SINÉAD REYNOLDS

# MIXED USE DEVELOPMENT, CUMBERLAND STREET SOUTH

## MODERN METHODS OF CONSTRUCTION REPORT (APRIL 2010)

ADVANCED CONSTRUCTION TECHNOLOGY

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# MODERN METHODS OF CONSTRUCTION

## INTRODUCTION

The client team have asked for the construction programme duration to be reduced. It is their belief that this could be done if modern methods of construction were adopted into the project. After the recent design team meetings it is believed that the significant areas were this could be achieved is in the concrete frame and in the internal finishes.

The client has asked that both the contractor and the design team put together a proposal on how the duration of the project can be reduced. This report concentrates on the major elements of the project and a clear methodology is put forward for the construction methods proposed.

This proposal ensures better quality standard of work, while it is the contention of the contractor that the quality will increase.

## BUILDING CONSTRUCTION PROCESS

The process of building construction involves the active participation of the architecture and the civil engineering for the completion of the task as per the approved plan for the building within a given time period. The construction of Cumberland Street South, Dublin City Center is a multitasking activity and needs close co-operation among all the major stakeholders for early completion of the project. The Building will be constructed with the assistance of a set of interrelated tasks and the timing of each task has its relationship with the overall business plan of the project. The contractor and the design team are the central players in the whole construction process and their active participation has the capacity to complete the given assignment well ahead of the given time schedule with no compromise on the quality of the construction work. However, the completion of the construction process task to be finished well before the given time depends upon the application of the new methods of the construction with judicious decision making process on a timely basis. The construction process for the construction of the development need a set of inputs like ingredients for the building construction, approved programmed tasks as per building regulations, labor and financing arrangements with flow of necessary funds as in accordance with the details of the concluded agreement between the owner of the building and the contractor(1). Construction style and applied methodology has influence on the pace and quality of the construction work and the utilization of modern means of construction like the use of prefabricated components, finishing techniques and the participation of the skilled manpower could result in the early construction of the building with no compromise on the quality of the overall work. The building will be constructed as a four story building with a basement for storage and the application of the modern construction technologies by the construction manager will help in the achievement of the objectives of the project, which is to complete the project well before the agreed completion timeframe. The project will be completed with the utilization of the resources both human and physical on an optimum basis with the assistance of the specific drawings, observance of the programmed tasks for each component of the building and a timely decision making process with a clear direction. The completion of the project with the utilization of the modern methods of construction will serve as a model for the building engineers and the architectures with the adoption of the techniques for the construction of similar buildings in future (2).

The drawings consist of four stories, mixed use development with a storage basement as the final product of the construction activity. The architect, the contractor and the design team are in a position to complete the assignment well before the given time schedule through the adoption of construction techniques as in to form modern building techniques and to take relevant decisions on at timely basis. The selection of the building material and the type of the construction mechanism has a direct impact on the completion period of the building. The procedures and the processes involved for the execution of the plan also have their impact on the completion period for the project. The initiation of a number of activities active simultaneously will provide a structural support to the project manager and to the contractor of the project to deliver the outputs in satisfactory manner. The process starts with designing a broader framework with broader outlines and moves in a systematic pattern with specific details for each individual segment of the project. The observance and fulfillment of all the details will provide a clue that the project is being completed as per the project design.

## DESCRIPTION OF THE WORK

The construction of Cumberland Street South is primarily based on the design and layout of the building with all its specifications. The description of the work starts with the details of the Basement of the building with the specifications of 12m x 14m x 3.5m deep through the concrete basement walls. The starting time for the construction of the basement plays a significant role for the whole project. The trial analysis will determine the pace of the whole construction work for the building. The use of the concrete basement slab will facilitate the completion of the task at the earliest (3). The construction of the other components of the building that is the other two floors, the roof and the roof gardens will take their pace on the basis of the completion of the work at the basement. The complete building will consist of a four stories building with a basement for storage, ground floor to first floor as the office accommodation and the second to third floors as the residential apartments. The technology applied on the roof and the roof garden will also effect the completion time for the construction of the building.

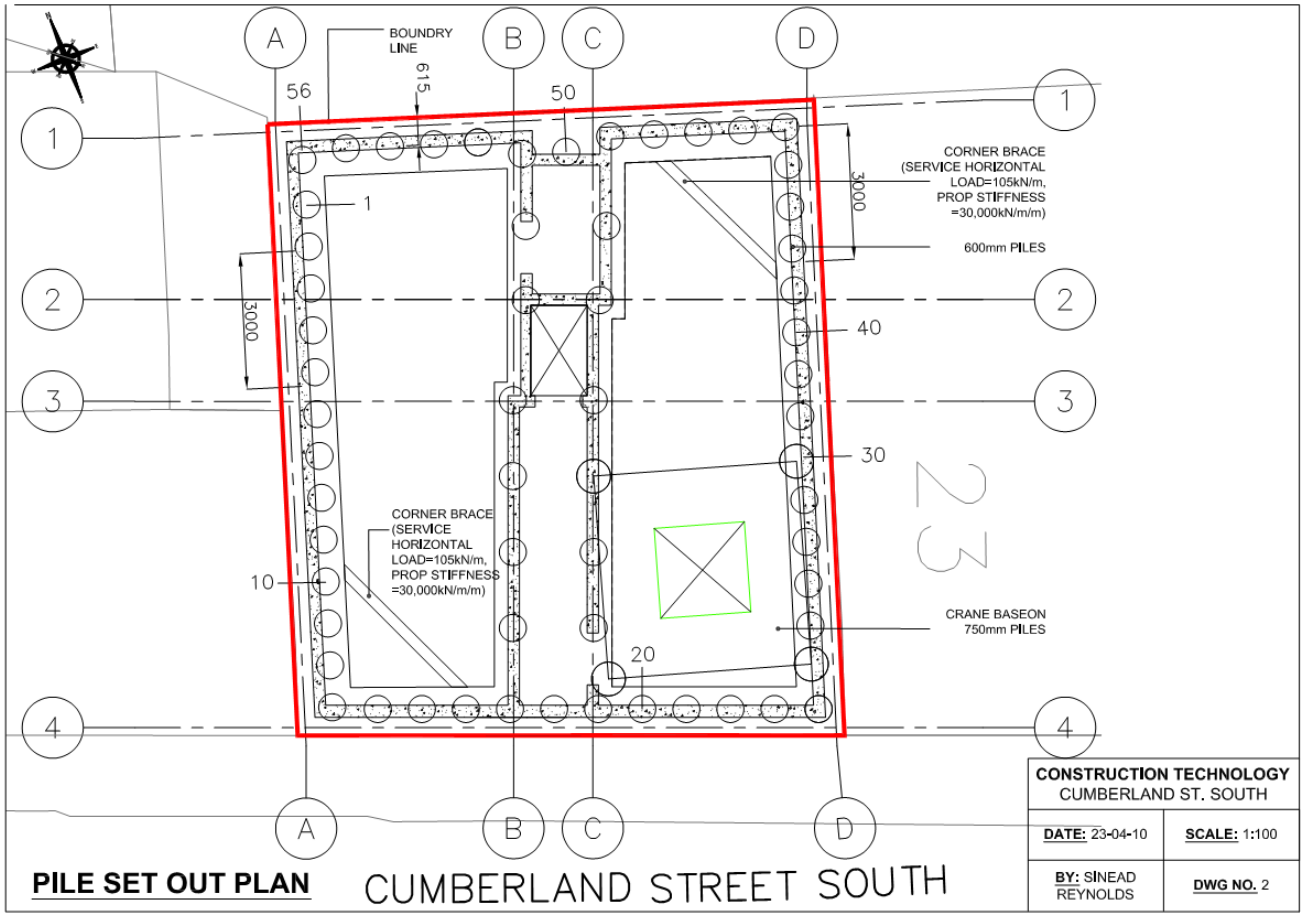


*Figure 1: Pile Set out Plan*

## THE ALLIED EQUIPMENT

The construction of the building depends upon the utilization of the building construction machinery like the excavator for the removal of the material from the site especially during the construction of the basement. A tower crane will be erected at the Crane Base area on the site for seeking technical help during the process. The use of the main vehicle for loading and unloading areas will facilitate the contractor and the skilled labor for the delivery of their respective spheres and the utilization of the modern machinery in the operational matters. This will contribute in the finishing process of the building. The use of machinery helps in the supply of inputs for their further utilization in the construction process. The contactor for the project is well aware of their significance of the machinery in the construction process and has taken sufficient steps for the supply the machinery as per its specific need in the project (4).

The project has envisaged in the utilization of crainage with a 30m tower crane for its operation to serve the basement. The crane would work with the help of a standard crane base with the dimensions of 5100 mm x 5100mm with the help of 600 mm piles. The site of the building is too small to cater for the needs of the building construction as per the approved design of the building. The contractor has decided to use prefabricated components for its early completion. To use the available space, the contactor has also decided to reduce the size of the crane to 4500mm x 4500mm with 750mm piles. The decision of the contactor to reduce the size of the crane has significant impact on the quality as well as completion time of the building. The decision of the project management to reduce the size of the crane will have the following impacts on the completion process of the building:

a) The project will facilitate grater accommodation for other building materials to be arranged at the project site for their utilization in the whole production process for the construction of the building, as per approved plan of the building with all its specific details.

b) The utilization of the prefabricated components will help the contactor of the building to initiate multi functions at the same time and their fabrication will improve the pace of the development process for advance completion of the whole work and the schedule of the project will therefore need upward shifting for its early completion.

c) There will be no compromise of the quality of the work as the decision will provide all the inputs on timely basis and their utilization in the construction process will lead the project to the direction of its completion, as per the required building standards with the reduced cost and no compromise on the quality of the work.

d) All subcomponents will be completed as per their demand in the construction process and will automatically provide confidence to the project team. Evaluation of the project on a weekly basis will serve as feedback for taking strategic decisions for timely the completion of the project. An early finishing date will motivate the contractor and the project manager to re-fix the new dates for each individual assignment in an advance stage and therefore the entire program of the project will move forward to facilitate all the stakeholders.

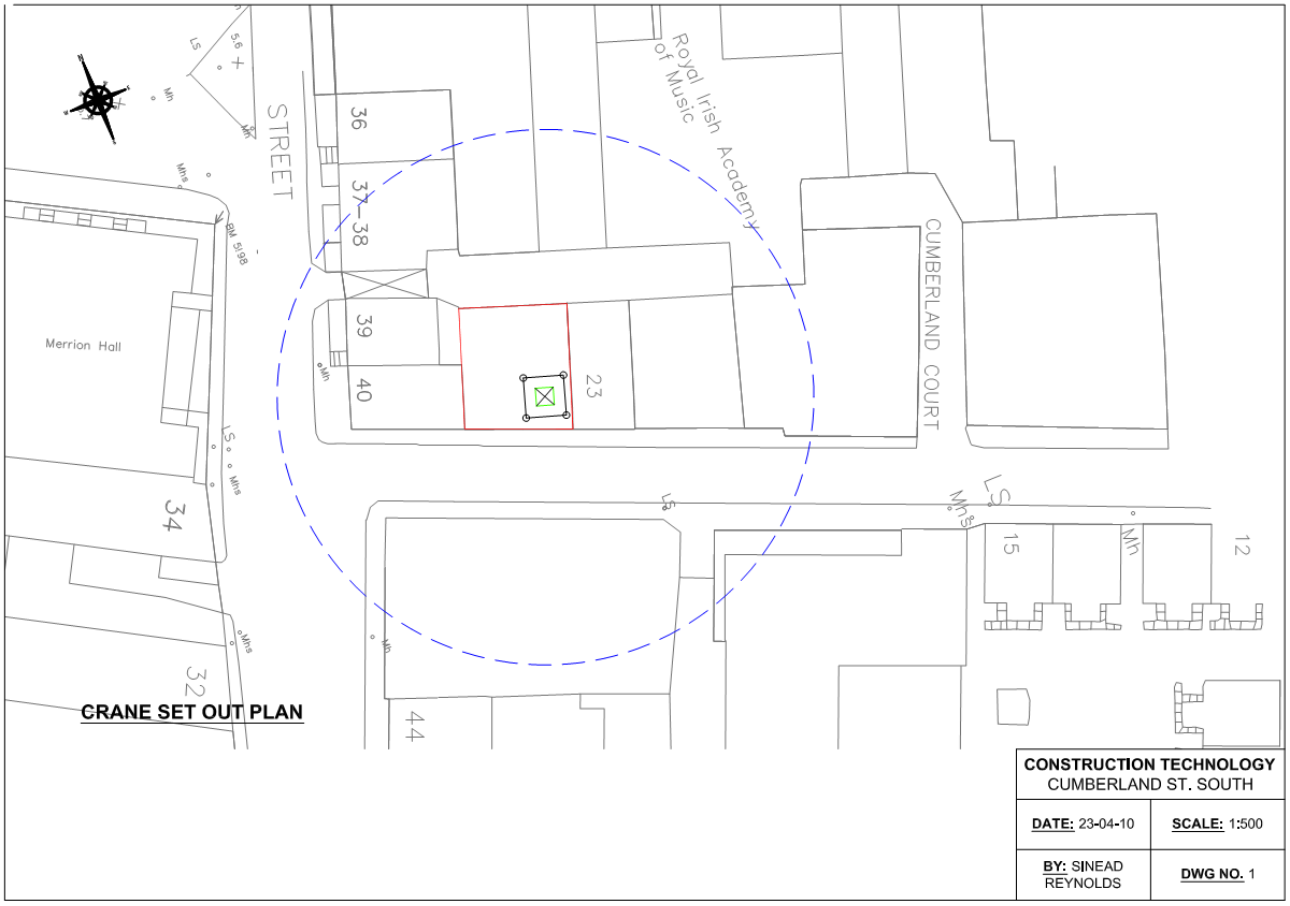


*Figure 2:* ***Crane Set out Plan***

## THE PLANNING OF THE CONSTRUCTION PROCESS AND ITS SIGNIFICANCE FOR THE COMPLETION OF THE BUILDING

The planning process serves as a blue print for all the stakeholders especially the contactor and the manager to implement the plan as per all its details. Early shifting of tasks as a result of the changing of the size of the crane at the development site and the use of pre fabricated components will provide an opportunity to the contactor to reschedule the project activities (5). The project activities are evaluated by the project on weekly basis and the use of prefabricated components will reduce the cost of the project on the basis of the following reasons:

a) The prefabricated components of the building are manufactured on a large scale with the application of the computer based designs and specifications with low cost per unit. For example, the construction of the block wall for the first, second and third floors will have cost of 170 euro/square meter and the prefabricated walls are available in the market at the rate of 130 euro/square meter, therefore the decision will lead to the saving of the cost of the construction of the walls for the above floors. The lower cost of the project on the basis of the utilization of the prefabricated walls will have no adverse impacts on the quality of the work as these components have been prepared on a large scale with the utilization of computer aided designs and computer aided machinery for the manufacturing of the product.

b) The use of prefabricated components in the building will facilitate the flow of traffic as un-interrupted without any damage to the construction of the building during the construction period. The flow of traffic as hurdle free will provide a conducive environment for the contractor as well as to the project manager of the building to implement the project as in accordance with the revised time lines for the project.

c) The decision of the contractor and the manager of the project to utilize prefabricated concrete components will help in lowering the cost of the project in the shape of the low utilization of labor in the construction process. The labor cost is a significant component of the overall cost of the building construction and a decrease in the labor cost will ultimately lead into the reduction of the cost of the building but without any negative impact on the quality.

d) A reduction in the labor cost on site will help in the generation of labor opportunities at the manufacturing sites of the prefabricated walls for the building and therefore will promote the prefabricated industries catering for the needs of the customers.

## FINANCING AND THE BUILDING CONSTRUCTION

The building construction project is a coordinated activity with the utilization of a variety of inputs both physical and human for the completion of the tasks. The availability of the financial resources as per agreement between the owner and the contractor promotes confidence among all the contracting parties of the construction process. The construction process for the development has been designed in the agreement with a Sub-contract target program for the completion of the project. The execution of the project with a feedback arrangement has influence on the completion period of the project. The project manager needs to deal with the sub-contract payments and with the final accounts of the building. The construction of the building starts with the initiation of the work at the basement and moves in a systematic pattern towards the erection and finishing of the building as in accordance with the timings of the project. However, utilization of concrete prefabricated components and a reduced size of the crane on site will help in the reduction of the completion period of the building. The release of the finance on an activity basis will facilitate the contractor to make the deliveries as per agreed with the technical standards along with the required quality.

## THE PROMOTION OF SUBCONTRACTING FOR THE BUILDING CONSTRUCTION

The promotion of subcontracting for the pre-cast concrete frame, floors and walls and for the designing and erection of the building also is a positive step with guaranteed payments to the subcontractors of the building. The subcontracting process for the external block work and External Stone Cladding will help in the reduction in the completion time for the development. The Sub-contracting process in the building industry promotes the development of specific skills as they are needed in building construction industry. The subcontractors will acquire the latest skills for the delivery of their respective works in accordance with the agreed clauses of the subcontracts, and, therefore, the quality of the delivered work will not be disturbed or deteriorated as a result of the subcontracting.

The installation of the facilities like heating, ventilation and domestic services are the essential segment for the building construction and all these facilities could be installed on subcontracting at economical rates. The execution of the agreements with the subcontractors needs to be drafted with the utmost of care for the maintenance of the quality of the installed services. The owner of the building needs to consider the following for signing the agreement with the subcontractors for the execution of the agreements like:

a) The sub-contracts may be the part of the final agreement and therefore all the agreements will be executed by the contractor with the subcontractors for the delivery of goods and services as per the required standards and quality within the given time frame.

b) The payments will be released to the subcontractors directly by the contractor and will be debited in the main account of the contactor.

c) For the maintenance of the quality of the goods and services, the durability of the goods and the products will be ensured by the contractor of the building.

d) The contractor will deal with the subcontractors for making payments to the subcontractors and will also maintain their respective accounts for making their final payments.

## THE CONSTRUCTION OF BUILDING AND PRE-LOADING OF THE FLOORS AND OTHER ESSENTIAL COMPONENTS

The construction of the building is a coordinated activity for the completion of the tasks as a complete product in the shape of the four story building. The provision of all essential services as per the requirements of the building is supplied by the contractors to honor the agreements. The installation of floors in the building is an essential ingredient for the building and the installation of preloading a floor at each finish floor level with a size of 12m x 14m including the basement will help in the early completion of the project.

The installation of pre-loading floors in the building could be installed during pre-cast frame erection with pre-packed materials. The installation of boxed-up components for each individual office and apartment is recommended for early completion of the building. Similarly, ironmongery, electric wiring sets, heating packs and the door linings could also be installed in the building on a subcontracting basis. The installation of all these products on a subcontract basis will help in the reduction of the completion time for the whole building but without any kind of compromise on the quality of the work. The subcontracting process needs close monitoring by the project manager on weekly basis for the maintenance of the quality of the work in the building.

## THE EXTERNAL WALLS AND FINISHING OF THE WALLS OF THE BUILDING

The external walls of the building will be constructed as a cavity wall, the type of wall will facilitate in the stoppage of the seepage in the building. Seepage in the walls of the building has a tendency to increase the cost of the building construction and the same has also a likelihood of increasing the repairing cost in the subsequent years of the life of the development. These walls will be constructed with an internal leaf with a 60mm thick rigid insulation board and a monocouche render finish for the external exposed walls of the building. Similarly, the building will be finished with the use of a stone finish as the plinth which will enhance the aesthetic value and durability of the building. The arrangement will be utilized in the front and rear side of the building.

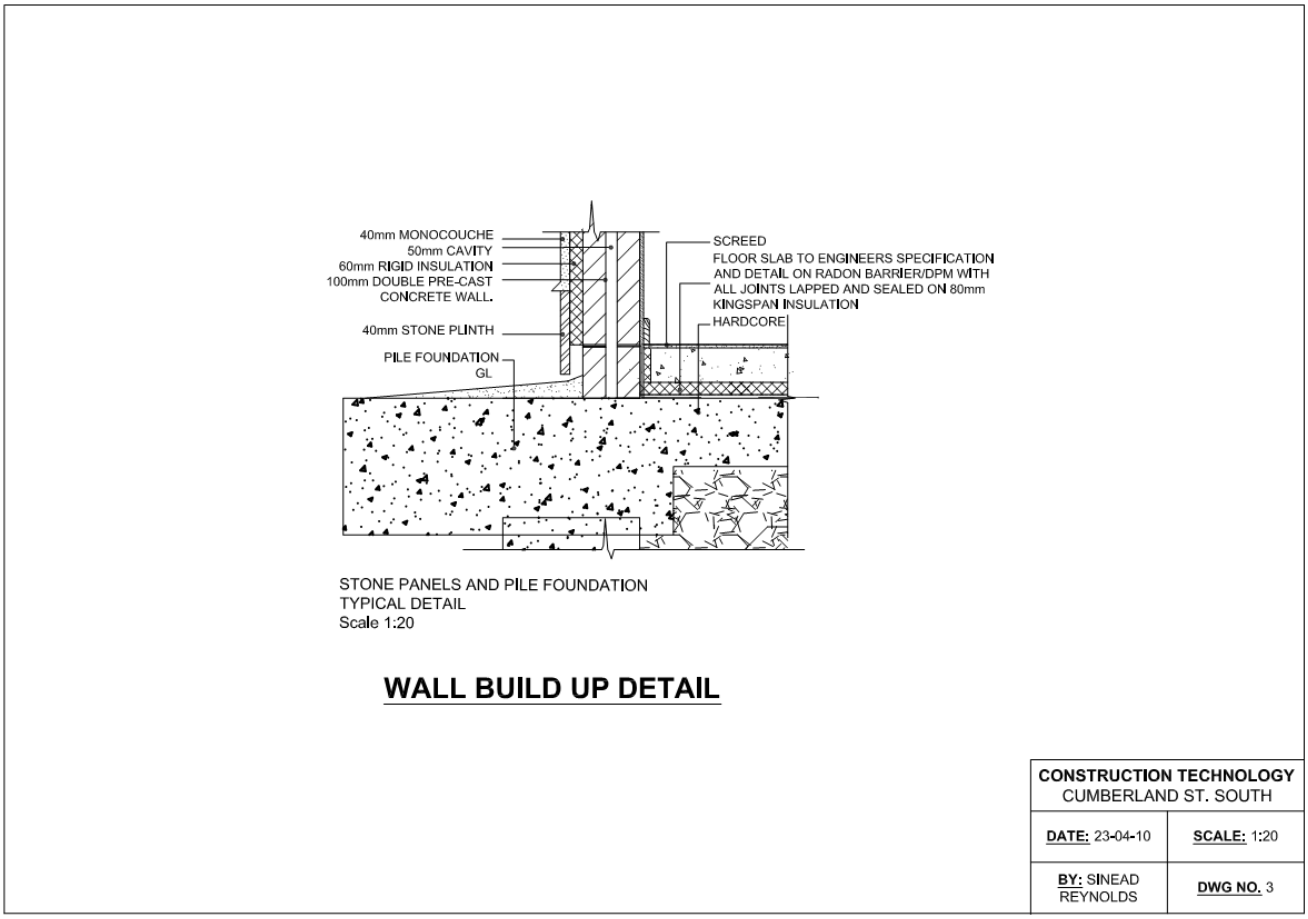


*Figure 3: Wall Build up Detail*

## CONCLUSION

The construction of Cumberland Street South in Dublin City Center is a coordination of activities with the participation of a number of primary and secondary stakeholders. All the primary stakeholders; the owner of the building, the project manager, and the contractor in favor of the early completion of the building and the adoption of a clear strategy for taking relevant decision making and their implementation will result in the early completion without any compromise on the quality. The use of pre-loaded floors, concrete prefabricated blocks for the construction of the walls of the building and necessary amendments in the size of the equipment like the Crane at the site for the construction will help in lowering the cost of the building with no compromise on the quality. The strategy as adopted by the top executives and the management team along with the contractor of the building has provided a plan for the construction that has the capacity for its replication for the achievement of the similar results.

## BIBLIOGRAPHY

1) Blank, Alan; McEvoy, Michael; Plank, Roger (1993). Architecture and Construction in Steel. Taylor & Francis. ISBN 0419176608

2) D. Rowland - T.N. Howe: Vitruvius. Ten Books on Architecture. Cambridge University Press, Cambridge 1999, ISBN 0-521-00292-3

3) John Ruskin, The Seven Lamps of Architecture, G. Allen (1880), reprinted Dover, (1989) ISBN 0-486-26145-X

4) Heyman, Jacques (1998). Structural Analysis: A Historical Approach. Cambridge University Press. ISBN 0521622492

5) Holm, Ivar (2006). Ideas and Beliefs in Architecture and Industrial design: How attitudes, orientations and underlying assumptions shape the built environment. Oslo School of Architecture and Design. ISBN 8254701741

## LIST OF FIGURES