposed concrete surfaces except where plaster or another facing or fairface concrete are provided for. The formwork shall ensure that a regular and smooth finish is obtained, free of excessive bulges, irregularities or unsightly markings or defects of any kind.

c) Fair-face Concrete Formwork shall be employed where shown on the Drawings, required in the Specification or directed by the Engineer. This type of formwork shall include use of new plywood or new steel sheets equal

thickness, joined by torque and groove joints in parallel and vertical or horizontal alignment, arranged so as to achieve concrete surfaces of the textures and patterns required.

Where the surfaces formed in wrought or fair-face formwork are defective, the Engineer may order repairs to be made in accordance with Section 202.7 above and, if large surfaces should be found honeycombed or otherwise impaired, he may order all such surfaces to be plastered with cement plaster. Repairs to fair-face concrete, where required, shall be made in accordance with Section 202.7 above, but if in the Engineer's opinion such repairs would be insufficient to restore the external appearance of the surface, he shall order surfaces destroyed and cast anew.

The cost of all above-mentioned repairs to concrete surfaces, including application of cement plaster, and re-casting shall be deemed to be included in the unit rates for concrete work in the Bill of Quantities and shall not be paid for separately.

202.10.3Form Ties

Embedded metal rods or sleeves used for holding forms shall remain embedded and shall terminate not less than 2½ cm from the face of the concrete. Embedded wire ties for holding forms will not be permitted in concrete walls which are to come into contact with liquids or where the concrete surfaces through which the ties would extend will be permanently exposed. Wire ties may be used for concrete walls to be plastered, stone faced or covered with earth. Wire ties shall be cut back at least 1.5 cm from the face of the concrete. The holes left in the concrete surfaces after cutting back of wire ties and removal of fasteners or holding rods or sleeves, and the insides of sleeves where sleeves are used, shall be completely filled with an approved non-shrinking mortar, and the mortar shall be finished flush with the concrete surfaces. This operation will be carefully carried out. The hole formed by the cutting process will be thoroughly cleaned and wetted before filling. Time mortar will be of damp, not wet, consistency. The patch will be properly towelled smooth to match the surrounding concrete surfaces and shall be thoroughly cured by keeping it moist continuously for at least three days. After the patch has hardened, the Engineer may require the patch and the adjacent concrete surface to be ground down smooth. Any patches that are loose or hollow on completion must be re-done. Water stop tie rods shall be used for liquid retaining structures.

All costs for complying with the requirements of this Subsection shall be deemed to be included in the unit rates for formwork and shall not be paid for separately.

202.10.4Embedded Metal Parts

Parts of metal work, such as fixtures for wall brackets, hooks and similar parts that are to be embedded in the concrete shall be attached to the forms in their proper position prior to placing of concrete.

All costs for and in connection with the installation of metal parts shall be deemed to be included in the unit rates for formwork and for concrete and shall not be paid for separately, except where specific items shall be included in the Bill of Quantities.

202.10.5Striking of Forms

To facilitate satisfactory progress with the specified curing and to permit earliest practicable repair of surface imperfections, forms shall be struck as soon as the concrete has hardened sufficiently to prevent damage by careful form removal. Forms shall not be struck until the strength of the concrete is such that form removal will not result in perceptible cracking, breaking of surfaces, or other damage to the concrete and that the concrete can sustain the loads to be borne at the time of striking. Forms shall be struck with care so as to avoid injury to the concrete, and any concrete so damaged shall be repaired at the Contractor's expense.

No forms shall be removed without the express permission of the Engineer's Representative, but the Contractor shall, nevertheless, accept sole responsibility for the removal and consequences thereof.

In no case shall forms to soffits be struck until test cubes from the actual concrete concerned have yielded the 7 days strengths specified.

As a guide to the Contractor and subject to the foregoing requirements the followings minimum striking times, from the completion of concrete placing, may be assumed:

- For sides of Foundations, slabs, etc. - 24 hours
- For sides of Beams in suspended work, sides of walls and columns - 48 hours
- For sides of Retaining Walls - 36 hours
- For soffits of Beams and Slabs in suspended works (spans up to 3 meters) - 10 days
- For soffits of Beams and Slabs in suspended works (spans 3 to 6 meters) - 12 days
- For soffits of Beams and Slabs in suspended works (spans over 6 meters) - 14 days
- For the soffits of beams having a span of more than 5.0 m, at least one support and for those of slabs having a span exceeding 6.0 m, at least one row of supports shall be left in place for an additional period of seven days.

If the striking times stated above are not sufficient to permit the unsupported concrete to sustain superimposed loads (such as support for the shuttering of an upper floor, storing of building materials, etc..). Such loads will require special supports to sustain theim.

202.11 Miscellaneous Concrete Works

202.11.2.1 Openings and Holes in Concrete

Openings in concrete walls or slabs or reservoirs shall be predetermined and subject to the approval of the Employer. No openings shall be made after formworks removal. The Contractor shall be responsible for the co-ordination of all requirements of his sub-contractors as regards provision of openings, holes and fixings, and prepare shop drawings.

Holes left after the removal of formwork shall be filled with a compensating epoxy-based mortar or any similar product. For water retaining structures water stop tie rods shall be used when filling the holes to ensure watertightness.

Where it is impracticable, as determined by the Engineer's Representative, to install metal parts in the forms as required under Subsection 202.10.4 suitable holes or recesses shall be formed in the concrete structure into which the metal parts can be placed and grouted in. The shape and dimensions of such holes shall be as shown on the Drawings or as determined by the Engineer's Representative, and they shall be formed with wooden core boxes, fabricated in such a manner that they can be completely withdrawn or broken up and removed after the concrete has set. All such core boxes shall be set with great accuracy with the aid of templates and securely fixed to prevent displacement during concreting. The supply and installation of all such core boxes and their removal when the concrete has hardened sufficiently shall be deemed to be included in the unit rates for formwork and concrete work and shall not be paid for separately.

Where the holes or openings have not been formed in the concrete during placement, the Engineer may either order the tearing down and rebuilding of the structure or the part thereof concerned, or permit such holes or openings to be cut in the hardened concrete to the dimensions shown on the Drawings or as directed by the Engineer. Such cutting shall be kept to the minimum necessary dimensions and shall be done by drilling, chiselling or the use of a power tool, all as approved by the Engineer and in such a manner as not to cause any damage to the concrete structure.

Reinforcement bars passing through such holes or openings shall not be cut without the express written permission of the Engineer's representative.

Where the forming of the openings or holes has been omitted by the Contractor's neglect, all tearing-down and rebuilding or cutting of holes and openings in the hardened concrete as aforesaid shall be done by the Contractor at his own expense,

in all other cases the cost thereof shall be borne by the Employer and shall be paid for as extra work under Clause 51 of the Conditions of Contract.

202.11.2.2 Manholes and Chambers

Manholes and chambers shall be constructed in the positions and to the details shown on the Drawings. The grades of concrete and types of formwork shall be as shown on the Drawings, as required in the Specification or as directed by the Engineer. The inside dimensions, unless otherwise specified, will be after plastering or to otherwise finished surfaces.

A base slab of concrete, supporting the walls, shall be cast on firm ground foundations (so as to prevent any differential settlement), on a blinding layer of Lean Concrete (Grade C10). Where shown on the Drawings, smoothly constructed U-shaped channels, to carry and direct the flow, shall be formed integrally with the concrete base, or may be constructed separately by benching. Adjacent floor areas shall slope to drain to the channel with a gradient of about 5% to 10%. All transition curves shall be smooth.
The whole of the floor areas and channel surfaces shall be finished with a smooth coat of cement mortar.

The walls of the manholes shall be made of cast-in-situ concrete or of precast concrete rings, all as shown on the Drawings. The construction of walls shall not start sooner than 24 hours after slab had been cast. Cast-in-situ concrete and precast concrete shall be Grade C30 for floors, walls; ceilings and Grade C15 for benching. Precast concrete Chamber and Shaft rings shall conform to requirements of B.S. 556, shall be of the tongue and groove type and shall be assembled with cement-mortar joints to ensure complete water tightness of the joints.

Internal surfaces of Manholes and Chambers shall be absolutely smooth. This shall be achieved by the use of wrought formwork or by plastering with cement mortar 1:1½ and steel trowel finish with the addition of cement in the proportion of 1 kg per square meter as shown on the Drawings or as directed by the Engineer.

Aluminium or galvanized steel steps, or a ladder if so shown on the Drawings, shall be provided in all manholes 1.25 m deep and over. The steps shall be staggered and spaced at about 25 cm vertically, or as shown on the Drawings. They shall be solidly embedded in the walls prior to the plastering. The top step shall always be located to accommodate the right foot. Step irons for manholes shall comply with B.S. 1247 type A and shall be hot-dip galvanized. All steps shall be built in as the work proceeds. Cutting out completed work for inserting steps or other fittings shall only be permitted where it is impossible to built them in as the concrete is being cast. Unless otherwise specified, in manholes with depths greater than 5.25 m, laders shall be installed instead of steps. The ladders shall comply with the Drawings or shall be as specified or directed by the Engineer.

Where shown on the Drawings or directed by the Engineer, pipe stubs for future connections shall be installed. The stubs shall extend at least 50 cm beyond the outside of the walls of the manhole and shall be plugged watertightly. Appropriate channels for the future connections shall also be prepared in the benching.

Unless otherwise indicated, manhole and chamber covers shall be suitable for heavy duty and shall be made of cast-iron to B.S. EN124 or concrete with cast-iron frames, of a type approved by the Engineer. Suitable lifting keys of mild steel shall be provided with the covers at a rate of 1 set of keys for each 10 covers. After the completion of the work, cast iron parts of the covers and the frames shall be thoroughly cleaned and painted with bitumen paint.

Manholes shall be watertight. The Contractor shall, if so required, test them in the presence of the Engineer. The Contractor shall provide all water labour, drains, stoppers, bends and other needful appliances for carrying out tests and no manholes or other work must be covered up until they have been seen and passed by the Engineer. The test to be applied to manholes and chambers shall be their filling with water to 10 cm below the slab or to finished ground level and after allowing due time for saturation of the concrete, by topping up to the original level. Thereafter the loss of water shall not be greater than the equivalent of 2 cm over the whole area of the chamber in 24 hours.

202.11.2.3 Thrust and Anchor Blocks

Concrete thrust and anchor blocks shall be formed at bends, tees and valves in accordance with the details shown on the Drawings or as directed by the Engineer. Excavation shall be made after pipelaying, and the blocks concreted immediately after excavation. The back of supports and blocks shall abut on to solid ground with all loose material being removed before concreting.

No pressure shall be applied in any section of main until the concrete has achieved adequate strength and at least three day's curing.

Flexible joints shall not normally be cast in. Where the size of the block does not make this possible, additional flexible joints shall be provided no greater than half a pipe diameter beyond each face of the block.

202.11.2.4 Concrete Surround to Pipes

Where pipelines pass under streams and rivers or where directed by the Engineer, the pipeline shall be surrounded with concrete as shown on the Drawings.

Concrete surround shall be broken at all pipe joints to retain flexibility in the pipeline. No joints shall be concreted in without the prior approval of the Engineer.

202.11.2.5 Precast Concrete

All precast concrete members to be used in the works, such as covers, lintels, sills, slabs, stairs, etc.., shall be manufactured on site or obtained from approved manufacturer. In either case casting shall be done under the supervision of the Engineer, whose approval of the place and method of casting must be obtained before starting work. If casting is done on the site, the Contractor shall prepare a suitable area near the structure for which the precast parts are intended, and samples of the precast work shall be submitted to the Engineer for approval before proceeding with the manufacture on site. Casting of the precast parts shall be completed in due time so as not to delay the completion of the structures and everything connected therewith.

Unless otherwise directed, precast elements shall be of concrete Grade C30P. All precast elements shall be true to dimensions and shapes as shown on the Drawings. Concrete surfaces shall be smooth and all corners square or chamfered, as shown on the Drawings or directed by the Engineer. Lifting lugs and similar metal parts, whether part of the reinforcement steel or not, shall be incorporated in the elements during manufacture. Precast elements shall not be transported or otherwise handled until the end of the curing period, which shall be at least 14 days.

Any precast concrete element becoming defective during casting or placing or from any other cause, and rejected by the Engineer, shall be removed from the Site by the Contractor who shall cast new elements to replace the rejected ones, and all expenses in connection therewith shall be borne by the Contractor.

202.11.2.6 Cast-in-situ Reinforced Concrete piles (Not Applicable)

202.11.2.7 Hourdis Slabs

A Hourdis slab is a monolithical reinforced concrete slab consisting of embedded beams and ribs separated by raws of hollow blocks (Hourdis blocks).

The reinforcement bars of the beams and ribs as well as the hourdis blocks shall be placed on the formwork prior to start concreting.

The hourdis slabs shall be carried out in accordance with the details and dimensions shown on the Drawings.

202.12 joint seals with elastomeric sealants

202.12.2.1 Major Components

The major components of a good joint seal are:

- The substrate,
- The joint filler,
- The bond breaker, and
- The sealant.

a) The substrate:

The more common substrates are masonry concrete, metal, and glass; these are generally classified as porous /or/ non porous.

- Some substrate may not be suitable for achieving a bond unless, treated mechanically, chemically, or both.
- When the substrate has a coating, this coating must be compatible with the sealant and its bond to the substrate and sealant must be adequate.
- The Contractor must consult both substrate and sealant manufacturers for suitable joint preparation methods and primers to be used before applying joint materials.
- Adhesion testing of trial applications in the site is recommended.
- Surface laitance and incompatible or bond-inhibiting form release agents on concrete surfaces, must be removed.
- Substrates must be clean, dry, sound, and free of loose particles, contaminants, foreign matter, water-soluble material, and frost.
- Joints in masonry and concrete should be sealed before cleaning exposed surfaces and applying required protective barriers.

b) Primer:

The purpose of a primer is to improve the adhesion of a sealant to a substrate. Many sealant require primers on all substrate; some on only certain substrate or on none at all. Most require a primer for maximum adhesion to concrete and masonry surfaces.

c) Joint Fillers:

A joint filler is used to control the depth of sealant in the joint and permit full wetting of the intended interface when tooled.

Some joints fillers may be incompatible with the substrate and sealant, causing stains, on either one of them or both. Some may be factory coated with a suitable material that provides a barrier to staining.

The Contractor must confirm this suitability, i.e. that the barrier coating must be acceptable to both, the sealant and the joint filler manufacturers.

Joint filler for vertical application may be flexible, compatible, closed cell plastic foam /or/ sponge rubber rod stock, and elastomeric tubing of such materials as:

- neoprene,
- butyl, and
- E.P.D.M.

They should resist permanent deformation before and during sealant application, be non absorbent to water or gas, and resist flowing upon mild heating since this can cause bubbling of the sealant.

- Open cell sponge type materials such as urethane foam may be satisfactory, provided that their water absorption characteristics are recognised. The sealant should be applied immediately after joint filler placement to prevent water absorption from rain.

- Elastomeric tubing of neoprene, butyl, or EPDM may be applied immediately as a temporary seal until the primary sealant is put in place, after which they serve to a limitated degree as a secondary water barrier.

  Joint filler for horizontal application (for floors, pavements, sidewalks, patios and other light-traffic areas may be compatible, extruded, closed cell, high density flexible foams, corkboard, resin-impregnated fiber board /or/ elastomeric tubing /or/ rods).

- These joint fillers should remain resilient in cold temperature, exhibit good recovery, not cause the sealant to bubble in the joint because of heat, and be capable of supporting the sealant in traffic areas.

- They should not exude liquids under compression, which could hydraulically cause sealant failure by forcing the sealant from the joint.

- Combination of joint filler may be used to form a joint in concrete and an additional filler material may be installed under compression across the width and to the proper depth just before the sealant is applied to provide a clean, dry, compatible backup.

d) Bond breaker:

A bond breaker may be necessary to prevent adhesion of the sealant to any surface or material where such adhesion would be detrimental to the performance of the sealant.

- The use of a joint filler to which the sealant will not adhere may preclude the need for a bond breaker.

- The bond breaker may be a polyethylene tape with pressure-sensitive adhesive on one side /or/ various liquid applied compounds, as recommended by the sealant manufacturer.

e) Sealant

Sealants are classified as:

- single component /or/ multicomponent
- non sag /or/ self leveling,
- traffic /or/ non traffic use

as well as according to movement capability.

- Characteristics of common elastic sealants are listed in the following Table 2.5:

Table 2.5
CHARACTERISTICS OF COMMON ELASTOMERIC SEALANTS

	ACRYLIC (SOLVENT RELEASES)	POLYSULFIDE		POLYURETHANE		SILICONE
	(ONE PART)	TWO-PART	ONE-PART	TWO-PART	ONE-PART	(ONE PART)
Chief ingredients	Acrylic terpolymer, inert pigments, stabilizer, and selected fillers	Polysulfide polymers, activators, pigments, plasticizers, inert fillers, gelling, and curing agents		Polyurethane prepolymer, inert fillers, pigments, plasticizers, accelerators, activators, and extenders	Polyurethane prepolymer, inert fillers, pigment, and plasticizers,	Siloxane polymer pigment, and selected fillers
Percent solids	85-95	95-100	95-100	95-100	95-100	95-100
Curing process	Solvent release and very slow chemical cure	Chemical reaction with curing agent	Chemical reaction with moisture in the air	Chemical reaction with curing agent	Chemical reaction with moisture in all, also oxygen	Chemical reaction with moisture in all
Curing characteristics	Skins on exposed surface; interior remains soft and tacky	Cures uniformly throughout; rate affected by temperature and humidity	Skins over, cures progressively inward; final cure uniform throughout	Cures uniformity throughout; rate affected by temperature and humidity	Skins over, cures progressively inward; final cure uniform throughout	Cures progressively inward; final cure uniform throughout
Primer	Generally not required	Manufacturer's approved primer required for porous surfaces, sometimes for other surfaces		Manufacturer's approved primer required for most surfaces		Required for most surfaces
Application temperature (°F)	40-120	40-100	60-100	40-120	40-120	0-120
Tackfree time	1-7 days	6-24 hr	6-72 hr	1-24 hr	Slightly tacky until weathered	1 hr or less
Hardness, Shore A Cured 1 to 6 months Aged 5 years	 0-25 45-55	 15-45 30-60	 25-35 40-50	 20-40 35-55	 25-45 30-50	 20-40 35-55
Toxicity	Nontoxic	Curing agent is toxic	Contains toxic ingredients	Toxic; gloves recommended for handling		Nontoxic
Cure time (days)	14	7	14-21	3-5	14	5
Joint movement capability (max.)	± 12.5%	± 25%	± 15%	± 25%	± 15%	± 25% high modulus ± 50% low modulus
Ultraviolet resistance (direct)	Very good	Poor to good	Good	Poor to good	Poor to good	Excellent
Dirt resistance cured	Good	Good	Good	Good	Good	Poor
Use characteristics	Excellent adhesion; poor low-temperature flexibility; not usable in traffic areas; unpleasant odor 5-12 days	Wide range of appropriate applications; curing time depends on temperature and humidity	Unpleasant odor; broad range of cured hardnesses available	Sets very fast; broad range of cured hardnesses; excellent for concrete joints and traffic areas	Excellent for concrete joints and traffic areas, but substrate must be absolutely dry; short package stability	Requires contact with air for curing; low abrasion resistance; not tough enough for use in traffic areas

202.12.2.2 Joint Design

The design geometry of a joint seal is related to numerous factors including:

- desired appearance,
- spacing of joints,
- anticipated movement in joint,
- movement capability of sealant to be used,
- required sealant width to accommodate anticipated movement,
- and tooling methods.

a) Sealant width

The required sealant width relative to thermal movement is determined by:

- the application temperature range of the sealant
- the temperature extremes anticipated at the site location
- the temperature at the time of sealant application, and
- the movement capability of the sealant to be used.

1) In the absence of specific application temperature knowledge, an ambient application temperature from 4°C to 38°C (40° to 100°F) should be assumed in determining the anticipated amount of joint movement in the design of joints.

2) Although affected by ambient temperatures, anticipated joint movement must be determined from anticipated building material temperature extremes, rather than ambient temperature extremes.

3) Many other factors can be involved in building joint movement including but not limited to:

   a) material mass
   b) color
   c) insulation
   d) differential thermal stress (bowing)
   e) residual growth or shrinkage of materials
   f) building sway and
   g) seismic forces

4) The design joint width should be calculated taking all possible movement and tolerance factors into consideration.

5) A simplified method (but no as accurate) is to use the accompanying graph.

b) Joint depth:

The sealant depth, when applied, depends on the sealant width; the following guidelines are normally accepted practice

1) For a recommended minimum width of ¼ in, the depth should be ¼ in

2) For joints in concrete, masonry, or stone, the depth of the sealant may be equal to the sealant width in joint up to ½ in

   a) for joints ½ in to 1 in wide, the sealant depth should be one-half of the width.
   b) for joints 1 to 2 in wide, the sealant depth should not be greater than ½ in.
   c) for widths exceeding 2 in, the depth should be determined by the sealant manufacturer.

3) For sealant widths over ¼ in and up to ½ in in metal, glass and other nonporous surface joints the minimum of ¼ in in depth applies, and over ½in in width the sealant depth should be one-half the sealant width and should in no case exceed ½in.

When determining the location of the joint filler in the joint, consideration should be given to the reduction in sealant depth with concave and recessed tooled joints, and the joint should be designed accordingly.

202.12.2.3 Application

To obtain proper adhesion, it is essential that:

- the sealant comes in direct contact with the substrate,

- the sealant wets the surface of the substrate
- the substrate is strong enough to provide a firm anchor for the sealant.

- If any of these conditions is not met, poor adherence will usually result.

- The sealant should be installed in such manner as to completely fill the recess provided in the joint.

Against a porous material, the sealant must enter the pores if goal adhesion is to be obtained. Sealants used for this application are thixotropic and will resist flow into the pores unless an external force is applied. Proper filling of the recess accomplishes this, in part, and proper tooling ensures it.

a) Joint preparation:

For a joint to receive sealant it must be cleaned out and raked to full width and depth required for installation of joint seal materials. Thoroughly cleaning all joints is by removing all foreign matter such as: dust, paint (unless it is a permanent protective coating), oil, grease, water proofing or water-repellent treatments, water, surface dirt and frost.

- Clean porous materials such as: concrete, masonry and unglazed surfaces of ceramic tile, by brushing, grinding blast cleaning, mechanical abrading, acid washing or a combination of these methods to provide a clean, sound substrate for optimum sealant adhesion.

- The surface of concrete may be cut back to remove contaminants and expose & clean surface when acceptable to the purchaser.

- Remove laitance from concrete by:

    - Acid washing
    - grinding or
    - mechanical abrading

- remove all form of oils from concrete by blast cleaning.

- remove loose particles originally present or resulting from

    - grinding abrading or
    - blast cleaning

- by blowing out joints with oil free compressed air (or vacuuming) prior to application of primer or sealant.

- Clean nonporous surfaces, such as metal, glass, porcelain enamel and glazed surfaces of ceramic tile chemically or by other means that are not harmful to the substrate and are acceptable to the substrate manufacturer.

- Remove temporary coatings on metallic surfaces by a solvent that leaves no residue. Apply the solvent with clean oil free cloths or lintless paper towels. Do not dip cleaning cloth in the solvent. Always poor the solvent on the cloth to eliminate the possibility of contaminating the solvent. Do now allow the solvent to air-dry without wiping. Wipe dry with a clean dry cloth or lintless paper towels. Permanent cloathings that are to be remain must not be removed or damaged.

b) Masquing Tape:

Install masquing tape at joint edges when necessary to avoid undesirable sealant smears on exposed visible surfaces. Use a non staining, non-absorbent, compatible type.

c) Primer and Joint Filler:

Install primer when and as recommended by the sealant manufacturer for optimum adhesion.

Install compatible joint filler uniformly to proper depth without twisting and braiding.

d) Sealant:

Install sealant in strict accordance with the manufacturer's recommendations and precautions. Completely fill the recess provided in the joint. Sealants are more safety applied at temperature above 40°F (≈ 5°C)

e) Tooling:

- Tooling nonsag sealants is essential to force the sealant into the joint and eliminate air pockets and should be done as soon as possible after application and before skinning or curing begins. Tooling also ensures contact of the sealant to the sides of the joint.

- Plastic or metal tools can be used. Most applicators use dry tools but they may be surface-treated to prevent adhesion to the sealant and may be shaped as desired to produce the desired joint profile. Dipping tools in certain liquids decreases the adhesion of the sealant to the tool. All liquids should be first tested and accepted for by the manufacturer. The use of some liquids may result in surface discoloration. In using tooling liquids, cares should be taken to ensure that the liquid does not contact joint surfaces prior to the sealant contacting the joint surface. If the sealant overlap the area contaminated with the liquid, the sealant bond may be adversely affected.

- Tool sealant so as to force it into the joint, eliminating air pockets and ensuring contact of the sealant with the sides of the joint. Use appropriate tool to provide a concare, flush, or recessed joint as required.

- Immediately after tooling the joint, remove masking tape carefully if used, without disturbing the sealant.

f) Field testing

In case where the building joints are ready to receive sealant and the question of adhesion of the sealant to novel or untried surfaces arises, it is advisable to install the sealant in a 1.5m (5 feet) length of joint as a test.

- It would be good practice to do this as a matter of standard procedure on all sites even though unusual conditions are not suspected.

- Following instructions of the sealant manufacturer and using primer as and when recommended, the Contractor will install the sealant in the joint and examine for adhesion after cure to determine whether proper adhesion has been obtained.

202.12.2.4 Bituminous sealant to waterproof horizontal joints

Once the joint sealant are approved by the Engineer, the Contractor shall submit for approval the application procedures.

Application conditions

1) Prior to filling the joints, the Contractor shall:

   a) make good damaged joints,
   b) grind or saw joints which are narrower than required,
   c) clean by grinding and brushing joint sides,
   d) clean with compressed air.

2) Bituminous sealants are hot applied under temperature ranging from 100°C to 130°C, and with a caulking gum. The nozzles shall be kept at the bottom of the joint to ensure a complete and tight filling.

3) In the event of a mastic creep in horizontal joints, the Contractor shall re-fill tightly the surface.

202.12.2.5 Surface strip joint seal (combiflex type or similar)

Surface strip joint seal, is applied, where shown on the drawings or indicated by the Engineer.

1) Many joints can be reliably and durably sealed with a system based on an elastomeric strip bridging the joint and bond on both sides of the joints with a special epoxy adhesive.

   a) This is a flexible water proof seal for joints. The strip is highly flexible and fully weather-resistant elastomeric membrane (neoprene, hypalon or E.P.D.M)

   b) The width of the strip varies from 100mm minimum to more than 500mm.

   c) The thickness varies from 1 to 3mm.

   d) In some cases the strip must be protected.

2) The Contractor shall apply the whole system in accordance with the manufacturer technical data sheet.

202.13 elastomeric support

202.13.2.1 General

Elastomeric supports must comply with the following criteria:

1) to be of simple design under normal execution procedures.
2) to permit:
   a) horizontal displacement due to any cause,
   b) rotation of the support due to bending under permanent loads, working loads and the effects of hydraulique shrinkage and thermal phenomena, without building liable stresses outside the elastomeric support.

The elastomeric support can fill all the substrate surface of the wearing walls /or/ only a part of this surface; the unoccupied surface. In this case must be filled by a compressible material to avoid the intrusion of concrete grout between the various elements of the elastomeric support.

202.13.2.2 Material and Application

The elastomeric support is generally constituted by a non-hooped elastomeric polychloroprene (neoprene) which under various movements and loads will sustain deformation, transmitting to the underneath wearing walls, vertical and horizontal efforts.

a) Eveness of the wearing substrate

The substrate wearing surface must be evened to avoid any accidental contact outside the designed contact surfaces; anyhow the wearing zones must be made horizontal.

The Contractor must furnish to the Engineer all necessary justifications concerning the elastomeric support and the procedures for the execution of the wearing surface.

b) Minimal characteristics

The following minimal characteristics must be submitted by the Contractor for the Engineer's approval:

- Maximal constraint which varies with the type of material used (around 30 bars /or/ 3 MPa for the non-hooped polychoroprene = neoprene)

- Minimal constraint to be obtained and which is needed to respect the condition of non-slipping of the elastomeric support on its substrate (around 15 bars or 1.5 MPa for the non-hooped polychloroprene = neoprene)

This condition may result for the elastomeric support to have a maximal dimension implicating sometime the impossibility to design a continuous linear elastomeric support. Thus needing to consider the use of strips or pads of elastomeric material.

A continuous break of ties must be then insured between the pads by incorporating between the pads of neoprene of a compressible material (polystyrene type) and making the joints between pads and polystyrene water tight to avoid concrete grout intrusion.

c) Minimal thickness of the Elastomeric Support

The required thickness of the neoprene support shall depends on the loads, the amount of sliding and permissible rotations.

The Contractor shall submit technical certificate from the manufacturer to the Engineer allowing him to control and approve the chosen sizes and thickness of the elastomeric support.

The minimal thickness is conditioned by two factors:

- the maximal distortion of the neoprene (α) which must not exceed $\alpha \leq 0.5$ radians.
- the thickness must be large enough to permit rotation of the support avoiding contact in the maximum compression corner zones.

d) Determination of the Horizontal stresses

As an example, horizontal stresses may be controlled by the following formula (DTU.20.12)

$$H = G \times S \times \frac{U}{e}$$

e = thickness of the support
S = surface of the support in contact with the substrate
G = Transversal elasticity coefficient of the neoprene (around 0.8 to 1.3 MPa or 8 to 13 bars depending of the neoprene quality)
U = displacement

The admissible displacement (U) in relation with the thickness (e) can be first estimated as follows:

Thickness (mm) e =	5	10	15	20
Displacement (mm) U =	2.5	5	7.5	10

e) Other approved elastomeric support

The elastomeric constituting the pad may be a mix vulcanised based on Ethylene - Propylene - Diene - Monomer (E.P.D.M) which has the following average characteristics:

- A shore hardness of 60 ± 5
- Specific weight 1.06 ± 0.02 g/ml
- Ultimate resistance (rupture) ≥ 15.0 MPa
- Maximum elongation (Rupture) ≥ 400%
- Tearing resistance ≥ 15.0 MPa
- Permanent deformation after 24 hours at 70oC ≥ 20%

- Module "G" of transversal elasticity 0.8 ± 0.1 MPa

f) Compression Sollicitation

The admissible load over an elastomeric linear pads support depends of the dimensions and number of elastomeric pads constituting the support.

The average admissible constraint on every single pad is obtained for example by using the following formula

$$\text{average} = 1.2 \times \beta \leq 5 \text{ MPa}$$

Where β (form factor) $= \frac{a \times b}{2xt(a+b)}$

t = thickness of the elastomeric support
a,b = dimensions (in plan) of the elastomeric support

g) Special dispositions

In case the horizontal effort is greater than the value of friction of the interface between the elastomeric support and the substrate, the following dispositions must be taken by the Contractor:

If not otherwise specified by the Engineer the Contractor may stick the pads to avoid uncontrolled displacement when setting the different elements.

A special glue approved by the Engineer must be laid on the primed substrate and on the back side of the pad. After a maturation time, the pad shall be applied on the glued substrate with force.

202.13.2.3 Slip membrane

This slip membrane is constituted generally

- a protection sheet
- a slip plate around 3mm thick
- a silicone lubrication or similar
- an elastomeric pad recovered with special slipping cover adhering to it.

This system fulfills most of the usual functions of elastomeric support as:

- uniform distribution of vertical loads
- horizontal displacement by slipping of the supported construction over it.

This system will permit under small thickness, wide horizontal displacement with minimum limitation of the horizontal stresses transmitted and after the displacement it does not exerce any underpinning stress on the construction at the contact interface.

The Contractor is asked to submit all technical specifications to the Engineer for approval before any purchase of the material.

202.14 Methods of Measurements

202.14.2.1 General

Except where otherwise specified, cast-in-situ concrete will be measured and paid for by volume. Separate payment will be made for reinforcement steel (by weight) and formwork (by area).

The following items shall be measured and paid for as specified hereafter :
- Manholes and chambers - by completed units.
- Precast concrete elements - by completed units, or by length or area.
- Cast-in-situ reinforced concrete piles - by linear meters.

A detailed description of the methods of measurements and payment for the different concrete works is given in the following subsections.

202.14.2.2 Cast-in-situ Concrete

Concrete will be classified for payment in accordance with grades, structural elements and location in the structure.

Except as otherwise specified, all cast-in-situ concrete will be measured by volume to the neat lines and dimensions shown on the Drawings or determined by the Engineer. The volume of all openings, holes and shown on the Drawings or determined by the Engineer. The volume of all openings, holes and recesses not actually filled by concrete will be deducted, but no deduction will be made for the volume of reinforcing steel or small openings (less than 0.1 sq.m. in surface area) and metal parts embedded in the concrete. No payment will be made for concrete that has been rejected or for concrete used to fill over-excavations.

Floors and intermediate and roof slabs will be measured over the external walls. Columns will be measured from top of foundation to first floor soffit and between floor slabs. Beams will be measured between columns or walls in length, and to floor soffits in height.

The unit rates for concrete shall include for : supply and transport of all materials to the site; batching, mixing, placing, vibrating and curing of concrete; testing of concrete; finishing of concrete, except as otherwise paid for under specially provided items in the Bill of Quantities.

Binding layers of lean concrete will be measured by square meters to a stated thickness. Cyclopean concrete will be measured by cubic meters including stones.

The shotcrete concrete will be measured by cubic meters including all means of application.

The Fiber concrete will be measured by cubic meters including all necessary metallic fibers.

202.14.2.3 Reinforcement Steel

Reinforcement steel will be classified for payment in accordance with the type of bars or fabric.

Measurement for payment of reinforcement bars will be made only of the weight of the bars placed in the concrete, on the basis of the net lengths and sizes, in accordance with the Drawings or as directed. Overlaps not shown on the Drawings will not be measured for payment. Payment for reinforcement bars will be made at the unit rates per kilogram (or ton) bid therefore in the Bill of Quantities, which unit rates shall include the cost of furnishing the reinforcement bars, furnishing and attaching tie rods and fasteners, wire ties and metal supports, if used, and of delivering, unloading, hauling, storing, sorting, cutting, bending, cleaning, welding if necessary, placing, and securing and maintaining in position all reinforcement bars, as shown on the Drawings or as directed, as well as waste and overlaps not shown on the Drawings.

Fabric reinforcement, required, will be measured on the basis of the area of work covered and will be paid for at the unit rates per kilogram (or ton) bid therefore in the Bill of Quantities, which unit rates shall include the cost of furnishing the fabric, cutting it to the required sizes, bending, placing, binding, supplying and placing all supports that are required, as well as the cost of all laps and waste.