CDI International Building Services Engineers

Office **Residential** Hotel&Resort Leisure Healthcare Heritage Retail Industrial Mixed use

Company profile

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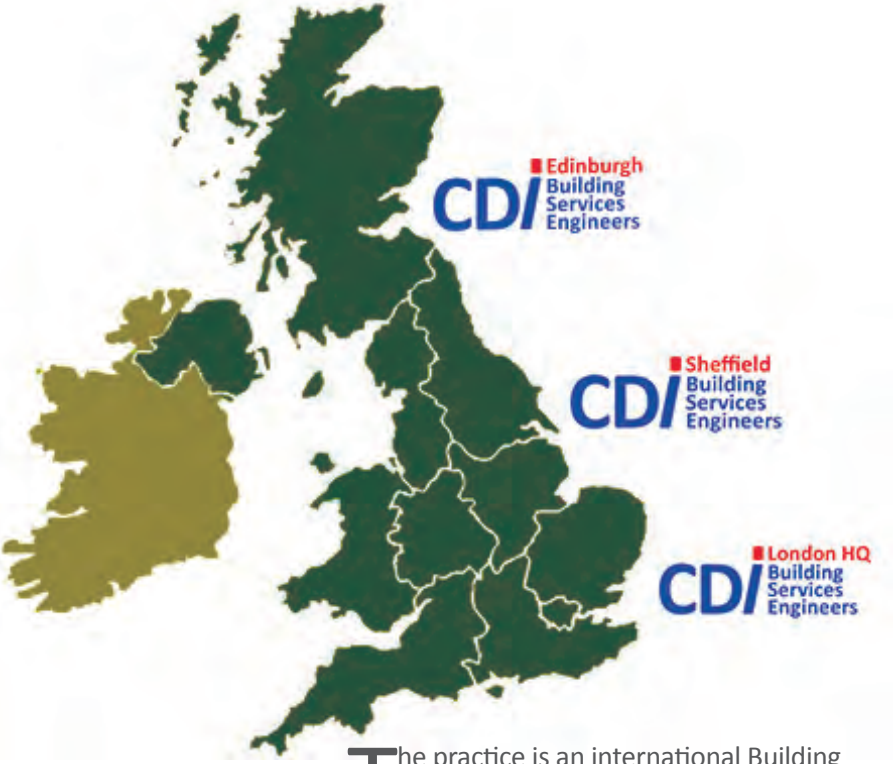
About CD International /



The practice is an international Building Services Consulting Engineers having completed award winning projects throughout Europe with construction values up to £300 million.

Location

The company has offices in London, Edinburgh and Sheffield with associate partners throughout Central and Eastern Europe, Central Asia and the U.S.

Sectors

Market strategy has been committed to developing consultancy appointments throughout all areas of the commercial sector including:

- Mixed-use & Retail
- Leisure and entertainment
- Office & tech hubs
- Hotel & Resorts
- Residential
- Listed & Heritage

The business strategy is also focused on a European and worldwide operation with a number of major projects successfully completed in continental Europe, Africa and the Middle East.

Working with lead architects and local partners on international schemes, we developed unique experience and ability to combine knowledge from various practices and implement it into the real project.

Services

The company offers a full range of professional services which can be individually tailored to meet specific client needs as follows:

- Mechanical Design
- Electrical Design
- Public Health Design
- Fire Protection and Life Safety
- Vertical Transportation
- Infrastructure
- Low energy design
- IT communication
- Low Carbon Energy assessment
- BREEAM assessments
- Thermal Modelling
- Energy audits and energy appraisals

Structure and Experience /

Working closely with architects and local specialists, we implement the latest technologies and modern approach to deliver comfortable and sustainable living environments.

Structure

- Project Directors remain an integral part of the design process.
- Shortened communication channels ensure a fast response time
- Project teams capable of handling a wide range of project types
- Individual groups draw upon the shared experience and resources within the company.

Mixed use projects

CD International engineers have been working under the multiple projects in mixed use and residential environment for the past 25 year.

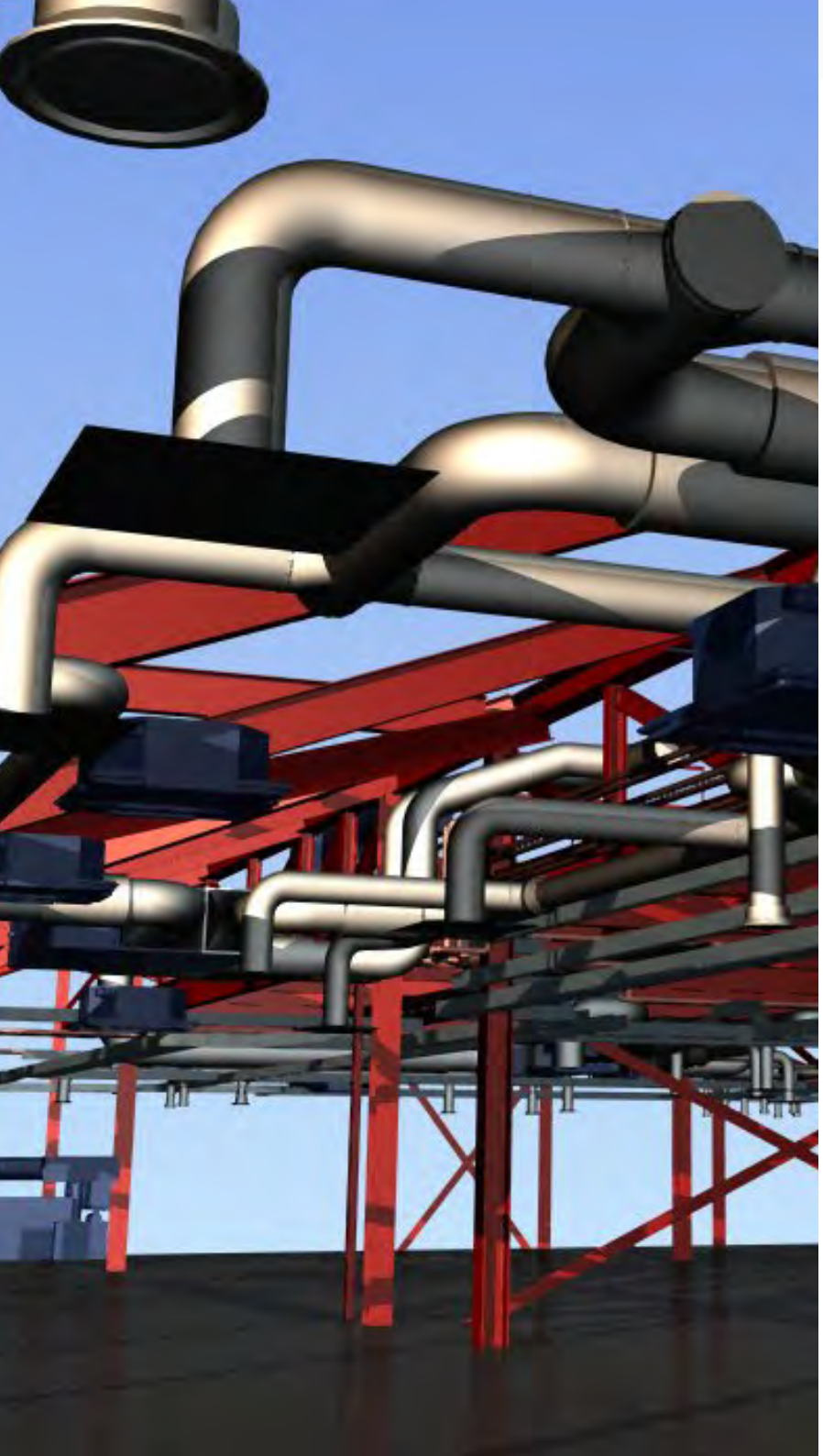
We have highly qualified team, with experience in design of building services for developments in Europe, including Russia, Ukraine, Bulgaria, Albania and the UK.

Experience

We have got strong technical engineering understanding of the projects in all building sectors and across many countries.

Geography of works

- Albania
- Armenia
- Belarus
- Croatia
- Czech Republic
- France
- Germany
- Macedonia
- Moldova
- Montenegro
- Poland
- Russia
- Serbia
- Ukraine
- England, Scotland & Wales
- Kyrgyzstan
- Kazakhstan
- Lebanon



Technology & BIM /

We have been using IESVE for Engineers modeling Software, SketchUP Pro and Revit® Architecture and MEP for most of the projects in the UK and abroad. This allows us to design comfortable buildings that consume significantly less energy and incorporate low-carbon and renewable technologies.

IESVE© for Engineers

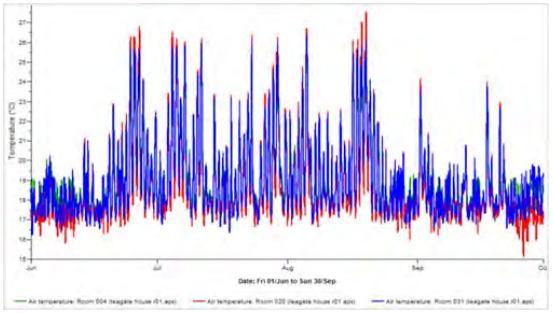
is a cutting-edge suite of building performance simulation tools. Used by leading sustainable design experts across the globe, it creates understanding of the performance impacts of different low-energy design strategies.

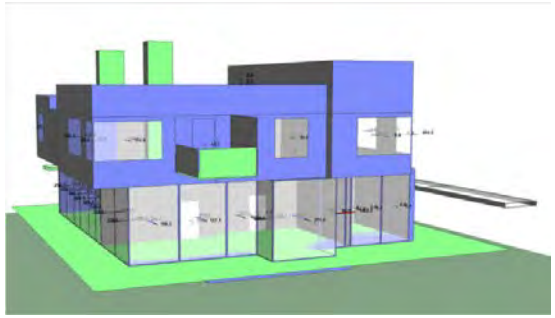
Autodesk Revit ©

REVIT© allow multiple disciplines work together on the same project. With REVIT© we can perform collision checking, which detects if different components of the building are occupying the same physical space.

SketchUP

SketchUP allow us to draw and present the project in 3D format, analyse best location and dimensions for Brise Soleil and has may other useful applications.





Sustainability and Planning /

We are committed to measuring the low energy design aspects for all our projects and believe this will become an ever increasingly important factor in the design process.

Sustainability

We are committed to developing sustainable projects utilising low energy solutions. We have a building technology team specialising in the field of sustainable/green building design. The company is a member of the, BREEAM register, BSRIA and CIBSE.

Our aim is to incorporate low energy solutions which offer the Client a realistic return on the investment. We have a dedicated internal team to offer comprehensive service on all aspects of low energy design including:

- Energy Surveys
- Thermal Modelling (IES software)
- Building Regulations Part L (SBEM) compliance calculations and EPC
- Renewable Energy Reports
- BREEAM , CODE for Sustainable Homes

Sustainable energy strategy

Our reports explore available low energy and renewable options and propose the Sustainable Energy Strategy. Energy efficient technologies, decentralised energy systems and renewable energy technologies are being considered to comply with the London Boroughs Development Plans and the Sustainable Design and Construction Documents (SPD).

London Plan Policies

The following policies has been assessed as set out in the London Plan 2011, Chapter 5 London's Response to Climate Change, and follows the hierarchy of using less energy, supplying energy efficiently and using renewable energy:

- Policy 5.2 Minimising Carbon Emissions - Sustainable Energy Efficiency (LEAN)
- Policy 5.5 Decentralised Energy Networks
- Policy 5.6 Decentralised Energy in Development Proposals (CLEAN)
- Policy 5.7 Renewable Energy (GREEN)

The London Plan Policy 5.2 & 5.5 & 5.7 Renewable Energy & Decentralised Energy Networks highlights the following approaches which should be considered in developing the sustainable energy strategy:

- Renewable Energy;
- Hierarchical carbon dioxide emission reduction;
- Decentralised Energy;
- Connection to Decentralised Energy Network.

Sectors /

Mixed Use Developments

Shopping centres & Retail Parks

Business Centres & Offices

Private & multi storey residential

Hotels & Leisure Parks

Energy Programmes and assessments

Client: Golden House, Uzbekistan
Architect: Chapman Taylor, UK
Structural: Tashgiprogor, Uzbekistan
Lighting: Scotts Lighting, Germany
MEP Design: CD International BSE, UK

Residential / Uzbekistan

Tashkent / Mirabad Avenue

Mirabad Residential project is a unique opportunity for a new type of residential development in the city of Tashkent and will initiate regeneration of the area and create a new urban quarter.

Context

We are proud to be one of a few international teams that are currently working in Uzbekistan. Beautiful country with the ancient history has been gradually opening up to the world and welcomes new approach and technologies to create new their living built environment.

The design team lead by Chapman Taylor Partners (CTP) with local planning institute advising on specific of planning and regulations. The competent design team with international experience is to ensure that local culture and traditions are embedded into the planning and design of the residential quarters.

There will be around 2000 mid and high- end apartments delivered in two phases, spread across four blocks with massive green courtyards in each block, underground parking and green roofs. First two floors of each building are allocated for commercial spaces, like shops, small offices, restaurant and amenities, including gym, nursery and services for the local residents.

Energy Strategy

Prior to the start of MEP design we developed and agreed with the Client a Sustainability Energy Strategy (SES). In order to realise the Strategy it was important to understand the drivers for change and to define a long-term vision for the scheme. Uzbekistan's Government initiated a number of important steps to support development of their energy sector, as the current energy infrastructure is overloaded and in-efficient with reported significant losses.

We proposed a Communal Central Energy Strategy, where heating and cooling network can deliver both the necessary capacity to meet current demand, significantly contribute to CO_2 emissions reduction and provide a robust framework to address future demand growth and variation between heating, cooling and electricity. Future proof the scheme is vital in terms of maximum capacity and capacity phasing, as is adopting emerging low carbon technologies as they become commercially viable.

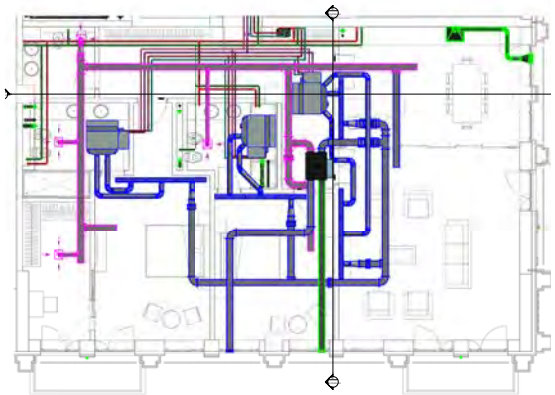
Heating and cooling

Tashkent is famous for its long hot summers and very mild winters, so the efficient cooling and air conditioning is essential. High standard of insulation also required to minimise heat losses.

Traditionally, residents would install the A/C units themselves, mounting an external block on the façade of the building. Unfortunately, there are a lot of examples, where such uncontrolled installations completely ruined the look of the building. One of the solutions implemented by our Client previously for de-centalised air conditioning was to install place holders for units, which form a part of façade decorations in traditional patterns. This allows to transfer the capi-

tal, running and maintenance cost of A/C to the residents, but does not allow the owner of the development to control energy spent on cooling or heating or benefit from heat recovery or efficiency of central chillers.

We proposed to install central heating and cooling, where each apartment unit is provided with cooling connections from the central system distribution of chilled water. Chiller will utilise environmentally friendly refrigerants and heat will be rejected via air cooled tower condensers. Heating is generated by highly efficient gas fired condensing boilers.



Ventilation

For ventilation, residential apartments using air handling units with heat recovery. Special requirements were placed for kitchen extracts. Firstly, by the existing building codes of the country, secondly, by the nature of the traditional cuisine of Uzbekistan that proved to be very spicy, aromatic and oil reach. Short length of extract to a façade was a traditional option, however this may create unwanted smell drifting along the elevation and reaching intake points.

Option with central kitchen extract duct to the roof could undermine the flexibility principles, and but was chosen after weighting all options.

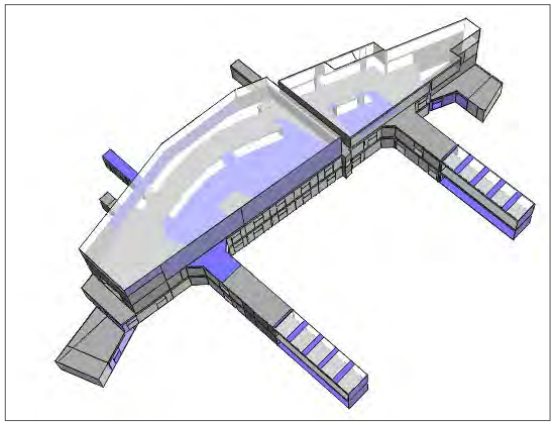
Building management system

Whole complex will be managed by one company and BMS systems will be installed to enable simple, efficient control and monitoring of all required functions, including HVAC systems with energy monitoring including all metering for the apartments and retail, fire and security systems etc. This is relatively new application in Uzbekistan and would need to be installed and operated based on soft landing principles.

Client: KERUEN
Architect: Chapman Taylor
Services Design: CD International BSE, UK

Mixed Use / Kazakhstan

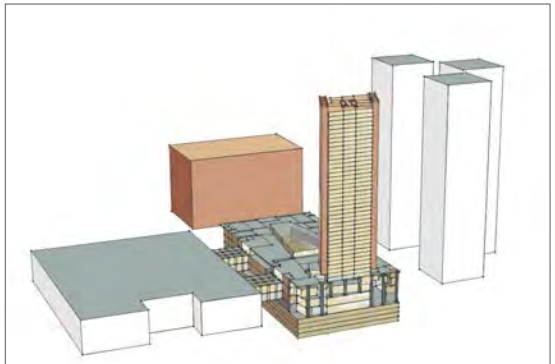
Astana / Keruen 2



Initial Concept design for the development of the site to the west and adjacent to Keruen shopping centre. It will combine luxury retail, leisure, F&B and high-end Residential uses.

Location

The site is located facing directly onto the Kisho Kurokawa designed 'Shining Path' (Nurzhol) green boulevard which forms the urban design centrepiece of the redevelopment of the city. It is to the west of the central plaza of the boulevard containing the high Bayterek monument.



Thermal modelling for Keruen 2

Retail

The retail concept is based on a central atrium, as it 'holds' customers in the shopping centre and provides excellent visibility to all the shops, restaurants and leisure facilities. In addition its north/south orientation provides strong connections between the prime access points on Nurzhol Bulvar and Dostyg Street.

The scheme is designed to be completely integrated, with 'racetrack' links at Levels 2 and 3.

Residential Tower

The tower sits neatly above the shopping centre on the north-west corner of the site.

The penthouse apartments will have the advantage of their own entrance lobby and lifts, as well as direct private access from their lifts to the spa, restaurants and the shopping centre.

Parking

The parking is on three levels below ground, with easy and efficient access and circulation. It is proposed that the lowest level has residential parking with its own ramp system. The Level -1 and -2 levels will be for retail customers.

MEP Systems

The following key drivers were considered at the pre-concept stage:

Extreme climate conditions of Astana with very warm summers and cold winters

There is an opportunity to benefit from low electricity tariff during night

Investment requirement to have separate plant and energy centre for residential towers and retail centre

Systems must be linking to existing Keruen 1 retail centre in order to integrate them in to one Building management system

Due to persistent strong wind, especially during winter month, common problem of any building in Astana is cold incoming air through entrance lobbies. We worked with architects to incorporate the solution into architectural and MEP design.

We have also provided the client with low energy and renewable technologies assessment.

We have provided the client with the Initial MEP strategy study. For residential towers we have considered investment cost, maintenance, energy efficiency for centralized and de-centralised system, .as the ventilation rates can be achieved using individual systems in each apartment or a combined system, concentrating AHUs in each plantroom with each AHU serving several floors.

For retail we have provide three options of ventilation in order to separate zones for food court, mall and retail area, with either displacement ventilations at the lower level, or supply at the bulkhead to atrium or to the shops as well .

Study for two options for smoke extract: ducted and impulse fan assisted.

Also, investigate the possibility to utilize a night time cooling.

Residential / UK

Woolwich/ Mast Quay Phases 1&2

The development achieved a score of 70.3, which meets the required Eco Homes rating of "Excellent"

CD International have been appointed to undertake the Public Health and Electrical services design at the Mast Quay residential development in Woolwich. The development consists of two number fourteen storey towers of high specification apartments coupled with a three storey affordable housing block. Mixed use" development of 218 no. 1, 2 & 3 bed Penthouse residential units along with approximately 730 sqm of commercial space.

Phase 2

- Block 'D' Tower of Ground/Deck + 14 Storeys with commercial at Deck Level and residential over.
- Block 'E' Tower of Ground/Deck + 22 Storeys of residential with stepping tail of deck + 10 storeys with commercial @ deck level with residential over.
- Both Blocks are accessed from a podium deck which comprises of a public square with access to the lower river level and riverwalk. Secure car parking is to be located underneath the deck at ground level.

Design: Nigel Upchurch Associates
Services Design: CD International BSE

Sustainability

The Mast Quay Phase 2 falls under the Greater London Authority's (GLA) Initiative for renewable energy and as such we must prove that renewable energy has been considered from the earliest design stage with a realistic strategy set out for the technology's inclusion and integration to the building fabric.

To achieve the required percentage reduction in carbon emissions it would be possible to install a ground source heat pump to provide heating for a part of the development.

The technology also provides an innovative, flexible and low maintenance solution for the landlord with only cost implications being the capital investment required for this installation.

Compared to the other suitable technologies the ground loop offers the most cost effective method of complying with the GLA's requirements and its inclusion only represents a cost increase of approximately 0.2%.

Architect: Upchurch Associates
Services Design: CD International BSE, London

Mixed Use / UK

London / New Kent Road

The erection of a part 3, part 4 and part 5 storey mixed use development comprising basement storage, commercial floor space at ground floor level and apartments at first to fourth floor together with associated amenity space. Ancillary commercial space provided at basement level.

Project outline

CD International was responsible for Sustainability Report for Planning application, which was granted by Southwark Council.

The proposed development at New Kent Road has achieved the balance of delivering a building which is of architectural merit, sensitive to the surrounding context and incorporates the sustainability ethos whilst ensuring a commercially driven solution.

The building has been orientated to minimise the effect of south facing solar gain.

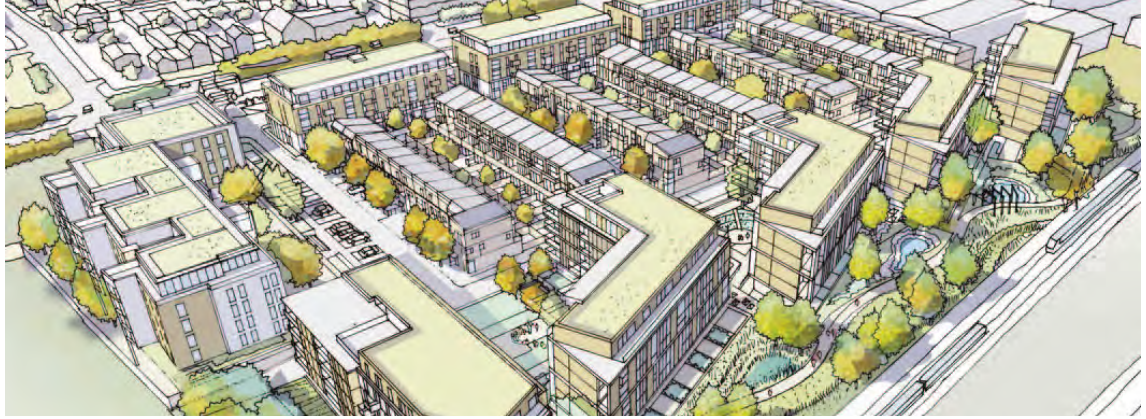
The building has incorporated all the good practice energy efficient techniques such as heat recovery, low compact fluorescent lighting, variable speed drives, condensing boilers, energy management control systems.

The building envelope has an improved thermal performance and air permeability. This has been supplemented by the use of LED lighting technology in the public areas and high efficiency glazing in the external façade.

The building has incorporated a Combined Heat and Power unit, and to maximise the waste heat.

The renewable energy has been provided by solar collectors. The solar collectors will also provide a solar buffer zone to reduce solar gain for the roof of the 4 storey building.

Water conservation has included a number of measures and rainwater harvesting collector is used to serve the commercial toilets.



Investor: Aitch Group
Architect: Stock Woolstencrodft Architects
Services Design: CD International BSE, London

Mixed Use / UK

Rainham / New Road

Th is an eight acre site in the heart of the 'London Riverside' Regeneration Area, that is being transformed into a flagship lo-cation for sustainable urban living with a new transport exchange, public squares and high quality open space. Project comprises of 519 residential units + 20,000 sq ft commercial space.

Project outline

CD International propose to deliver a high standard residential development with a high standard of sustainable construction to achieve a BREEAM rating of ''Very Good'' and at the very minimum achieving a Level 3 Code for Sustaina-ble Homes and working towards Level 4.

Our engineers explore available low energy and renewable options and proposes the sustaina-ble energy strategy for the proposed develop-ment.

Energy efficient technologies, decentralised energy systems and renewable energy tech-nologies have been considered to comply with the local London Borough of Havering Planning Policies (policies 3.4 and 3.5) and the Sustaina-ble Design and Construction Documents (SPD) together with policies stated in the London Plan:

– Policy 4A.3 Sustainable Energy Efficiency
– Policy 4A.4 Energy Assessment
– Policy 4A.5 Provision for Heating Networks
– Policy 4A.6 CHP and Decentralised Energy

The current London Plan identifies the need for resilience and security of supply with the current infrastructure provision. The proposed Energy Centre goes some way to addressing this point with the inclusion of Combined Heat & Power Plant, developing heating and electric-ity independently and efficiently.

The integration of each technology has been assessed, addressing key architectural and planning issues such as structural, sight and noise implications.

Developer: Loncor Homes Ltd
Architect: Twenty First Architecture Ltd
Services Design: CD International BSE, London

Mixed use/ UK

London / Baylis Road

The project consist of demolition of the existing building and the erection of 4 and 7 storey linked buildings with mixed development comprising of commercial and residential units with associated amenity space and car parking. A BREEAM Pre Assessment has been carried out for the retail and office space and early indications predict that each space will achieve a very good rating.

Project outline

The proposed development at Baylis Road Lambeth London has achieved the balance of delivering a building which is of architectural merit, sensitive to the surrounding context and incorporates the sustainability ethos whilst ensuring a viable solution.

The sustainability approach follows the guidelines of the Lambeth Council's Planning Policies (Environmental Issues Best Practice) and the Sustainable Design and Construction Documents (SPD).

The building has incorporated all the good practice energy efficient techniques such as heat recovery, low compact fluorescent lighting, variable speed drives, condensing boilers, energy management control systems.

The building envelope has an improved thermal performance. This has been supplemented by the use of LED lighting technology in the public areas and high efficiency glazing in the external façade.

The building has incorporated a green roof to assist in reducing solar gains and also attenuating the peak storm water flow rate from the area of roof.

The building has incorporated a Combined Heat and Power unit, and to maximise the waste heat.

The renewable energy has been provided by solar collectors. The solar collectors will also provide a solar buffer zone to reduce solar gain for the roof of the ground floor plus 6-storey building.

Water conservation measure and rainwater harvesting collector is used to serve the commercial toilets.

Developer: Media Office
Services Design: CD International BSE, London

Residential/ UK

London, Soho / Marshall Street

The regeneration of Marshall Street Baths commenced approximately in 2008, partly as a commercial and partly as a residential development.

Project outline

CD International provide building services design, including Sustainability report for planning applications and Code for Sustainable Home assessment for 12 new apartments.

Achieving Code Level 3 for all flats was the planning requirement. These flats are now built, handed over and have been occupied since December 2010. Since then, a part of the commercial area is being converted into three additional penthouse flats.

Architect: Upchurch Associates
Services Design: CD International BSE, London

Residential/ UK

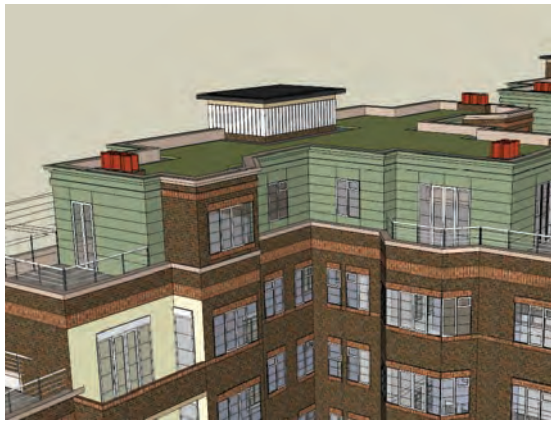
Chiswick Village / Rooftop Apartments

Development of 15 luxury penthouses on the top of the Chiswick Village Mansions together with improvement of common areas.

Project outline

CD International prepared sustainability and renewable energy studies for planning application. We have proposed whole house ventilation with heat recovery, air-sources heat pumps and micro-CHP units.

Part of the overall sustainability strategy for the development has been the inclusion of green roofs and accommodation of 15sqm solar panels per penthouse.



Client: Private
Architects: ADAM Architecture
MEP: CD International BSE

Luxury residential/ UK

Berkshire / Bear Ash Residence

A luxury residential property Bear Ash House, located on the attractive site, set on the edge of hamlet Hare Hatch in Berkshire. The house of around 700sqm sets on two storeys, basement and attic, and occupies an elevated position with south view over garden and parkland.

Project outline

Phase One included walled garden and shed for garden equipment and swimming pool.

Phase two included design of actual house, which will consist of:

- Air-conditioned basement with playroom, TV lounge, gym and cellar and technical rooms for engineering equipment.
- Ground Floor: Portico entrance leading to the Dining hall and through to Drawing room. Floor also accommodates Study, Library and kitchen.
- First floor contains bedrooms for the whole family.
- Attic floor used for observatory green house and storage.

CD International has been appointed to undertake Initial Concept Design of MEP services with Feasibility Studies with further progress to Detailed design and Construction Supervision.

Architect: Louise Crossman Architects
PM: PWP Architects
QS: Lavingtons
Services Design: CD International BSE, London

Residential / UK

West Somerset / Bittescombe Manor

Bittescombe Manor is set on the south facing slopes of the Brendon Hills just outside of the boundary with Exmoor National Park. Main house is positioned in the centre of its own land (63 acres) and enjoys superb uninterrupted views over the landscaped gardens, lakes and open countryside.

Project outline

There are several projects on the site, including extensions to the house and conversion of outbuildings.

CDI provide MEP services design. Electrical works includes moving overhead electrical lines to underground, bringing new power line for the extension.

Mechanical and public health engineers designed pool ventilation and heating with heat recovery and the use of air sourced heat pumps. Also includes new kitchen ventilation, lighting, sound system and drainage.

Phase 1 includes works to the existing house: swimming pool and gym complex, with showers, sauna & steam room; plant room and storage.

Pool will be equipped with a waterfall, a jet pool and a main pool with hydro floor that elevates transforming the pool hall into the cinema or ballroom at the push of a button.

The building becomes part of the landscape with a grass roof forming a terrace from the landscape behind.

Phase 2 includes works to renovate barns into two residential units and one guest house and to build new stables. Each barn conversion incorporates a bedroom with en suite, kitchen and lounge.

Client: Private
MEP: CD International

Luxury residential/ UK

Buckinghamshire/ Holmewood House

Holme Wood House is a private luxury development located in Marlow, Buckinghamshire.

Project outline

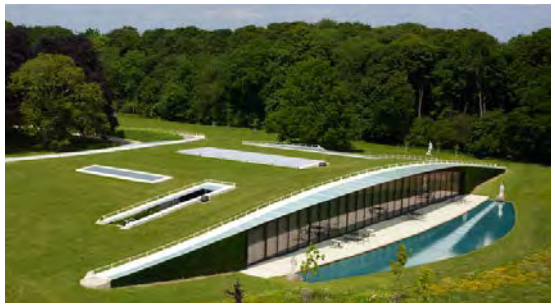
The project is a bespoke house, which comprise a single storey development with a 5m high-doomed grass roof. A swimming pool is located within the centre of the house and the property is divided between 4 master bedrooms with en-suite facilities, a living room, dining room and study form the main living quarters.

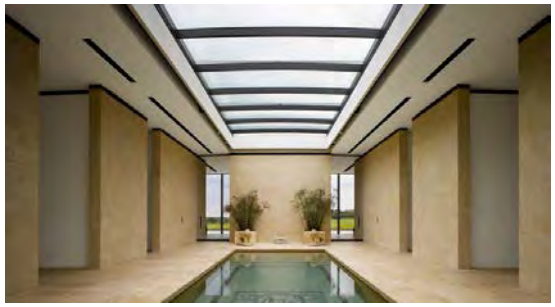
The Client has a comprehensive fine arts collection which shall be displayed throughout the property with an Art Gallery vein.

Technical Overview

Site wide irrigation system with bore hole supply; All air central ventilation system with zoned reheats; 'Smart house' technology for lighting and climate control; Full heat reclaim pool hall ventilation system.

Due to the Client's sensitivity to noise, a full acoustic appraisal of the services scheme was implemented in the form of door and window contact disabling the chiller and all ventilation services were designed with a low velocity.





Client: Private
Architect: PM/QS: Lavingtons
Services Design: CD International BSE, London

Residential/ UK

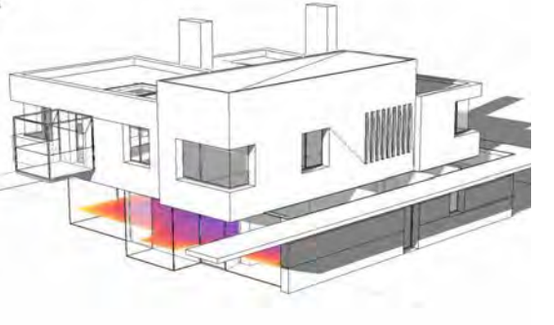
Bramley / Lea Gate House

CDI has provided initial Concept Design, thermal modelling, and site supervision during construction stage for a new 3 storey private house completed with a new barn and outdoor swimming pool.

Project outline

The environmental design has been developed to reduce the carbon footprint, lower running costs, aiming for a Code 6 house – a zero carbon emission building.

The flat roof over the first floor block was dedicated to solar panels to capture solar energy for heating. A number of skylights have also been positioned on the roof mainly to bring natural light to the core of the building on the ground and first floor.



The building envelope is to be airtight to minimise the amount of warm or cool air that can pass through the structure, background ventilation is provided instead by a zoned mechanical ventilation system to recover the heat before discharging the air externally.

The flat roof over the first floor block was dedicated to solar panels to capture solar energy for heating. A number of skylights have also been positioned on the roof mainly to bring natural light to the core of the building on the ground and first floor.

- The first floor has been design to overhand the the ground floor windows to reduce solar gains.
- Off-setting basement level slab allow in relation to ground floot layout allows us to bring air duct for fresh air.
- Back ground ventilation is provided instead by a zoned mechanical ventilation system to recover the heat before discharging the air externally.
- Air source heat pump and undefloor heating were inmplemented throughtout the house.
- Specialy designed roof ventilation outlets at high level provided greater stack effect for natural ventilation.
- The building envelope is airtight to minimise the amount of warm or cool air that can pass through the structure.
- Thermal insulation has been improved from the required base levels and concrete structure design to reduce solar gains.
- Facilities have been provided to install Solar Thermal and PV on the roof.

Work in progress: Ventilation outlets and under floor heating installation

Client: Q Development
Architect: Terry Pawson Architects
Structural Engineer: Elliott Wood Partnership
Services Design: CD International BSE, London

Residential/ UK

Kingston-upon-Thames / Twin Houses

CD International was appointed as M&E Consultancy to offer full services in connection with the design, specification and procurement of M&E services for the project.

Project outline

Two stone clad family houses are located on a quiet suburban road on the outskirts of London. Each house is arranged over three floors and organised around a central courtyard that connects through to the main garden and brings daylight into the basement level

The 600 sqm houses are designed to symmetrically reflect one another and are slightly staggered on the gradient of the site. Internally, rooms are positioned around a central courtyard which brings light to the lower ground floor.

The ground floor is devoted to family life and entertainment; private bedrooms are located on the first floor and guest bedrooms in the lower ground floor facing into the courtyard

"The houses possess a balance and coherence that creates a serene contact between them and the land. The suggested materials and colours belong entirely to the scheme. This is an absolutely first class design. It has been very well thought through, and created with skill and courage. This elegant, staggered pair of buildings sits comfortably within the mature landscape, creating a very positive aesthetic."

Excerpt from Design Review Panel report

Residential / UK

London SW / Private House

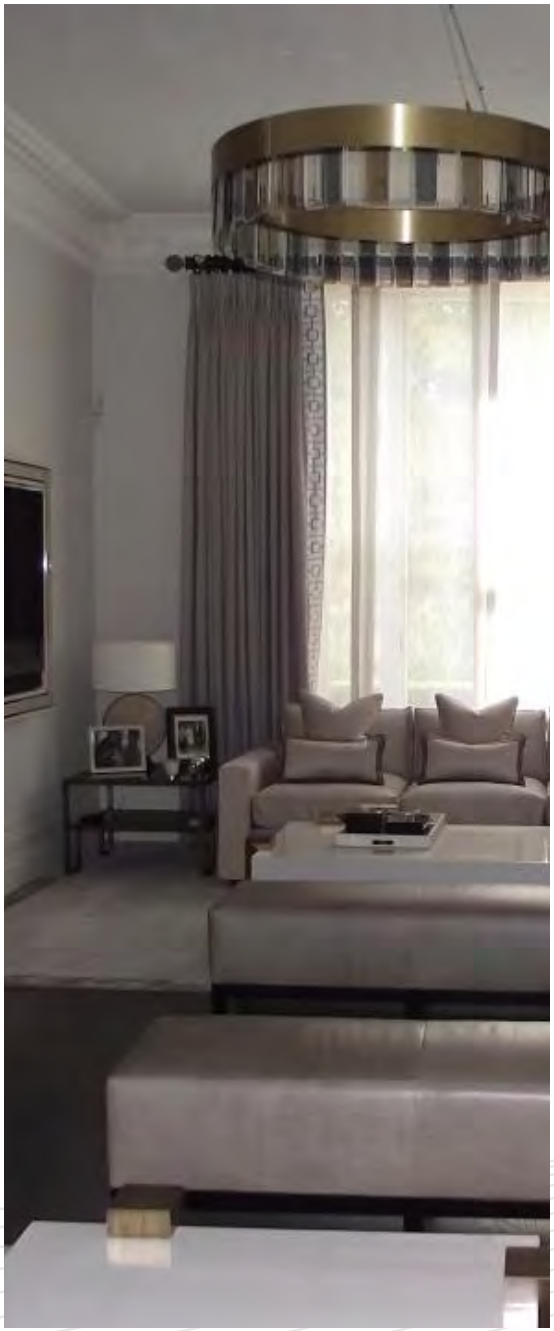
Project outline

A new basement extension constructed to serve the new Swimming Pool, Family Room/Gym, Steam and Sauna Rooms, Cinema area and plant space. The Lower Ground Floor is reconfigured to provide additional bedrooms and staff area.

Due to a substantial part of the works having sub-structure grounds around the perimeter walls, the heat loss is significantly reduced. However, we proposed that U-value heat transmittents to be approximately 20% below current Building Regulation Guidelines.

The existing property is a four-storey building located in the Borough of Kensington and Chelsea. Project proposal is to create an additional basement pool area and also extend part of the lower ground floor.

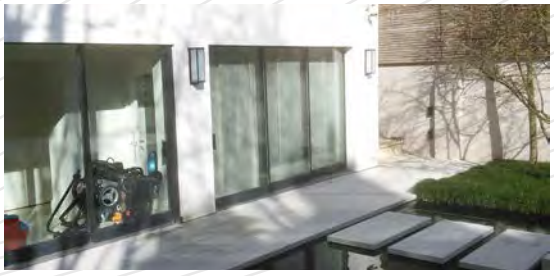
Design: Studio Upchurch Associates
Services Design: CD International BSE



The environmental conditions within the main pool hall to be achieved through the use of heat recovery/heat pump ventilation systems. This will recycle energy from the latent heat being extracted from the pool hall and used to heat the pool water as well as the supply air.

For the other areas in the basement, we proposed to have fresh air and exhaust ventilation utilising a heat recovery unit which would recycle heat within the exhaust air and pre-heat the incoming fresh air.

The majority of the new basement would be heated by underfloor heating circuits. This system utilises low grade temperature water which would be produced by an external air sourced heat pump.



In the new pool hall, wasproposed to utilise lightwells to introduce natural daylighting into the space. This will assist in mitigating artificial lighting.

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