EVOCATIVE INFRASTRUCTURE
AN URBAN CAVE AT YONGE-EGLINTON STATION

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

The cellar dreamer knows that the walls of the cellar are buried walls, that they are walls with a single casing, walls that have the entire earth behind them. And so the situation grows more dramatic, and fear becomes exaggerated.

Gaston Bachelard (quoted from *The Poetics of Space*)

The transition below grade demarcates a portal into a different realm. Underground architecture calls for a unique approach to design. This thesis is interested in looking at underground architecture through a phenomenological approach: looking at the cultural perception of the underground, informed by both physiological and psychological motivators; as well as the cultural expectations and use of the underground in the metropolis. It seeks to answer the question: What defines an architecture which celebrates the conditions inherent in being underground? The downwards descent into the earth carries with it negative cultural associations which have plagued the construction of underground architecture in the past. Due to these negative associations, programs relegated to the underground city typically consist of places where people are not expected to dwell for long periods of time. While the negative associations can be difficult to overcome, there is also a certain magic to the underground found in its more positive associations. These include: fertility of the earth, protection offered by the cave, the advent of technology, and the possibility of a fantastical realm past the portal demarcated by the grade line. These positive affectations have begun to be exploited in more recent architectural precedents. As the underground network of transit stations has become more formally recognized as an important part of the urban realm, more investment is made in the design of these transit stations. The thesis project will explore the role of the underground in Toronto and its impact on its architecture through the design of a new Yonge-Eglinton Station at the intersection of the historic Yonge Subway line and the new Eglinton LRT. This thesis proposes a design which is beautiful for its melding of two dialectic pursuits: the pursuit of an evocative experience, and the pursuit of a functional construction: the urban cave.

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This thesis was not just a product of my own work, but a compilation of the inspiration, motivation, and support provided by those around me. Thank you.

DEDICATION

To my family.

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EVO



EVOCATIVE INFRASTRUCTURE

AN URBAN CAVE AT YONGE-EGLINTON STATION

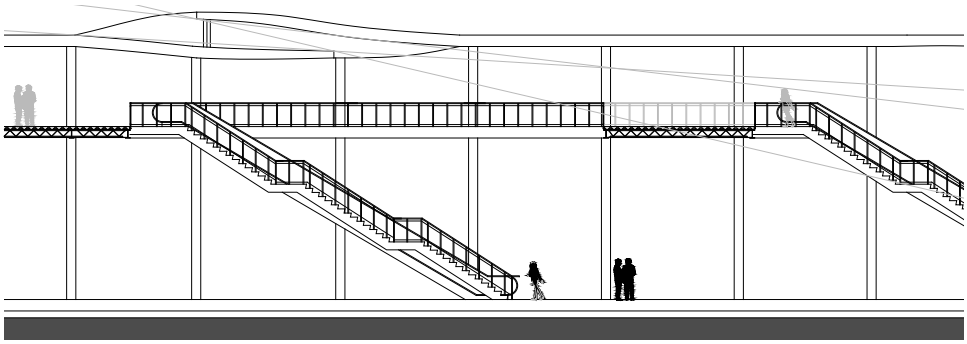


Fig. 1.2
Sectional view of proposal for Yonge-Eglinton Station

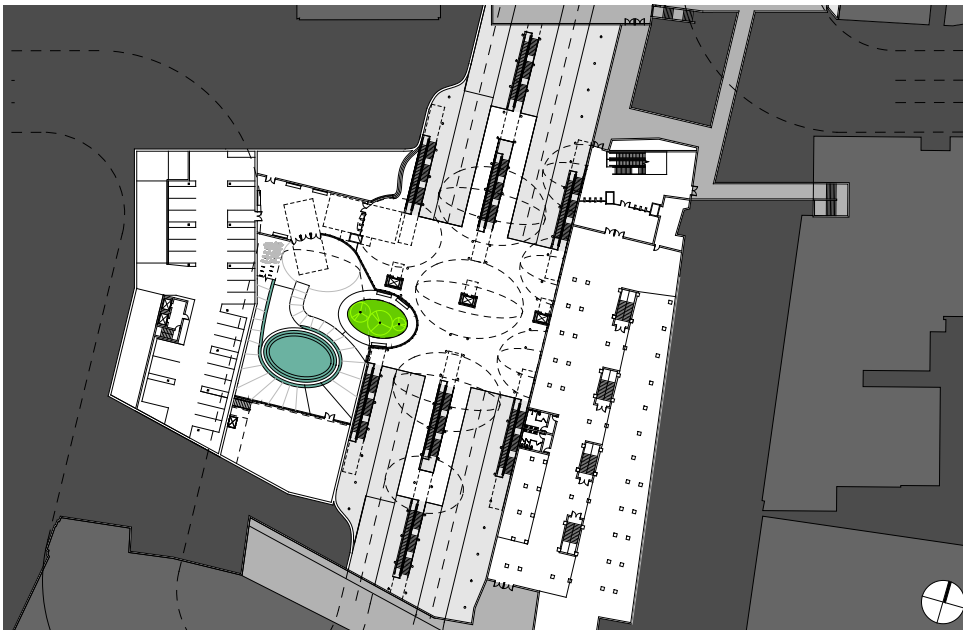


Fig. 1.3
Proposed Underground Plan for Yonge-Eglinton Station



Fig. 1.4
collaged vignette, Ofelia's underground hallucination

Fig. 1.1
(title page, full spread image)
Existing Eglinton Station

AUTHOR'S PREFACE

I'd like to preface my thesis by articulating my general interests in architecture and how they have manifested in the following explorations into the topic of underground architecture.

The architect is both an artist and an engineer; his/her work must find a mediation between both design influences. To me, architecture is most interesting at the crux of the conflict between the pursuit of the poetic sensual experience and the geometries and relationships required for utilitarian construction. This thesis is my own attempt at exploring the (seemingly) reciprocal pursuits in a type of architecture which is characterized by the exaggeration of both.

I've used the philosophy of phenomenology and its approach to the analysis of perception for its own dual nature and for its basis in the human experience. Our experience of space is based in both the physiological stimuli sending signals to our brains as well as the cultural affectations which cloud the psyche and filter our overall perception. Our built architecture and cities reflect that experience and mold it. The form of architecture is a reflection of this human condition.

My thesis ends with a design proposal for an expanded transit station at Yonge-Eglinton Centre to accomodate connection to the new Eglinton LRT. The design is my attempt to bring the emotive potential unique to underground architecture together with the functional spatial design required of a transit station. The design is the result of this ongoing dialogue. The presented version of the design falls, arguably, more under the headline of functionality based design. It loses some of the raw emotive potential presented in the cultural analysis, modeled studies and collages. Ultimately, though, in order to build an underground transit station which is functional, and people aren't afraid to be in, it can't be all about the poetic, sensual underground experience.

The following studies explore the spectrum between the raw affective power of the underground and the cultural expectations for its utilitarian use and comfort levels.



INTRODUCTION

PART ONE

1.1 UNDERGROUND ARCHITECTURE

1.2 EXPLORING THE UNDERGROUND CITY

1.3 YONGE-EGLINTON STATION

The timeless task of architecture is to create embodied existential metaphors that concretize and structure man's being in the world. Images of architecture reflect and externalize ideas and images of life; architecture materializes our images of ideal life. Buildings and towns enable us to structure, understand, and remember the shapeless flow of reality and, ultimately, to recognize and remember who we are. Architecture enables us to place ourselves in the continuum of culture.[1]

-Juhani Pallasmaa

Cities and their architecture are constructs which we, as humans and architects, build in order to house our lives. They act as a setting for human existence. As such, architecture becomes a metaphor for how we live, the culture which we have created for ourselves, and how we see ourselves. The architect gains a great power and responsibility to create buildings which respond to and celebrate their place within the continuum of culture. The architect also gains an insight into ways in which to provoke experiential response, both through stimuli affecting the dweller physiologically or psychologically through the inference of a cultural or emotive affectation.

Fig. 1.5
(opposite, full page)
Escalators lift to glazed opening, Canary Wharf Station, London, UK, Foster & Partners

1.1 UNDERGROUND ARCHITECTURE

The horizon regulates a differential and artificial game, as an oscillation signal between visibility and invisibility, between disappearance and eternity, between experience and its otherness or nothingness. … The subterranean level is thus a threshold zone, a Janus-faced figure, which plays with deceptions.[2]

Robert Thiel

As for the cellar, we shall no doubt find uses for it. It will be rationalized and its conveniences enumerated. But it is first and foremost the dark entity of the house, the one that partakes of subterranean forces. When we dream there, we are in harmony with the irrationality of the depths.
… The cellar dreamer knows that the walls of the cellar are buried walls, that they are walls with a single casing, walls that have the entire earth behind them. And so the situation grows more dramatic, and fear becomes exaggerated.[3]

Gaston Bachelard

The underground is a place which holds immense cultural connotations. The downwards descent into the earth carries with it evocations of imagery and emotion associated with fear of the underworld, the repulsiveness of dirt, death, and darkness. Due to these negative associations, programs relegated to the underground city typically consist of storage and basements, transit infrastructure, and utility distribution: places where people are not expected to dwell for long periods of time. This trend is changing as cities grow in density and technology allows better power over the provision of comfort.

In the last few decades, western cities are seeing a collection of architectural precedents which celebrate the opportunities inherent in underground construction. Transit stations are now considered projects worthy of design by architect. Ontario's transportation authority, Metrolinx, has recently developed a "Design Excellence" program, holding a committee of architects and engineers who take part in the design of all new transit infrastructures. Transit architecture is no longer solely the domain of the engineer and functionality based design. There is a realization that transit stations are an important fragment of the urban realm in the dense metropolis as the primary method for a large portion of the population for transport in the city. The underground is now seen as a piece of the city, worthy of occupation. Below grade, we find shopping malls, restaurants, offices, places of worship, and even parks. The underground has become recognized as a part of the publicly occupied domain; a part of the urban experience.

This thesis seeks to answer the question: how can we make great underground architecture which celebrates the conditions inherent in it being there? The conditions for building underground beg for a unique

approach to design. Through a phenomenological analysis, one discovers the cultural evocations and sensual potential in subterranean occupation. Fear of the underground has long plagued the creative potential in underground architecture; only in the last few decades has underground architecture broken from its traditional dark box. The thesis is interested in looking at underground architecture through a phenomenological lens: looking at the cultural perception of the underground, informed by both physiological and psychological motivators; as well as the cultural expectations and use of the underground in the metropolis. The practical difficulties in subterranean construction must be considered: technology required to provide adequate comfort levels (light, ventilation), the cost of displacing large amounts of earth, and difficulty in providing egress below grade. The thesis proposes a design which is beautiful for its melding of two dialectic pursuits: the pursuit of an evocative experience, and the pursuit of a functional construction.

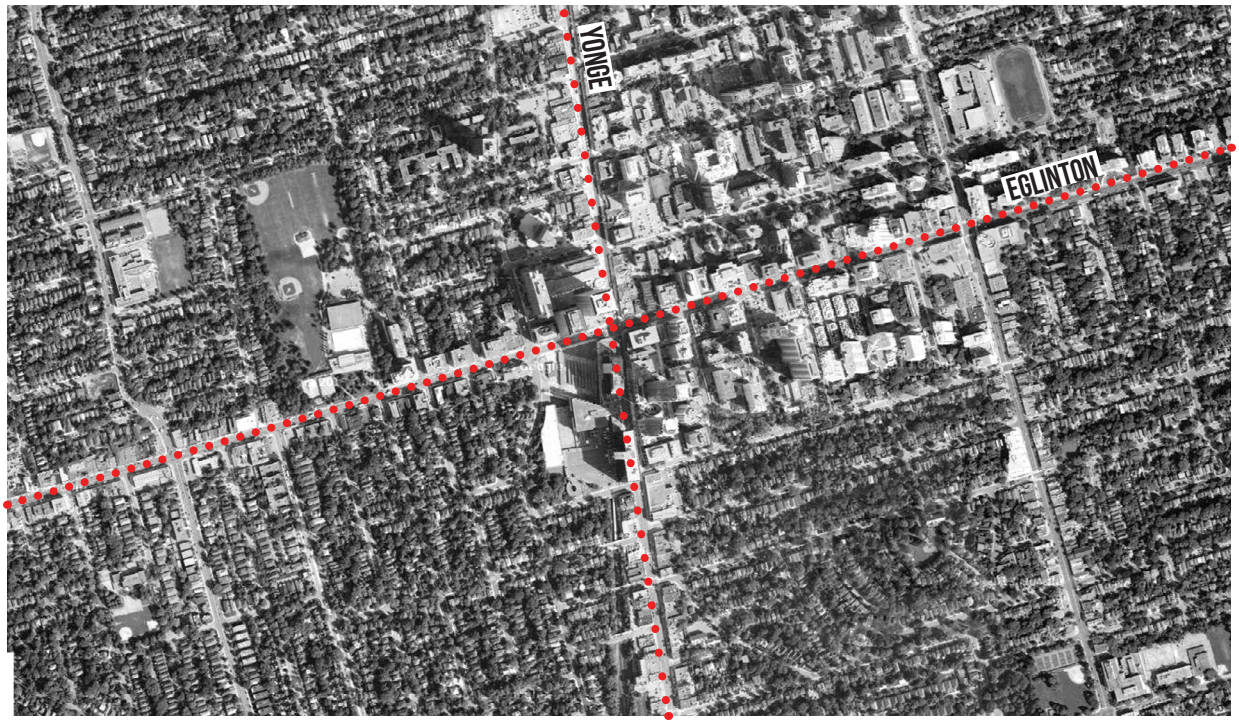
1.2 EXPLORING THE UNDERGROUND CITY

In order to explore the intentions outlined, the study begins in theoretical terms, assuming imagery and philosophy as a basis and moves on into their impact on real physical spaces and approach to the design of the city.

Part Two: Phenomenology and Architecture, studies the relationship between phenomenology and architecture, identifying key terms which will be used to analyze case studies later in the thesis. This study will be based on five seminal texts: *Phenomenology of Perception* by Maurice Merleau-Ponty; *The Poetics of Space* by Gaston Bachelard; *Questions of Perception* by Steven Holl, Juhani Pallasmaa, and Alberto Pérez-Gómez; and *The Eyes of the Skin* and *The Embodied Image* both by Juhani Pallasmaa. The texts were chosen in order to develop a framework for analyzing the science of perception and experience and their impact on the forms of architecture and cities.

The thesis moves on to explore cultural imagery associated with the underground in *Part Three: The Underground*. The purpose of this chapter is to develop a general answer to the meaning and connotations behind the term 'the underground' in western culture. It begins with the analysis of four spatial archetypes: the underworld, the cave, the mine, and the sewer. Imagery from these archetypes is closer analyzed through case studies of art, film and literature which use the underground as a meaningful setting, subject or plot device. Here, three common themes are identified: the underground as a place of hiding, a new human habitat, and a fantastical realm. Finally, the analysis moves on to see how this imagery affects the form of the underground city and its character in three cities: Rome, Paris, and New York City. The imagery, themes, and cities chosen




YONGE
EGLINTON

for study in this chapter provide a snapshot of certain views of the underground realm. They were chosen not to provide a complete analysis of the underground in western culture, but to provide a fairly comprehensive image which can inform the thesis project.

Next, architectural case studies are conducted in *Part Four: Underground Architecture.* The architectural precedents studied provide a link between the effect of cultural imagery and the sensual implications of underground occupation on experience while also speaking to the cultural expectations for functional design. This section is split into two: first looking at transit station precedents and then at underground 'collective space'. The precedents chosen speak to an ideal of an underground architecture inspired by its subterranean location.

In *Part Five: Urban Infrastructure*, the thesis begins to look in more depth at the nature of the underground in the thesis site: Eglinton Station in Toronto. The underground in Toronto holds the growing rapid transit infrastructure. There is a growing interest in investment in this infrastructure, populates seeing the TTC (Toronto Transit Commission) system as an important part of the urban form of the city, allowing for the density required of a 'big city'. Part of this investment in Toronto is the Eglinton LRT rapid transit expansion project whose construction is predicted to be a catalyst for densification and growth in the urban form. The chapter looks into the implications of the LRT in Yonge-Eglinton Centre and the functional and programmatic requirements which will be expected at a renewed Yonge-Eglinton Station.

Fig. 1.6
City of Toronto: Eglinton Avenue runs East to West, Yonge Street runs North to South

1.3 YONGE-EGLINTON STATION

The thesis will culminate in a design project at Eglinton Station to accommodate connection to a new underground rapid transit line along Eglinton Avenue. The Eglinton LRT, a part of Metrolinx's transportation plan for the Greater Toronto Area, began construction in summer 2013 and is set to open in 2020. The new LRT line will run along Eglinton from Mt. Dennis in the West to Kennedy station in the east. It will connect to Toronto's first subway line, the Yonge subway line, at the thesis project site: Eglinton Station. With a new vital role in the urban form of the city, connecting the historic core to future development along Eglinton Avenue fueled by the rapid transit expansion, Yonge-Eglinton Centre has the potential to develop into a northern secondary core for Toronto. This potential will be fostered through a development which connects to a renewed Yonge-Eglinton Station on the site of an out of commission bus yard. The proposal will provide space for cultural attractors, an office tower, and an open space which transitions between grade level and below. Design for the new transit station will be inspired by the evocative qualities of the underground

Fig. 1.7
Yonge-Eglinton Centre


EXIT St Clair Av


EXIT St Clair Av
Litter

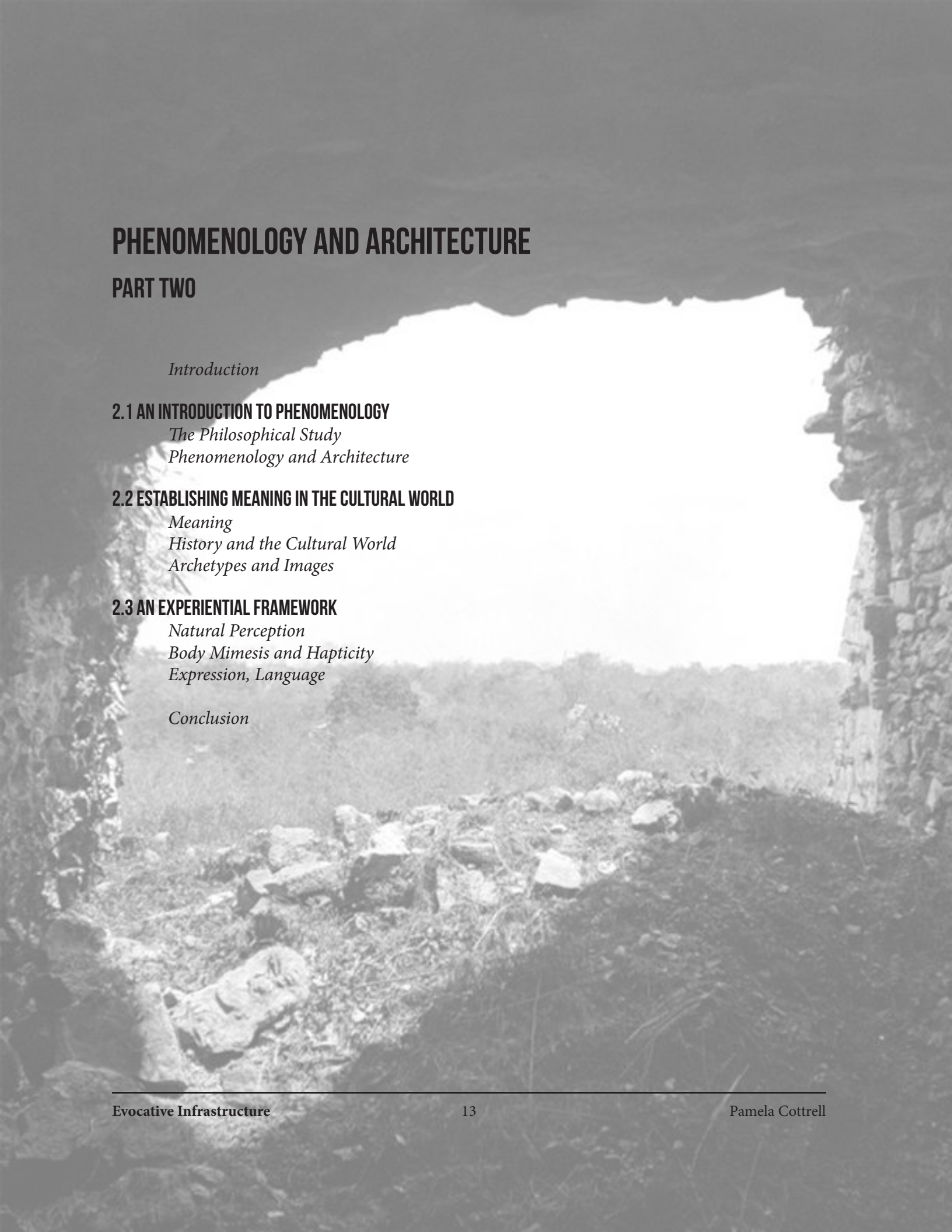
complimented by the utilitarian requirements of a transit station as the catalyst for an evolving, densifying city centre.

The design proposal will work with both factors to create an architecture where these dual motivators complement each other to make a beautiful architecture. The proposal seeks a sensual architecture inspired by the perceptual experience. There is potential in invoking the power of underground imagery to evoke an emotional response from dwellers of the space. Inhabiting the 'sous-terrain', the dweller can feel grounded, protected, connected to the fertility of the earth. As an important piece of the city's infrastructure, the space must also be functional, it must be capable of allowing the circulation (and potential egress in the case of an emergency) of large numbers of people, it must allow for a secure monitoring of commuters and the passage of trains in a timely manner, and it must remain structurally stable under the incredible mass of the earth pushing on all sides. By pursuing both concerns equally and together, the architecture sings. In the final section of the thesis, *Part Six: Evocative Infrastructure*, methods for achieving this will be materialized in the design proposal for Yonge-Eglinton Station.

ENDNOTES

1. Steven Holl, Alberto Perez-Gomez, and Juhani Pallasmaa, "Questions of Perception: Phenomenology of Architecture", *Architecture + Urbanism*, Special Issue (July 1994): 37.
2. Roger Thiel, "The Art of the Fugue," *Daidalos*, no. 48 (15 June 1993): 69-70.
3. Gaston Bachelard, The *Poetics of Space*, translated by Maria Jolas (Boston, Massachussetts: Orion Press, 1964), 18, 20.

Fig. 1.8 - 1.9
St Clair West Station, Toronto transit architecture



PHENOMENOLOGY AND ARCHITECTURE

PART TWO

Introduction

2.1 AN INTRODUCTION TO PHENOMENOLOGY

The Philosophical Study
Phenomenology and Architecture

2.2 ESTABLISHING MEANING IN THE CULTURAL WORLD

Meaning
History and the Cultural World
Archetypes and Images

2.3 AN EXPERIENTIAL FRAMEWORK

Natural Perception
Body Mimesis and Hapticity
Expression, Language

Conclusion

INTRODUCTION

Architecture being a meaning-for-embodiment-consciousness demands an erotic projection from the maker and the participant, an abandonment of ourselves for the other, an act whose final objective is our realization as embodied imagining selves.
... It is the fragmentary artifact par excellence that may allow us to identify our opaque nature under the linguistic 'house of being', while embracing use-values in our secular society.[1]

-Alberto Pérez-Gómez

We live in a 'man-made' world. Architecture grows from and is a response to the human condition. At its most basic it is a requirement for shelter; in its complexity it is a response to the cultural wants and needs, the psychological demands, and physiological requirements of society. Phenomenology has been described, by Maurice Merleau-Ponty, as "the study of essences."[2] It can be further explained as the study of the forces which make up our world and how we interact with it. Architecture is a major contributor to and resultant of our human setting. This relationship makes theories in phenomenology a useful lens with which to explore meaning and cultural experience in architecture.

This chapter will explore the study of phenomenology and key concepts while also bringing in concepts in architecture through a phenomenological lens. The goal of the study is to begin to explain the forces at work in the perception of architecture and argue for a sensual approach to architectural design.

2.1 AN INTRODUCTION TO PHENOMENOLOGY

THE PHILOSOPHICAL STUDY

Perception is not a science of the world, it is not even an act, a deliberate taking up of a position; it is the background from which all acts stand out, and is presupposed by them. The world is not an object such that I have in my possession the law of its making; it is the natural setting of, and field for, all my thoughts and all my explicit perceptions.
... there is no inner man, man is in the world, and only in the world does he know himself.[3]

-Maurice Merleau-Ponty

We exist in the world, and the world exists through us and our embodied experiences. Phenomenology is the study of the forces which shape the world and our interactions with it. With that, every single human artefact, be it a word, a gesture, or a piece of architecture, is inferred with meaning. Phenomenology is the rigorous science exploring the meaning behind everyday life. The study looks into how we physically and psychologically perceive objects, space, ourselves, and each other within the continuum.

The study of phenomenology has been developed from the beginning of the twentieth century by several philosophers, each with their own approaches and interests but all with the shared priority in seeking a rigorous philosophical study based on individual perception and experience seeking the meaning of 'being'. Edmund Husserl (1859-1938) is credited as the founder of the phenomenological movement with his book *Logical Investigations* (1900/1)[4]. Husserl was interested in historicism and psychology in critiques of logic, defining a phenomenological approach at the time. Further pioneers of the field include Martin Heidegger, Hannah Arendt, and Maurice Merleau-Ponty. Heidegger's pivotal work, *Being and Time* (1927), explores the meaning of being in the world. Heidegger developed a 'hermeneutic phenomenology' rooted in a historically mediated circle-of-understanding that is constitutive of existence.[5] Arendt was heavily influenced by Heidegger; through works such as *The Human Condition* (1958), Arendt expressed her belief that man differentiates himself from animal in his creation of a self-made and meaningful world[6] while also delving into the meaning of being in said world: the human condition. Finally, Maurice Merleau-Ponty, whose seminal work *Phenomenology of Perception* (1945) is one of the main resources for this thesis, was interested in the relationship between consciousness and the world. He developed a rigorous analysis of the science of perception in both a physiological and psychological sense. His theory speaks to how we interact with others and the world through the science of perception.

PHENOMENOLOGY AND ARCHITECTURE

Architectural structures are simultaneously utilitarian constructions for specific purposes, and spatial and material images of our being-in-the-world. They are lived metaphors, that mediate between the world and the human realm of life, immensity and intimacy, past and present.[7]

-Juhani Pallasmaa

Architecture expresses the duality of perception: it acts as a cultural psychological artefact as well as engaging sensory physiological perception. The connection between the study of phenomenology and the study of architecture was argued in an important text written by three architects: Steven Holl, Juhani Pallasmaa, and Alberto Pérez-Gómez. The text is a special issue of *A+U Architecture and Urbanism* entitled 'Questions of Perception: Phenomenology of Architecture', published in July 1994. The authors delve into the phenomenon of architecture: its place as a cultural artefact, its role in mediating our relationship with the world, and its beauty in arousing sensual perception. The architectural phenomenology movement is an effort to move away from an intellectualised approach to design to an approach motivated and contextualised by human interaction and existential use.

At its very basis, architecture is a means of shelter: an evocation of our need for protection against the elements. But on another level, architecture is an expression of the culture from which it is born. Pallasmaa writes: *Buildings and cities are instruments and museums of time. They enable us to see and understand the passing of history.*[8] Architecture mediates and expresses our connection to the world. In it, one finds an artefact of our current and past psychology, sociology, anthropology, economy, politics, myth, cultural values, biology, and so on. This also means that all of these realms contribute to the making and meaning of architecture. Meaning in architecture lies in its existence and its use-- through program or otherwise. Architecture humanizes the world, providing much needed shelter and meeting the other wants and needs that our society needs fulfilled; it is the ultimate human artefact.

Architecture maintains a second importance in its ability to engage our sensory perceptions. Steven Holl describes this play of sensory stimuli: "The passage of time; light, shadow and transparency; color phenomena, texture, material and detail all participate in the complete experience of architecture."[9] The senses invoked in architecture range from the most primal and basic: sight, touch, auditory, olfactory and taste, to more psychological methods of perception: hapticity and body mimesis, defined as the ability to unconsciously understand architecture's structure or other attributes through a sort of bodily metaphor. Through engagement of the senses we are reconnected to the world on a primal level. We are invited to think about the space, to make ourselves at home. Pallasmaa explains the implication of sensual perception in the perception of a

Fig. 2.1
(previous page, full-spread)
out of the cave



cathedral facade:

I confront the city with my body; my legs measure the length of the arcade and the width of the square; my gaze unconsciously projects my body onto the facade of the cathedral, where it roams over the mouldings and contours, sensing the size of recesses and projections; my body weight meets the mass of the cathedral door, and my hand grasps the door pull as I enter the dark void behind.[10]

We use our sense of perception to understand architecture upon confrontation; further meditation reveals its meaning and place within the larger realm of the cultural world. A phenomenological approach to analysis of architecture allows for a comprehensive exploration of how we experience and perceive it in our built setting on an everyday, real, basis.

Fig. 2.2
Collage: the Vitruvian man measures a church portal

2.2 ESTABLISHING MEANING IN THE CULTURAL WORLD

MEANING

The taste of the apple... lies in the contact of the fruit with the palate, not in the fruit itself; in a similar way... poetry lies in the meeting of the poem and the reader, not in the lines of symbols printed on the pages of a book. What is essential is the aesthetic act, the thrill, the almost physical emotion that comes with each reading.[11]

-Jorge Luis Borges, Forward to Obra Poética

The significance of a thing inhabits that thing as the soul inhabits the body: it is not behind appearances.[12]

-Maurice Merleau-Ponty

Everything; the clothes we wear, the furniture we sit on, the buildings that shelter our heads, everything, has meaning because it is a product of the world we have built for ourselves. In our making it, we endow the world with the implications of the human condition; the form of the world responds to what it means to be human and alive. It is inferred that everything, even something which appears to be meaningless or random, is connected to the larger world. It's being in that world means that somehow it is responding to it, perhaps in its being seemingly haphazard. The study of phenomenology deduces that meaning is inherent in existence, but also seeks to establish an understanding of how we establish and experience meaning as a cultural entity.

Meaning is established through analysing the underlying structures which produced the action, artefact, and/or overall cultural context. Understanding history can only be achieved by analysing all angles simultaneously; any and everything can, in theory, affect the outcome of history. This means that in establishing meaning to our cultural context we must analyse all aspects of it: ideology, politics, religion, economic, and etcetera, with the goal of finding a structure of underlying relationships which produced our world. Having said this, it is difficult to perfectly define the intentions behind an action. Meaning in our actions as humans lies in the interplay between our biological motivations and psychological interests.[13] An example of these differing motivators affecting meaning can be seen in the meanings attributed to colours. For example, red is the colour of blood, and seems to have an attention grabbing effect on the eyes (whether this is for biological or psychological reasons could make up a thesis of its own). It also has some historical and cultural connotations. We attribute

a powerful personality to the colour red; Goethe said red 'invades the eye'.[14] We further establish meaning by observing the actions of other players within our world. Having understood where meaning comes from, we must beg the question: why seek meaning, what purpose does meaning in our world serve?

"Whether it be a question of vestiges or the body of another person, we need to know how an object in space can become the eloquent relic of an existence; how conversely, an intention, a thought or a project can detach themselves from the personal subject and become visible outside him in the shape of his body, and in the environment which he builds for himself."[15] It is important to gain insight into where we came from, understanding what meaning is endowed in each other and the world and why. This allows us to become a better part of it, gain an understanding of where everything came from and why we are the way we are, why we live the way we do, and consider our response to this world we are humanized in.

By recognizing where our world comes from, the architect gains a certain power. The architect, as designer of cities and houses, plays a key role in the shaping of our world. The architect responds to the wants and needs of society, while also keeping in mind the lifecycle of the building in designing for the future. Considering the phenomenological interest in meaning and how it shapes perception is a way for architects to begin to understand the weight of all architectural decisions. What does the decision to use concrete, the production of which is one of the biggest causes of carbon emissions in the world, say about our society and its value? What kinds of values do we want our architecture to project? The phenomenologist philosophy means that everything in our cultural realm has meaning. This means that the architect, as designer of cities, gains power and responsibility.

HISTORY AND THE CULTURAL WORLD

The phenomenological world is not pure being, but the sense which is revealed where the paths of my various experiences intersect, and also where my own and other people's intersect and engage each other like gears.[16]

-Maurice Merleau-Ponty

The timeless task of architecture is to create embodied existential metaphors that concretize and structure man's being in the world. Images of architecture reflect and externalize ideas and images of life; architecture materializes our images of ideal life. Buildings and towns enable us to structure, understand, and remember the shapeless flow of reality and, ultimately, to recognize and remember who we are. Architecture enables us to place ourselves in the continuum of culture.[17]

-Juhani Pallasmaa


ERANOT
UTAMOH





Fig. 2.5
The Parthenon, Fredrick Edwin Church, 1871, oil on canvas

We occupy this world amongst others, inserted in a cultural continuum. My insertion into a cultural world invites contemplation over my relationship with others within it and how their perceptions and behaviours affect my own. The world we live in was made by men and women like me. I place myself in history by taking part in this cultural world. While my memories of history are blurry, at best, history instils in me behavioural patterns, impressions, archetypal images, and an architectural background. Everywhere around me are objects and structures moulded by human needs and wants. I perceive the cultural world and the artefacts within it through a combination of my perceptual sensations and the perceptual traditions ingrained in me. My insertion in a history gives me a kind of density, a density of experience and expectation.

Recognition of our inclusion in a cultural world allows for greater connection with those also within it. The cultural world is something which we, as a people, share; it is the overarching structure which produces and is a result of our search for meaning. The poet who places themselves within the larger cultural continuum can recognize the emotional and psychological cues within words and imagery, to express a more meaningful work. The artist who looks into our cultural hopes and fears has the ability to make their work accessible to a larger audience. The novel 1984 by George Orwell is proof of this. The setting in 1984 is a world where governing forces have taken a terrifying authoritarian direction. With the advent of technology and real authoritarian governments, the Nazi party in Germany, Mussolini in Italy, Stalin in Russia, this book speaks to a real fear based in real cultural and historical issues. There is power over perception in recognition and celebration of our place in our cultural world.

Fig. 2.3 - 2.4
film stills: Metropolis (Fritz Lang)
The world portrayed in Metropolis: tall beautiful skyscrapers of the rich fueled by the workings of the proletariet in the dangeruos underbelly of the city, spoke to fears of class war in cultural history

The architect who is connected to their past, their history, is able to







make a more evocative architecture, one which connects the occupant to their shared cultural realm as well as to their imagination, memories. The architect can connect with the occupant on a level beyond function. Take the Parthenon, for example; the Parthenon was built over 2500 years ago with an extraordinary amount of care and investment to connect the Greek people to their gods and to the cosmos at large. It stands as a testament to an interest of the Greek people to maintain and celebrate this link to their cultural past and, on some level, maintain this link to the cosmos. On a smaller time scale, we can see the rise of the middle class and the movement away from city centres in the design of suburban neighbourhoods versus their urban core counterparts. The typical suburban home is surrounded by a large yard with perfect green grass, inside there is an eat-in kitchen, living room, dining room, family room and powder room on the ground floor; the second floor contains several bedrooms along with one or more bathrooms. This has been chosen as superior, at least in some ways, to living in the downtown core by much of the middle class. Downtown core housing consists of dense urban houses and multiple unit residential buildings. While things have changed, from the 1960's through the turn of the millennium suburbs continued to expand rapidly. Urban developers were responding to a cultural and technological shift in interest in moving away from dense urban centres, to a suburban small community based periphery where the middle class could get the taste of country life while remaining close to amenity. Architecture is both a result of our cultural realm and forms it; the architect and builder gain a unique influence.

Fig. 2.6
suburbia as portrayed in Tim Burton's Edward Scissorhands (film still)

ARCHETYPES AND THE IMAGINATION

[The phenomenologist] takes the image just as it is, just as the poet created it, and tries to make it his own, to feed on this rare fruit. He brings the image to the very limit of what he is able to imagine.[18]

-Gaston Bachelard

Carl Jung defined 'the archetype' in his essay "On the Relation of Analytical Psychology to Poetic Art":

The primordial image or archetype is a figure, whether it be a daemon, man, or process, that repeats itself in the course of history wherever creative fantasy is fully manifested. Essentially, therefore, it is a mythological figure. if we subject these images to a closer investigation, we discover them to be the formulated resultants of countless typical experiences of our ancestors. They are, as it were, the psychic residua of numberless experiences of the same type.[19]

Fig. 2.7 - 2.8
(left to right)
St Jamestown Multiple Unit Residential Building, Toronto; example rowhouse downtown Toronto

The Archetype or image is something that comes from our collective







Fig. 2.11
the underworld archetypal space (Aeneas and the Sibyl, unknown artist, 1800)

unconscious with origins somewhere in both memory and legend. It belongs to the imagined realm while affecting our perception of the cultural world. The image differentiates itself from a metaphor in that a metaphor implies a reference or comparison, while the image invites a becoming of the image, the image puts us into a defined imaginary realm. The image invites us to live in its world.

Archetypes are represented in art, poetry and architecture in order to present an idea on a primordial level. Author Gaston Bachelard wrote *The Poetics of Space*: a book which speaks to the role of imagery in art, architecture, and poetry. Images explored in *The Poetics of Space* include: the house (with the cellar and garret as parts within it), drawers, chests and wardrobes, birds' nests, and shells. Bachelard invites the reader to occupy these archetypal images at varying scales. We consider what it would feel like to live and think within the cellar, the garret, the drawer, the shell. Archetypal figures in literature include: the great mother, the father, the child, the devil, the god, the wise old man, the wise old woman, the trickster, and the hero. These archetypal figures are used in literature and art to connect to a primal image of their character.

An archetype is defined by its ability to connect to a primal image which is always general, never too detailed or imposing, inviting the reader to imagine in their own terms. An image defined too clearly begins to become metaphorical; it begins to block the mind from imagining by imposing an author controlled visualization. Bachelard tells us that in using the image in poetry, art or architecture, we should identify the dominant quality of said image. This can be

Fig. 2.9 - 2.10
the attic and the cellar



found by identifying 'its adjective'. For example, in the archetype of 'the house' one might define the dominant nature that of safety, protection. Another dominant idea can be defined by its being our personal space within the world-- it is our 'home'. By recalling an image in poetry, the author invites echoes of images of past experiences in real or imagined realms.

In *The Embodied Image*, Juhani Pallasmaa introduces the new term embodied image which, like these examples, appears to have more architectural and spatial connotations. Pallasmaa defines his embodied image: "... the most deeply existentially and experientially rooted architectural experiences impact our minds through images which are condensations of distinct architectural essences. ... The embodied image is a spatialised, materialised and multi-sensory lived experience."[20] The embodied image evokes an imagined world on an architectural scale as well as on a miniature one. In architecture, like in art and poetry, we have the opportunity to recognize and take advantage of this phenomenon. Architecturally rooted archetypes include: the house, the cave, the tower, the castle, the church, the underworld, and so on. These images can also be broken down into parts: the cellar and garret in the house, the dungeon in the castle, the cathedral portal. All are images found in daydreams and stories but with real world roots. The embodied image in architecture recalls its roots in the larger cultural continuum from which it is born.

Fig. 2.12
out of the cave

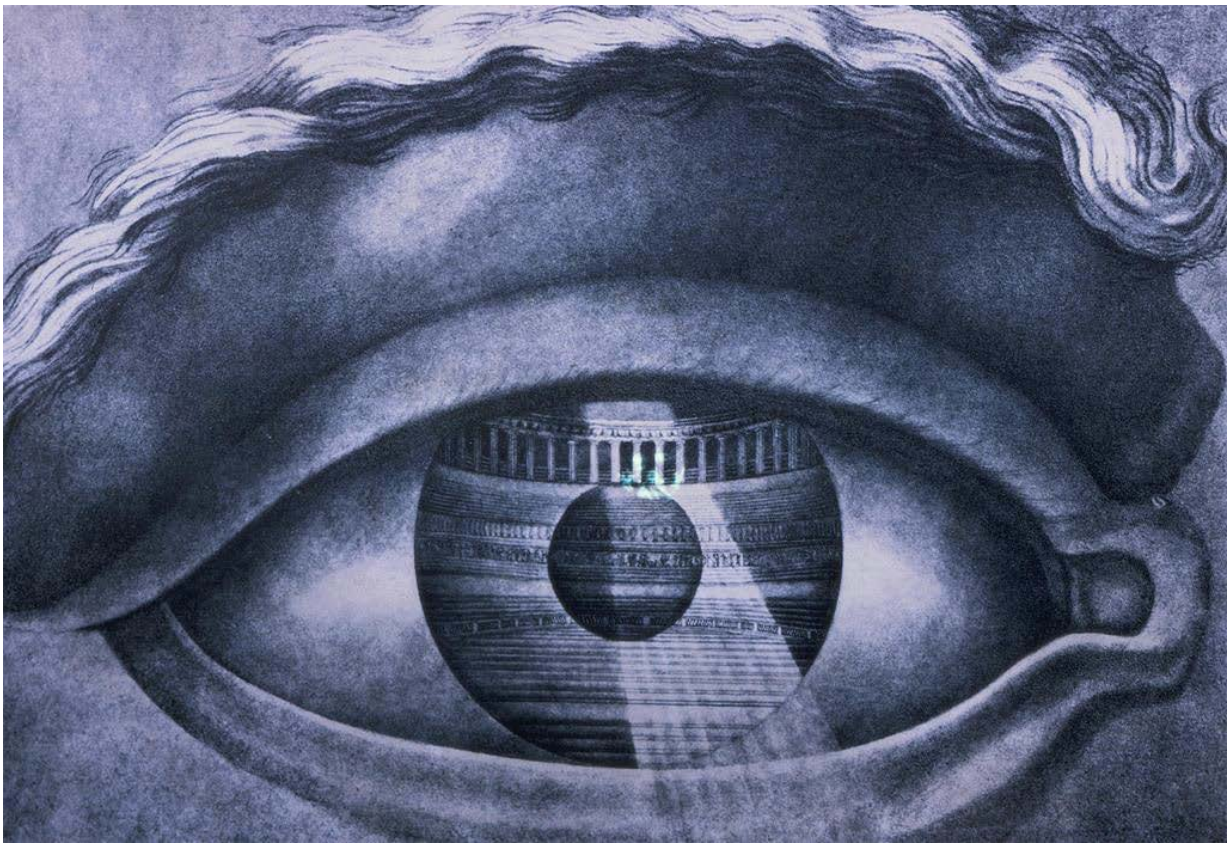


Fig. 2.13
Eye Reflecting the interior of the Theatre of Besancon, Claude-Nicolas Ledoux, drawing, 18th C.

2.3 AN EXPERIENTIAL FRAMEWORK

NATURAL PERCEPTION

Between my sensation and myself there stands always the thickness of some primal acquisition which prevents my experience from being clear of itself. I experience the sensation as a modality of a general existence, one already destined for a physical world and which runs through me without my being the cause of it.[21]

-Maurice Merleau-Ponty

Sensual perception is the instinct which allows us to take in and understand the world around us. The essential function of our perceptive abilities is to experience and respond to stimuli, ultimately allowing for understanding of our surroundings and further, the taking in of knowledge. With that, perception can be defined as an 'interpretation' of the signs that our senses provide in accordance with this bodily stimuli, the mind then develops an impression of what is perceived and can react accordingly.[22] This perception becomes a relationship between perceiver and perceived. There would be no perception without the world; I know I exist because I have a perceived world. Natural perception allows for the communication with our surroundings vital for allowing us to feel familiar within them.

We have sensual organs which correspond to certain sensual stimuli: eyes for seeing, skin for touching and feeling, ears for hearing, nose for smelling, and tongue for tasting. In reality, we never see with only our eyes, never touch with only our skin, we perceive with our whole body, all of the senses act at once in synergy. Bachelard said: "intuitionists, in fact, take in everything at one glance, while details reveal themselves and patiently take their places, one after the other, with the discursive impishness of the clever miniaturist."[23] The act of perception, though typically done unconsciously, can take time; levels of detail have been described as coming in as echoes or reverberations. With each echo, the perceived image becomes clearer and clearer. We comprehend our surroundings in flashes of sensual details which combine to create a whole image.

Sight and touch can be considered to be the major senses used to perceive space, with secondary help from the auditory sense. Through sight we are able to perceive depth and movement within the visual field. Through touch we are able to perceive materiality, material details, and orient ourselves within the setting. Sound, through sensed reverberations, gives us a sense of the volume of a space as well as a sense of the materiality of the space based on the types of sounds vibrating off materials. In this way, the auditory sense aids both sight and touch in the natural perception of space. Architectural experience is rooted in its



Fig. 2.14
The Lonely Metropolitan by Herbert Bayer

ability to stimulate the senses. The architect can use this ability to create a bodily engaging architecture.

BODY MIMESIS AND HAPTICITY

The very essence of the lived experience is moulded by hapticity and peripheral unfocused vision... All the senses, including vision, are extensions of the tactile sense; the senses are specialisations of skin tissue, and all sensory experiences are modes of touching and thus related to tactility.[25]

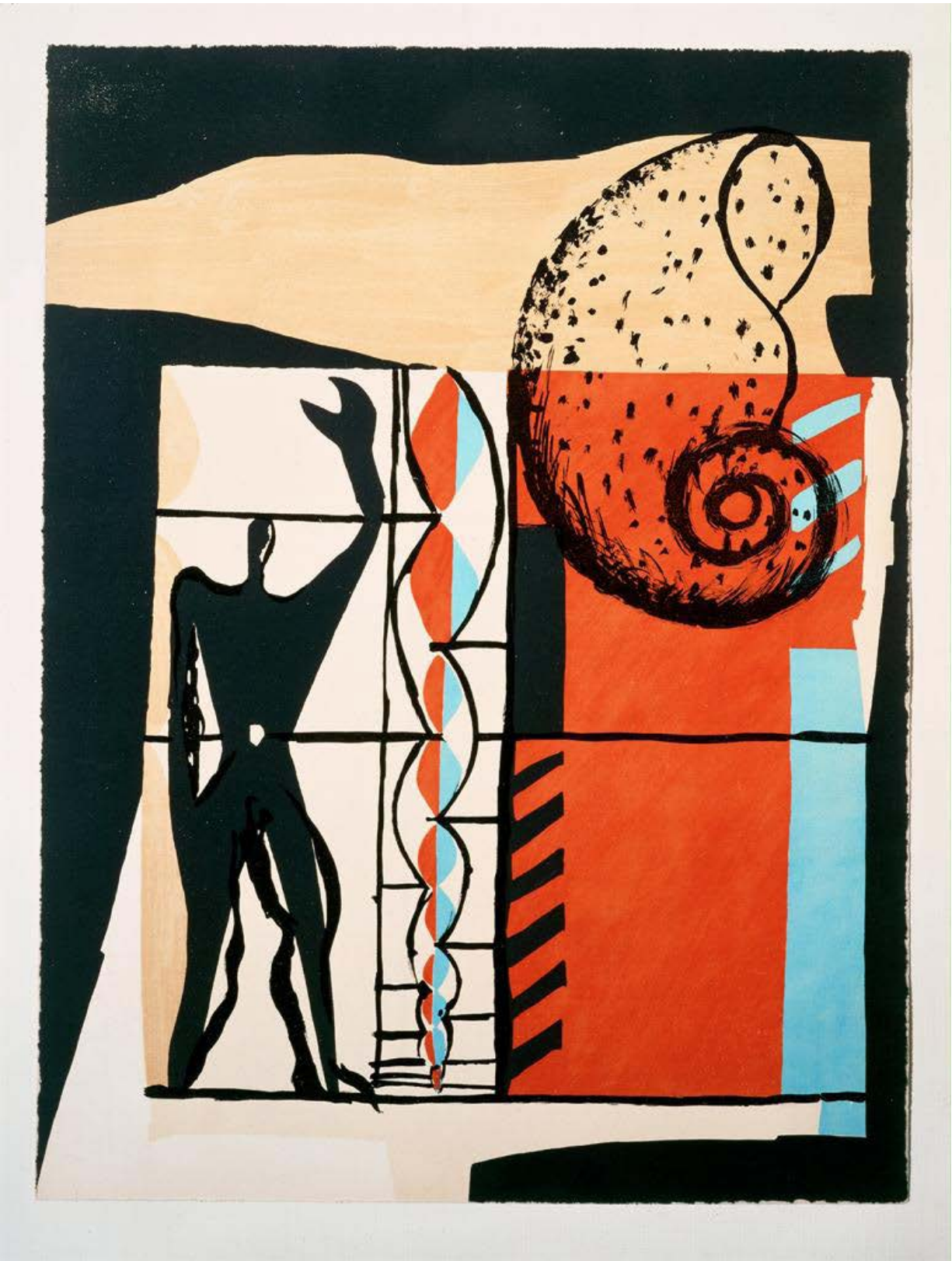
-Juhani Pallasmaa

There is my arm seen as sustaining familiar acts, my body as giving rise to determinate action having a field or scope known to me in advance, there are my surroundings as a collection of possible points upon which this bodily action may operate, -- and there is, furthermore, my arm as a mechanism of muscles and bones, as a contrivance for bending and stretching, as an articulated object, the world as a pure spectacle into which I am absorbed, but which I contemplate and point out.[26]

-Maurice Merleau-Ponty

The *phenomenal body*, a term coined by Merleau-Ponty, is created through the synthesis of the senses in the mind; their synergy allows our setting and perceived objects to be projected around us as a whole. The phenomenal body is a part of the subconscious. It is the part of the brain where our perception, arguably, really happens. What this also means is that we don't have to physically touch something to perceive that same sense of touch, we don't have to see with our eyes in order to see. This is where the notion of hapticity comes from. In studies of the blind, hapticity is the term coined to describe how they can perceive space without having the ability to see it. Juhani Pallasmaa has explored the notion in an architectural context in his book *The Eyes of the Skin: Architecture and the Seven Senses* (2005) arguing that we do in fact see with our skin. The notion of the phenomenal body and hapticity are all based on the idea that all senses are connected to the brain and this is where perception actually happens.

The concept of body mimesis is premised on the concept of the brain being the home base for all perception but extends that to the body as the mediator. Through the body, the mind is capable of awareness, capable of understanding stimuli in a multi-sensory world. Given that all sensory perception happens in the mind, one has the potential to experience sensory stimuli, in an abstracted way, through thinking about said perception; we are able to engage the organs in a mental way. Body mimesis is about a kind of empathetic sense of perception whereby I am able to unconsciously sense what others are experiencing-- be it people, structures, characters in a novel-- by being relayed, perhaps through observation, the experience. The empathetic sense of body mimesis is how we are able to connect, on a physiological level as well as psychological, to art depictions, literature and poetry, and even architecture.



The perception of architectural space is based on this total body psychic mode of perceiving. Through the empathetic sense we are able to sense the tension and compression in architectural structures, we are able to sense 'what the brick wants to be' as Louis Kahn famously put it. By visualizing or picking up a brick, for example, we are able to feel its mass, its density, internal pressures, and through body mimesis we can begin to sense how the material can be used. Through the phenomenal body we are able to experience scale in an architectural setting. We unconsciously project ourselves into a space to get a sense of measurement in it. In spaces where the human body is comparable to dimensions we feel more at home, more familiar. In larger scale spaces there is a sort of beyond human experience-- there is a message of that space belonging to a greater realm. With the same phenomenal body we occupy buildings without actually occupying them. We can get a sense of space by looking at a picture or other form of visualization; we can begin to get a sense of the experiential qualities of that space.

The phenomenal body and body mimesis are subconscious abilities of the mind used in perception. These abilities help us to perceive our own surroundings as well as understand the perceptions communicated by others.

EXPRESSION, LANGUAGE

Words-- I often imagine this-- are little houses, each with its cellar and garret. Common sense lives on the ground floor, always ready to engage in "foreign commerce", on the same level as the others, as the passers-by, who are never dreamers. To go upstairs in the word house is to withdraw, step by step; while to go down to the cellar is to dream, it is losing one self in the distant corridors of an obscure etymology, looking for treasures that cannot be found in words. To mount and descend in the words themselves-- this is a poet's life.[27]

-Gaston Bachelard

As humans, and members of a cultural world, we seem to hold a primal need to express ourselves and communicate with others. We do so in many ways: through language whether it's written or spoken, art, body movements and gestures, and so on. This is why we develop language, as a means to communicate. People can only communicate with us if we can understand them, and so language is born. Every word has a use, particular words, referring to archetypes, awaken a larger idea and meaning within that single word. We create sentences, bring words together, in order to communicate a collection of meanings which, together, form a message for someone else to understand. In theory, the process of expression, can introduce to the reader or respondent a new realm of experience, not actually lived in reality, but lived in a sort of external memory.

Fig. 2.15
"D", Painting by Le Corbusier



Fig. 2.16
The Treason of Images (This is not a Pipe), Rene Magritte, 1929, oil on canvas

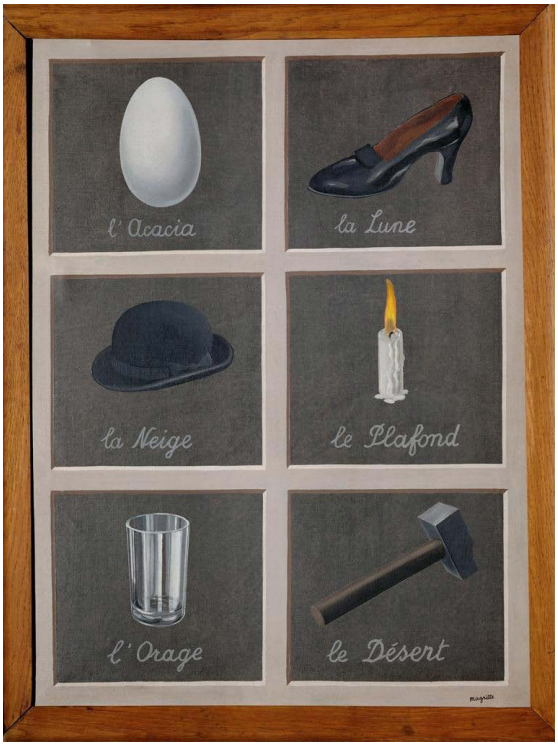


Fig. 2.17
La clef des songes., Rene Magritte, 1930, painting

By reading a story in literature, or about a building in an architectural journal, I am able to live the experience of this story or structure in my own psyche; I bring this experience into me and it becomes part of my collection of memories, part of my cultural world. This process is allowed through my own bodily experience. I am able to recall, unconsciously through my muscle memory, a similar collection of experiences and build in my mind the described story. And so, I am able to communicate with others, introducing my ideas into their field of perception and bringing in theirs.

In architecture, we develop a drawn language through which we communicate. Plans, sections, elevations, and axonometric drawings are all abstracted projections designed to be technically, and potentially poetically, informative. We have also developed a language of lineweights which show depth as well as importance in a drawing. Consideration over the mode of expression in architectural design is extremely important. For technical reasons, it's extremely important that others are able to understand the construction aspects properly; for poet reasons, we use our drawings to communicate our concepts. Our drawings need to be able to speak for themselves, when we are not there to. For this reason, the phenomenological interest in expression and language is a helpful consideration for the architect when producing drawings for a project.

CONCLUSION

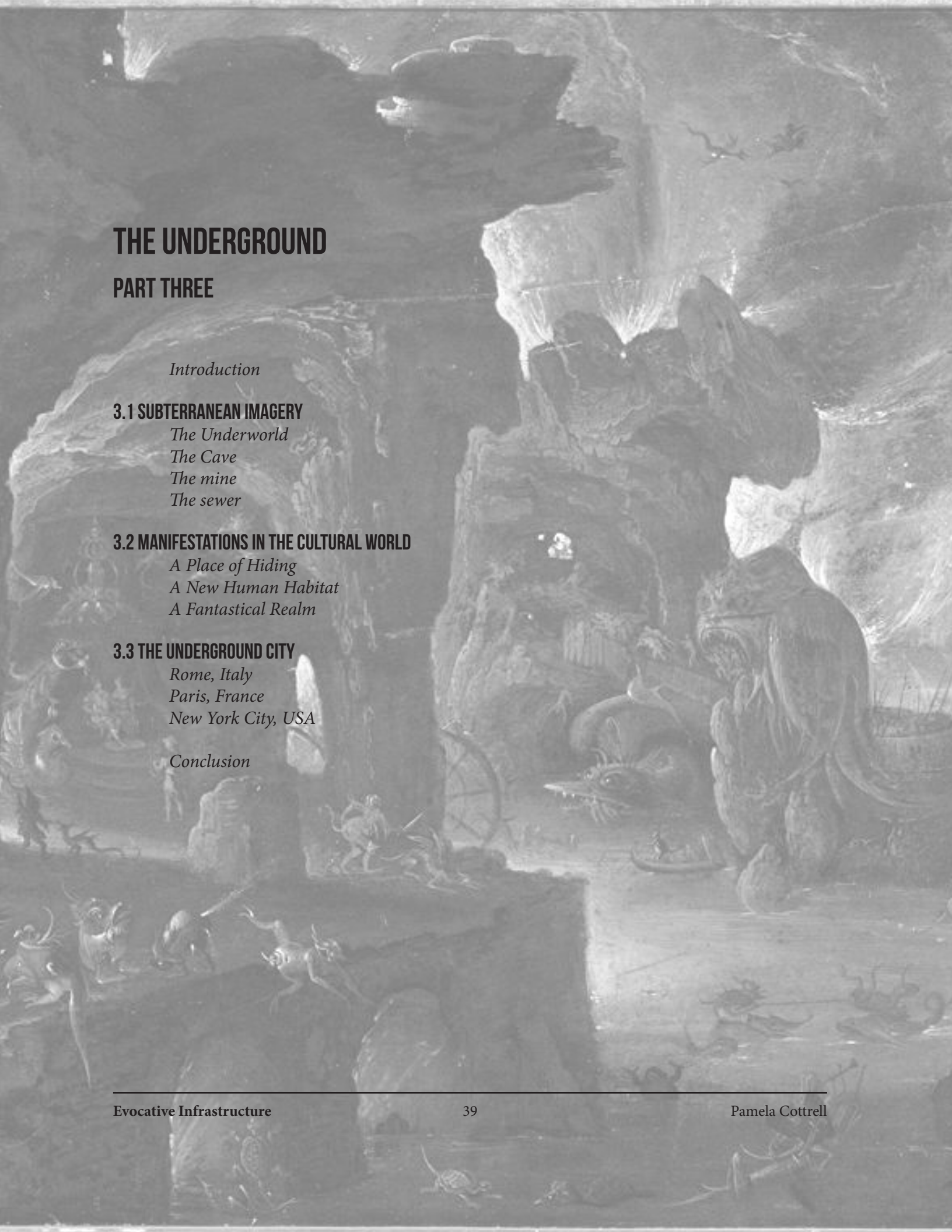
Experience of phenomena- sensations in space and time as distinguished from the perception of objects- provides a 'pre-theoretical' ground for architecture. Such perception is pre-logical i.e., it requires a suspension of a priori thought. Phenomenology, in dealing with questions of perception, encourages us to experience architecture by walking through it, touching it, listening to it. 'Seeing things' requires slipping into a world below the everyday neurosis of the functioning world. An underground city for which we have keys without locks, it is full of mysteries. Phenomenology as a way of thinking and seeing becomes an agent for architectural conception.[28]

Steven Holl

The thesis topic, as explained in chapter one, is the underground city. The underground holds deep cultural connotations responding to the psychological cultural memories associated with it, the physiological stimuli which give it character, and the cultural continuum of the metropolis in which it resides. The philosophical study of phenomenology is being used as a lens for analysis and catalyst for the design of an underground architecture because of its connection to both the emotive connotations descent into the earth and the stringent cultural expectations for functionality of underground infrastructure.

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THE UNDERGROUND

PART THREE

Introduction

3.1 SUBTERRANEAN IMAGERY

The Underworld
The Cave
The mine
The sewer

3.2 MANIFESTATIONS IN THE CULTURAL WORLD

A Place of Hiding
A New Human Habitat
A Fantastical Realm

3.3 THE UNDERGROUND CITY

Rome, Italy
Paris, France
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Conclusion

INTRODUCTION

The underground holds a beautiful ability to evoke emotions associated with subterranean cultural imagery. The descent into the earth beckons a distant memory of the underworld of Greek myth, the caves of primitive man, the miner's descent into darkness. These cultural perceptions play a role in shaping the Metropolis' underground city. This chapter is an exploration of the perception and depictions of the subterranean in the cultural world; ultimately, looking for the meaning defined by society of the term 'underground'. We begin by looking at four archetypes associated with the underground: the underworld, the cave, the mine, and the sewer. Next, these archetypes are analyzed in the context of cultural manifestations: art, film, and literature. Three common depictions of the underground are identified and explored through examples: the underground as a hiding place, as a new human habitation, and as a fantastical realm. The third section again builds on the last two. We look at how cultural imagery of the underground have shaped and been shaped by the built world through three cities: Rome, Paris, and New York City. The intent of this chapter is to gain an overview of the Western cultural relationship to the underground and how this affects the perception of the built world.





3.1 SUBTERRANEAN IMAGERY

THE UNDERWORLD

Hades' realm is contiguous with life, touching it at all points, just below it, its shadow brother (doppelganger) giving to life its depth and its psyche.[1]

-Hillman

Through me you enter into the city of woes
Through me you enter into eternal pain,
Through me you enter the population of loss.
. . . Abandon all hope, you who enter here.[2]

-Dante Alighieri, Divine Comedy

The underworld, the ancient land of the dead, is deeply rooted in our cultural perception of the underground. This archetype comes from myths stemming back to antiquity. The Ancient Greeks and Romans believed that the Underworld, where the souls of the dead were sent, lay directly below our feet. In Greek myth, the cosmos were split into three realms: the air, the sea, and the underworld. These realms were ruled by Zeus, Poseidon, and Hades, respectively. The Underworld was a realm which held the souls of the dead but also held a strong relationship with agricultural fertility and the cycle of life. The goddess 'Tellus', or 'Terra Mater', was a lower world god but also presided over the fields of nature with a maternally earthy character.[3] Today, the connection of the underground to the underworld still exists and affects our perception of underground spaces.

Fig. 3.1
(opposite, and made black & whte for previouse full-page spread)
Orpheus in the Underworld, Roalandt Savery, 1610-1615, oil on wood

The underworld archetype is portrayed in several myths and paintings but most notably so in portrayals of the myth of Orpheus and Eurydice. Orpheus is a poet and musician with almost supernatural abilities to move anyone with his music. His lover, Eurydice, is bitten and killed by a poisonous rattlesnake on their wedding day. Playing his lyre, Orpheus is able to put a spell on the guardians of the Underworld and descend to the depths in an effort to save her. There, he makes a deal with Hades and Persephone to allow him and his wife to return to the land of the living with the stipulation that he lead her out with his song and cannot turn back to look at her until they reach safety. But at the entrance, Orpheus looks back, longing to look at his beautiful wife, only to watch as she fades back into the Underworld.[4] In this myth, the underworld is portrayed as a dangerous place guarded by hideous monsters. Painted portrayals of Orpheus's journey into the underworld depict a rocky terrain filled with demonic figures and lit with the glow of chaotic fires.

Fig. 3.2
Orpheus Sings before Pluto and Prosperpine in the Underworld, Jan Brueghel the Elder, 1594, oil on copper





Imagery of the Underworld portrays it as dark, with a rough terrain and a fiery inner glow. The landscape includes a water feature representing one or more of the five rivers of the Underworld. These include the River Styx, also called the 'river of hatred' which is the most prominent, and the River Acheron, the river of pain, where 'Charon' rows the souls of the dead in his ferry into Hell. The Underworld is home to the bodiless souls of the dead, and so the landscape is representative of one where humans do not typically roam, one which is unfriendly to human occupation.

Imagery of descent into the darkness of the earth holds strong connotations of the descent into the underworld. The underground gains a dangerous but mystical quality from this relationship. As the place where plants which sustain human life are born and grow as well as the resting place of the human dead in many religions, the earth is a symbol for the cycle of life. As mortals, we tend not to appreciate the reminder of our being a part of the cycle of life, a reminder that we too, one day, will be interred forever. This connection to the underworld is one of the reasons why underground architecture is not typically a popular avenue. In architecture one does not want to recall the image of the underworld as a dark, dank, place of death. It has the potential to recall the magical realm of ancient myth: the place where one finds incredible figures hidden in the shadows, where the gods of fertility reside, and a connection to the souls of those who used to walk the earth.

Fig. 3.3
Aeneas and the Sibyl, unknown artist, 1800, oil on canvas

THE CAVE

The aesthetic of the cave has to do with its statics; the pressure from the surrounding masses of earth engenders the doubly curvature surfaces. … it is a cave.[5]

Oh, yes, everyone likes caves… People get a positive pleasure going into my gallery. Going into a building that isn't there, they get that feeling of, 'Where are we going?' Since every room is about ten times bigger than they expect, there's a positive element of surprise and romance. Caves are probably an atavism of some kind; people enjoy being enclosed.[6]

-Philip Johnson, on his underground gallery

The cave offers an imagery of protection from known danger as well as of primitive nature. Caves and caverns are natural cavities formed underground or in the sides of cliffs. The cave as an archetype appears to have a primal conception as a natural source of shelter for the oldest human descendants and animals. The view of caves as a natural source of shelter from wind, sun and precipitation is physiologically motivated. The cave is used as a source of protection but also has

Fig. 3.4
Dante and Virgil in the Underworld, Filippo Napoletano, 1617-1621, oil on panel







Fig. 3.7
Plato's Cave, Jan Pietersz Saenredam, 1604, After Cornelisz

connotations of man's primitive beginnings.

The formation of caves is telling of where they are found and their shapes. Caves are formed through wind-erosion, water-erosion at the shoreline of large bodies of water, and during the cooling of lava flows from volcanic activity. Large natural cavities are mostly formed in 'Karst systems'. These are formed when flowing water dissolves limestone and dolomite; the water dissolves calcium carbonate in the presence of oxygen, and as the water flows along systems of joints it gradually widens the joint into large cavities.[7] Caves tend to be found in places of extreme weather conditions and have offered relief from said weather for our earliest ancestors. They offer protected space where it is needed most.

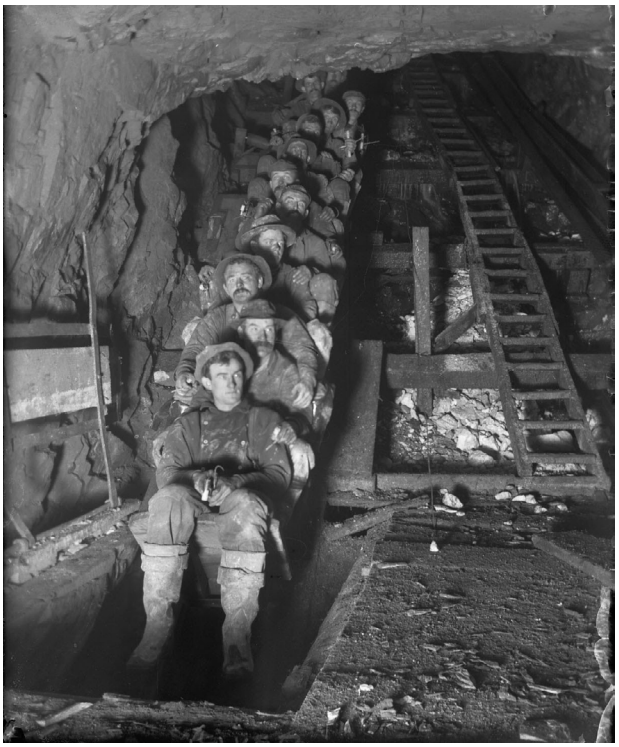
Fig. 3.5
Mulu Caves, Malaysia

The opening of a cave is used as an image representing moving out of a primitive past into an enlightened present. This image has its birth in Plato's *Allegory of the Cave*. The narrative, told by Socrates, describes a group of people chained facing a blank wall in a cave their entire lives. These people watch shadows projected on their wall by people and things passing in front of a fire behind them. The shadows on their wall become the prisoners' view of reality. Socrates explains that the philosopher is like a prisoner freed from the shackles in the cave, seeing beyond the presented reality of the shadows. In the light, the philosopher can see a true reality; in the darkness of the cave, reality is disfigured and manipulated in the shadows.

The cave is representative of a primitive life: the basic need for shelter and pre-enlightenment. The archetype of the cave is used to speak to a source of protection and refuge. This archetype is used in both allegory and physical architecture such as the gallery described by Philip Johnson. Imagery of movement out of the darkness of a cave and into the light of day is used to represent a coming into knowledge or seeing beyond what normal society

Fig. 3.6
Entrance to Philip Johnson's Painting Gallery at the Glass House







observes. The complete imagery provided in the archetype of the cave leads to a perception of the earth as a source of protection from the elements or the world at large but as secondary in value to living in the light of day.

THE MINE

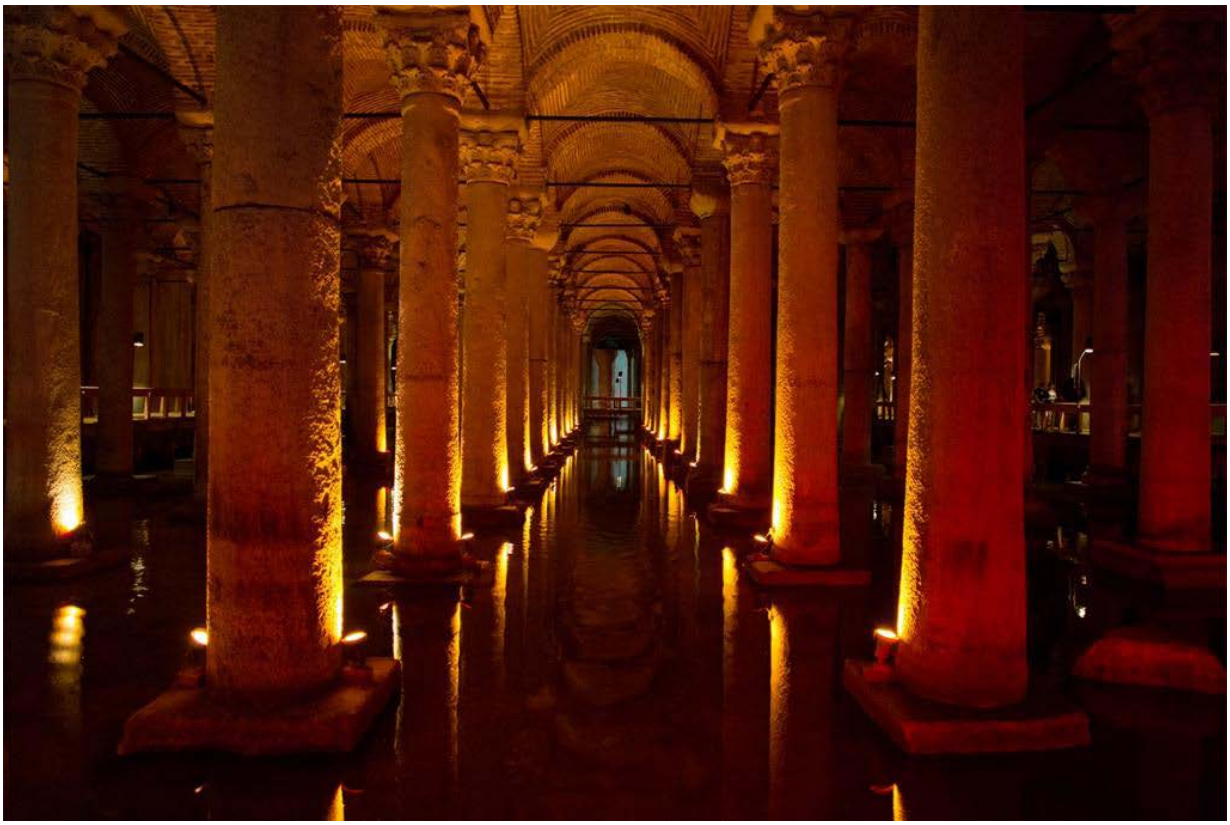
The miner inhabits only a void, a space that is never static, but which is always altered by his excavation, as he moves continuously forward along the seam. This occupied space is always threatened by collapse as the ground moves, its gases and its dust infiltrate the organism of his body. In the altered acoustics of the underground, as extra-corporeal sounds become deadened by the volume of the earth, recognition of the interior of the body becomes stronger. The pumping of blood, the passage of air through the lungs becomes audible, the body listens to its own sounds.[8]

Fig. 3.8 - 3.9
Calumet and Hecla Mining Company; Mine shaft in Mexico

The mine archetype presents a deep shaft; darkness envelops the miner as he descends deeper and deeper into the mass of the earth. In the 19th century, when the first subways opened up, members of the middle class were exposed to the mined underground for the first time; tourists began visiting mining sites and returned stunned by "the black pits, the blighted landscape, the smoke and steam, the strange noises of machinery, the flaring lights of furnaces, and the dark, demonic human figures."[9] This image of the mine is still associated with underground architecture and especially in its construction. Descending down the long escalator into deep transit systems, such as Moscow's subway system, laying ten to thirty stories underground, one cannot help but recall an image of the miner descending the mine shaft elevator into the blackness of the mine. This perception is affected by a physiological instinct against the filth and lack of access to air in descending deep into the earth's core.

The danger and terrible working conditions made for a perception of mining as socially degrading and dangerous. Historically, the job of the miner was employed by members of the lowest social rung: convicts, prisoners of war, and slaves.[10] Even today, mining is a very dangerous job, although not necessarily reserved to the poor. Miners are in constant danger of collapse or flooding of the mined tunnel, and many suffer long term health conditions due to poor air quality underground. In its earliest use mining was a very dangerous task; for example, construction of the original subway tunnels in England had to be stopped several times due to collapses leading to fatalities due to inherent problems in construction techniques. One of said techniques was to pressurize the tunnels during construction to hold back the earth and water. Long term exposure to this condition lead to long term health defects and sometimes death to the miners. The history of mining has created an image of the mine as a dark, dank, and dangerous place where men plunder the earth constantly at risk of cave in and

Fig. 3.10
Park Pobedy Escalator, Moscow





slowly chipping away at their health as they chip away at the walls around them.

The image of the mine affects the perception of deep underground architecture. The Moscow subway was built to double as a bomb shelter during the Second World War and the Cold War with tunnels as deep as 74 metres (or 24 storeys) below grade. These tunnels are accessible by endless escalators; on these long rides, riders are accompanied only by the sounds of the mechanized stairway, their thoughts, and perhaps the popping of their ears as air pressures change during the deep descent. The mine archetype, through association with deep underground descent, coupled with the physiological effects of changes in pressure, brings a perception of inherent danger in such a deep descent. The risk of cave-in, though unlikely, affects the perception of this architecture. It becomes a place one does not wish to reside for long periods of time. Riders are at the mercy of the surrounding structure's ability to hold back the masses of earth surrounding them as escape is unlikely at such a negative altitude.

Imagery of the deep descent into the mine, coupled with the actual physiological implications of deep descent underground, provide a perception of danger and risk in inhabiting deep underground architecture. This perception inhabits the riders of Moscow's deep subterranean Metro system. The further one descends into the earth, the more they sense the impending strength of the mass of earth which surrounds them and weighs upon the structure which they occupy.

Fig. 3.11
Basilia Cistern; overview, 6th century, located 500 feet southwest of Hagia Sofia, Istanbul, Turkey.

THE SEWER

Still another resemblance between Paris and the sea. As in the ocean, the diver may disappear there.
The transition was an unheard-of one. In the very heart of the city, Jean Valjean had escaped from the city, and, in the twinkling of an eye, in the time required to lift the cover and to replace it, he had passed from broad daylight to complete obscurity, from midday to midnight, from tumult to silence, from the whirlwind of thunders to the stagnation of the tomb, and, by a vicissitude far more tremendous even than that of the Rue Polonceau, from the most extreme peril to the most absolute obscurity.[11]

-Victor Hugo, Les Misérables

The underground galleries, organs of the large city, would function like those of the human body. Pure and fresh water, light, and heat would circulate beneath the urban skin like he diverse fluids whose movement and maintenance support life. Secretions would take place mysteriously and would maintain public health without troubling the good order of the city and without spoiling its exterior beauty.[12]

-Baron Haussmann

Fig. 3.12
The Cloaca Maxima, Rome

The Sewer archetype marks the advent of the technological environment





in the underground; sewage tunnels carry waste, distribute water, while also holding a network of dark, man-made passageways directly below urban streets. Cities now have an expansive subterranean counterpart which distributes services for public use made up of electrical cables, water distribution, sewer pipe, gas mains, transit tunnels, telephone and internet lines, fibre-optic cables and even roads underground. These networks of tunnels, pipes and wires now form the city's underbelly. The modern metropolis carries with it a doppelganger below its streets; here, the cogs which operate the machine of the city are hidden from view.

The cultural history of the sewer is rich and reaches as far back as Ancient Roman construction. Its history carries with it a cultural interest in these urban networks sometimes even in the form of tourism. The first sewage and water systems were developed by the Romans. They developed aqueducts which carried fresh water into the city into cisterns for storage, as well as sewage tunnels which drained waste into nearby rivers. The first of these sewers was called the Cloaca Maxima built in the sixth century BC. These systems were built to a monumental scale and many, though maybe no longer in use, are now tourist attractions to those impressed by the relative technological prowess of the Ancient Romans. The Underground Cistern, in Istanbul, is an example of an ancient piece of infrastructure which has now become a tourist attraction and even featured in a James Bond film. Paris houses one of the most renowned sewage systems. The Paris sewer system takes on the same fabric as the streets, acting as a sort of doppelganger below. As such, the Paris sewer system has taken a role as a hiding place in many stories, most notably, in Victor Hugo's *Les Misérables*.

Fig. 3.13
Rosedale Creek Sewer, Michael Cook, Vanishing Point

In *Les Misérables*, the main character, Jean Valjean, evades the war on the streets of the French Revolution by descending into the dark sewer. Sewers are often used as a hiding place for characters in novels and in film likely because of the potential for movement around the city and the ability to observe others in the secrecy of the shadowed sewers. As Valjean descends into the sewers in escape, Victor Hugo describes their damp squalor, but focuses on the palpable darkness of the Parisian sewer. The only inklings of light come from the few, and far between, grated openings. The rest of the tunnels are complete, all encompassing, blackness. Hugo's imagery of the sewer speaks to the underground as a dangerous place where only the refuse of society can find escape.

The archetype of the sewer has led to the perception of a technological nature for the underground coupled with potential for unknown inhabitants in the larger infrastructural spaces. A cultural interest into the infrastructural underbelly of cities can be seen in 'sewer tourism' and the image of the sewer employed as a setting for characters seeking some sort of refuge in literature and films.

Fig. 3.14
Walbrook/London Bridge Sewer, London, UK, 2008, from Undercity.org 'Guerrilla History & Urban Exploration'





3.2 MANIFESTATIONS IN THE CULTURAL WORLD

A PLACE OF HIDING

This subterranean world is populated with lost souls, marginal figures, 'people... who, for one reason or another... lack public approval and know they are not felt to be beneficial or useful... but as outcast, unworthy and contaminating. All people so constituted have a subterranean hue to their thoughts and actions; everything about them is paler than in those whose existence is touched by daylight.[13]

The perception of potential danger and inherent darkness of the underground has created cultural imagery of the underground as a place of hiding. History has seen several characters descend to the underground in hiding, both in narratives, and in reality: Mussolini in Italy, Nazis in occupied France and Stalin in Russia hid and held secret meetings in underground tunnels. Underground subway stations became a safe place for Londoners to hide during the World War Two bombings, bunkers were built in all major cities during the Cold War as a place to hide out during a potential nuclear attack. Recently, Muammar Gaddafi was found in the sewers while attempting to escape during Libya's violent uprising against his regime. In films and literature, the underground is used as a setting for characters seeking refuge from other characters or society where the underground is often their last resort.

Fig. 3.15
Film Still: Le Dernier Metro

Le Dernier Métro, directed by Francois Truffaut in 1980, tells the story of a woman, Marion, and her Jewish husband, Lucas, who own a theatre in Paris during Nazi Occupation. They hide him in a secret underground cellar beneath the theatre. He is confined to this room save for at night when he can ascend but only in total darkness so as not to alert Nazi watchmen. The Nazis enforced a strict curfew, so every night Marion turns out the lights and pretends to go home, but turns around and descends into her husband's underground hideout. The room is small and dank, accessible only from a small spiral staircase below a hidden trap door near the stage. Lucas is able to hear the rehearsals and development of a play through vents between the stage and his cell. Lucas feels imprisoned in the cellar but remains there to be close to his wife and his life's work. In the cellar, Lucas is cut off from almost all human contact. He lives in a room which had originally stored old set pieces, cast-offs from the theatre, and these still litter the corners of the room. The film portrays a man who has resorted to living underground as a last resort; he deals with the burden of hearing and watching life continue at grade while he is cut off below.

Fig. 3.16
Film Still: Le Dernier Metro

The Third Man, written by Graham Greene and directed by Carol Reed,



Fig. 3.17
Flm Still: The Third Man. Harry Lime on the run in the sewer tunnels, caught in the glow of police search lights

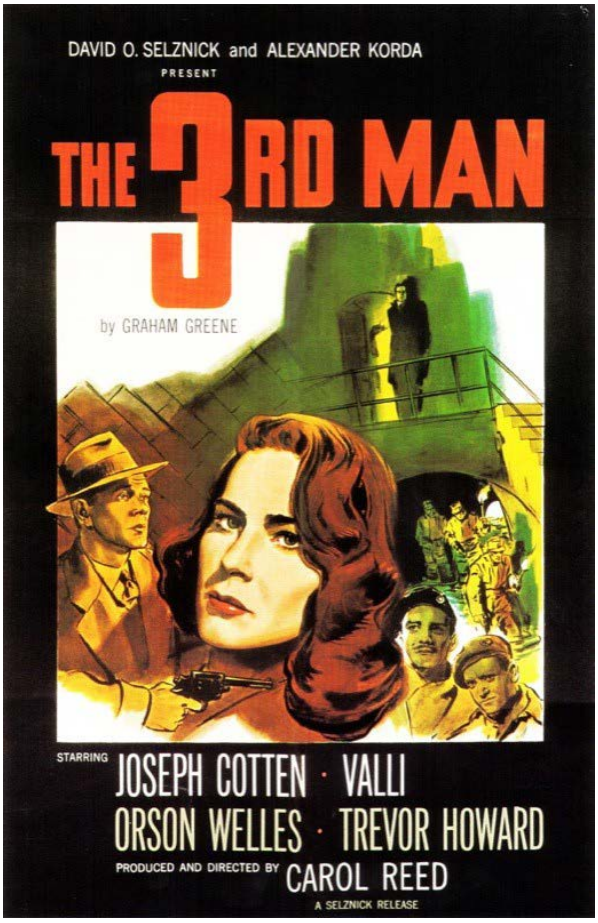


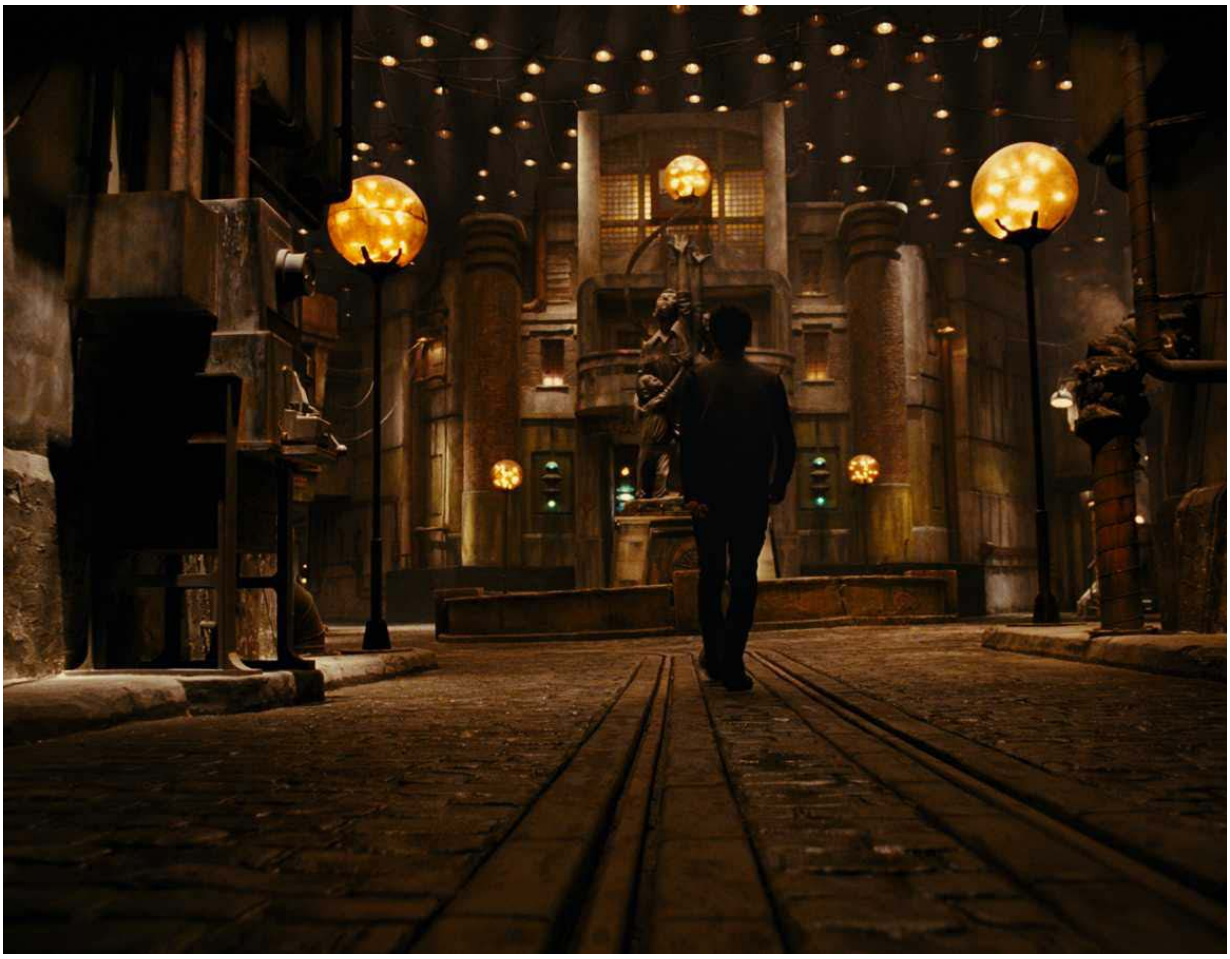
Fig. 3.18
Original Poster Art for The Third Man theatrical release

is the story of a supposed dead man hiding in the sewers of Austria. The main character, Holly Martin, an author, goes to Vienna to take a job offered by his friend Harry Lime. When he gets there, he finds that Lime was allegedly struck and killed by a truck just a couple of days earlier. Police contact Martin for questioning and tell him that Lime was a racketeer heavily involved in the city's crime ring. They are investigating his death to learn more about the ring. With the help of Lime's lover, Martin looks further into his friend's death to find that it was staged and Lime is hiding in the sewers with the rats. Martin helps the police catch his friend who he has learned is a criminal. The movie ends with a chase scene in the underground. Lime had maintained an upper hand before in his seemingly extensive knowledge of the city's underground network. But when the police become aware of his whereabouts they use their manpower to block off all access points. The very sewer tunnels where Lime once sought refuge become a trap. He is cornered and shot. The image of a dark figure in the endless brick vaulted sewer tunnel is definitive of the film and imagery of protection in a city's sewer system.

Finally, we find a character hiding in a city's underground in order to evade a society in which they do not belong in the story in *The Phantom of the Opera*, written in 1909 by Gaston Leroux. Leroux tells the story of the Phantom of the Paris Opera House. The Phantom is drawn to the Opera house with his own beautiful voice and love of music. The Phantom hides his disfigurement from a malicious society by living in underground basements and sewers. But the Phantom, Erik, becomes mentally unstable living alone underground for so long. He blackmails the Opera to have Christine, a chorus girl who Erik has fallen in love with, sing the lead in Faust. When the Opera disobeys his wishes he drops a giant chandelier onto the stage and kidnaps Christine, hoping to make her fall in love with him. As one of the architects of the building, Erik holds a special knowledge of the bowels of the building. He builds traps to kill anyone who comes down looking for him. His underground realm becomes the headquarters of a mad man who has been corrupted by and taken refuge from an inconsiderate society. Those looking to save Christine do so at risk of peril. The underground in this narrative is a place of great danger where one must be constantly at alert for it is the resting place of an unsound mind.

The subterranean realm is a last resort for characters looking for invisibility and protection from society and its dangers above ground. *Le Dernier Métro's* underground cell holds a man escaping the Nazis in occupied Paris. Harry Lime, in *The Third Man*, is a 'dead man' on the run from the police living in secret in the sewer tunnels of Vienna. Erik, in *The Phantom of the Opera*, seeks refuge in the underground sewers and basements from a society where he does not belong. These narratives reinforce a perception of the underground potentially holding an adverse society of those refused from living above ground.





A NEW HUMAN HABITAT

Subterranean surroundings, whether real or imaginary, furnish a model of an artificial environment from which nature has been effectively banished. Human beings who live underground must use mechanical devices to provide the necessities of life: food, light, even air. Nature provides only space. The underworld setting therefore takes to an extreme the displacement of the natural environment by a technological one.[14]

Science Fiction authors have considered the possibility and repercussions of humanity choosing to leave the surface of the earth or being forced off of it and made to settle in an underground realm. Many of these narratives are spurned on by the possibility of humanity having to evade an ecological or military disaster. These underground settings represent a technological environment, devoid of nature. Humans must survive through the maintenance of technological means.

Fig. 3.19
Film Still: City of Ember

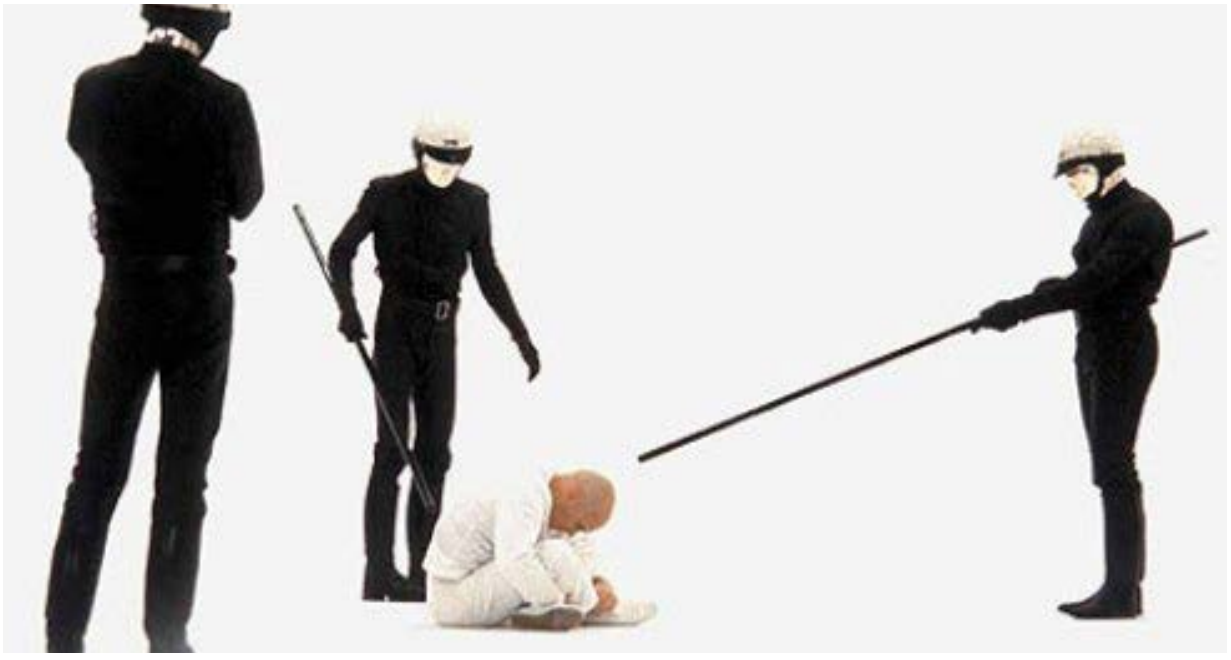
H.G. Wells wrote *The Time Machine* in 1895, as a warning that a highly technological environment could insulate humankind from nature's hazards to a point where they would cease to develop and adapt in a positive way. The book describes the adventure of the Time Traveller. The Time Traveller travels to the year AD 802,701. There he meets the Eloi, a group of small, childlike adults who appear to be the result of humanity conquering nature with technology and evolving to adapt to an environment in which strength and intelligence are no longer required for survival. When he returns to his Time Machine, he finds that it is stolen. He is then assaulted by the Morlocks, a group of ape-like troglodytes who live underground and come to the surface only in the darkness of night. Underground, the Morlocks operate the machinery necessary to sustain life on the surface which they maintain in order to maintain the survival of the Eloi, their main food source. The Morlocks are a descendent of humanity which has taken to the underground in a long term adaptation into a technological world. With the advent of technology, they no longer need nature to survive, even maintaining the health of their food source through technological means. *The Time Machine* speaks to a consequence of moving underground: a completely technological environment.

The City of Ember centers on a young girl living in an underground city. Ember holds a society which has been living underground for hundreds of years, appearing to forget that a surface of the earth even exists. The story and adventure of the girl is spurred by the city's ongoing depletion of resources and irreparable state of infrastructure. The girl finds what appears to be a map out of the city. Goaded by a governing body which is hoarding large stocks of the leftover food, the girl and a friend follow the map looking for a better world. *The City of Ember* uses the underground to add to the image of a city which is in peril due to its

Fig. 3.20
Film Still: City of Ember







being completely segregated in darkness. The city's place underground recalls the imagery from Plato's Allegory of the Cave. Society is kept 'in the dark', it is only upon reaching the surface of the earth is basking in the glow of the sun that the characters come to realize the terrible conditions in which they were living. The earth above is portrayed as a sort of utopia filled with brilliant light and nature as opposed to the dark, damp and muddy underground city where people fear the artificial lights going out forever.

THX 1138, directed by George Lucas in 1971, describes an underground environment devoid of nature which uses technology to control its inhabitants. The main character, THX, lives in a futuristic society which regularly drugs its inhabitants in order to maintain their compliance and allow them to conduct dangerous tasks calmly over long periods of time. In a technologized environment, humans become a part of the machine. Man becomes inseparable from machine; biological necessity becomes a weakness. THX decides to escape. He ends up being chased down an endless underground road tunnel. Eventually finding a ventilation shaft, THX begins a long vertical climb. When he reaches an opening, the film watcher realizes the city had been entirely underground the entire time as he stands in front of a large orange setting sun. The over saturated image is in complete contrast with the setting of the rest of the film. The underground city had been devoid of colour, its people all wearing white and the police wearing black. The imagery here recalls Plato's Allegory of the Cave much more distinctly. His perception underground of what life should be and his place in the world was completely skewed. Upon exiting the underground world, THX is able to realize his potential, he can take his freedom.

The novels and films given above are a result of a perception of the underground as a potential avenue for human occupation inevitably leading to a detrimental shift in society. The underground condition of these settlements has the limiting quality of being in complete separation from nature. The Morlocks lose their humanity by their descent underground to a technological realm. The citizens of the City of Ember's survival rests on the upkeep of dying infrastructure and depleting food reserves, ultimately leading to the death of society when resources eventually run dry. THX's underground city keeps him in the dark, in a technological world he is unable to fend for himself and is forced to succumb to its controls. While underground construction and habitation is possible, these narratives point out a perception in our cultural world that it is not a possible long term habitation option.

Fig. 3.21 - 3.23
Film Stills from THX 1138





A FANTASTICAL REALM

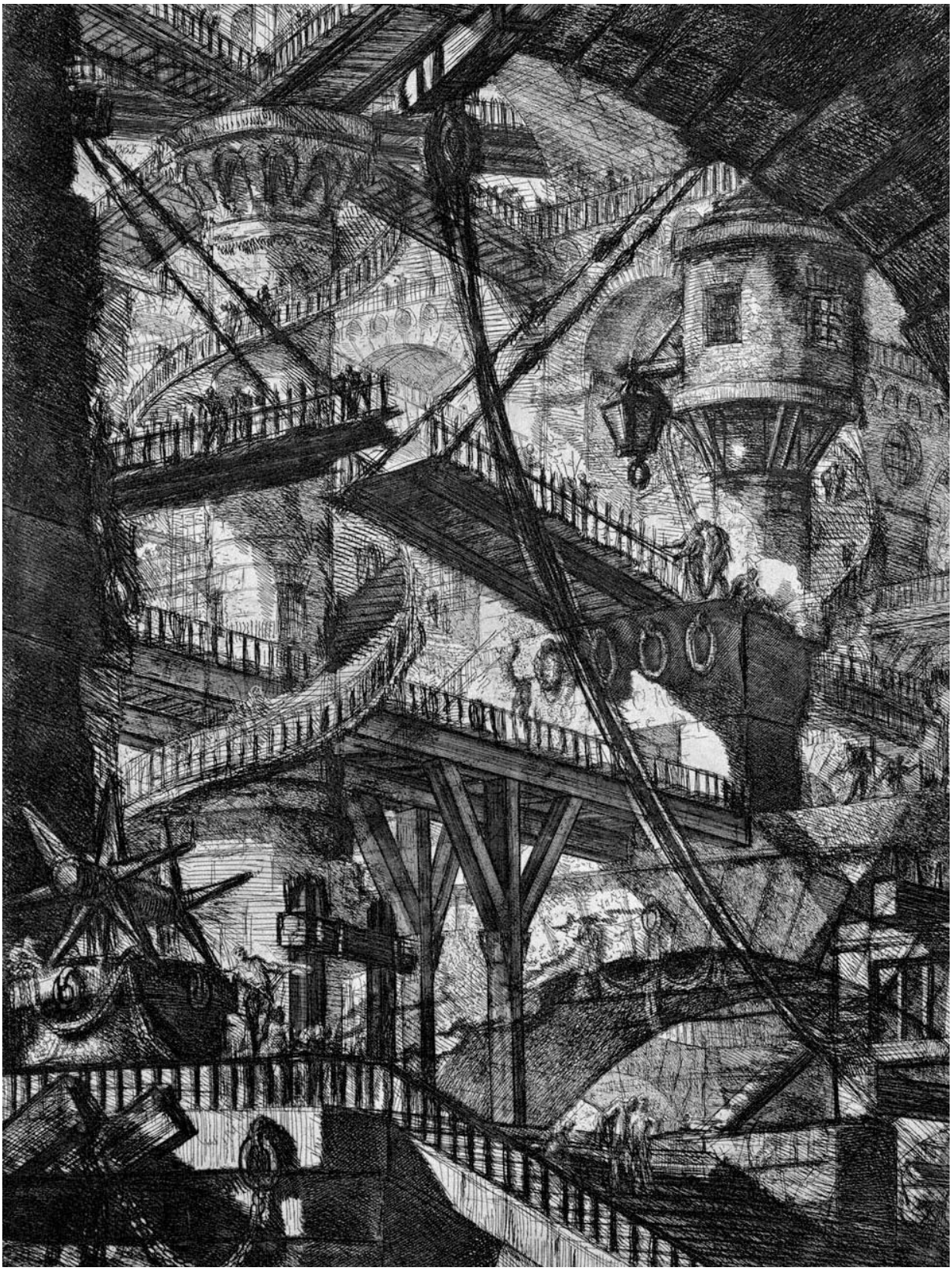
The descent into the subterranean realm has often been used as a portal to the fantastical. The following films, *Pan's Labyrinth* and Fritz Lang's *Metropolis*, use the transition between above and below grade as a portal to a new realm. In the case of P*an's Labyrinth*, this new realm is magical and full of potential, in *Metropolis* it is a dark underworld where the repressed lower classes work themselves to death. Piranesi's *Carceri* series likens the descent into the underworld to the descent into the dreamed realm, a descent deep into the psyche. Finally, *Roden Crater Project*, the life project of artist James Turrell uses the portal into the earth as a method of silencing all stimuli signalling the entrance into a different kind of space. These cultural responses to the underground adds a hint of mystery and magic to the perception of underground spaces and signal the potential power of the transition space along the grade line.

Fig. 3.24
Film Still: Pan's Labyrinth

The film *Pan's Labyrinth*, directed by Guillermo Del Toro in 2006, uses a fantastical underworld as a foil to a young girl's increasingly traumatic reality. The story is set in 1944 in Post-Civil War Spain. The young girl, Ofelia, is travelling to move in with Captain Vidal, her pregnant mother's new husband. One night, a large stick insect comes to her room, turns into a fairy and leads into a forest and down stone stairs to an ancient labyrinth nearby. There, she is met by a faun who tells her she is Princess Moanna of the underworld. Vidal's cruel nature becomes apparent as we see him brutally kill several Spanish rebels. Ofelia repeatedly escapes to her underworld retreat. Here, she finds refuge in overcoming dreamed obstacles involving magical creatures. In the final scene of the film, after the climax of her terror, Ofelia is transported to the beautiful Underworld where her parents, the King and Queen of the Underworld, await her. It is a glowing, golden realm, a foil to the dark, blue-toned settings of the rest of the film. Ofelia's underworld is a mystical realm where she can escape the hardship of her life. The young girl's innocence is saved by her love of fairy-tale and her underworld retreat.

The relationship between a proletariat underworld and bourgeois towers in the sky in *Metropolis*, directed by Fritz Lang in 1927, is used to tell a socio-political message. *Metropolis* tells the story of an over-privileged bourgeoisie exploiting the oppressed proletariat. The settings used are exaggerated into fantastical realms to convey the opposite natures of the two worlds. The proletariat descend as groups wearing the same dark uniform down a long elevator ride into the underworld similar to the elevator in a mining shaft. There they work and feed the machine which powers the towers in the sky. The underworld is filled with massive machinery which takes on demonic form. Men are thrown into a large central demonic looking machine which appears to literally eat the men as its energy supply. The environment is large and cavernous. A woman gathers the men together in a cave-like room looking to excite them

Fig. 3.25
Film Still: Metropolis



into revolting against their oppressors. Here, the underworld is a dangerous realm where men are forced to into slavery and inevitable death in order to maintain the living conditions of an upper class living in the sky.

Piranesi's *Carceri* series describes a dreamed prison-like underworld. He draws an underworld built of monumental stone structures in maze like compositions. The structures are filled with dark figures which appear haunting, ominous. The light source appears to be coming from within, signalling that this realm is not of this world. The images are of dreams of prisons and torture chambers in a hellish nightmare. These drawings connect the underworld to its origin: the psyche. Piranesi, an architect by trade, saw a hell defined by its heavy, dark, and massive architectural features. In 'Drawbridges' we see a scene filled with multiple bridges, staircases, and drawbridges in a chaotic composition which doesn't appear to move anywhere but up towards an unknown light source. The scene also contains sharp, unknown machinery operated by dark figures. This machinery and the architectural features take on a scale beyond human cognition: a clue to the fantastical nature of the imagery. Piranesi's *Carceri* series underworld takes on the form of a dreamed dark, mystical, prison.

James Turrell's *'Roden Crater Project'* creates an underground space which is designed to connect the visitor to the magical abilities of their sensory system. The California artist has devoted 30 years of his life to this amazing piece of art and architecture built inside an extinct volcanic crater in northeast Arizona. It consists of a number of subterranean rooms connected by tunnels. These rooms are arranged so as to receive light, day and night, in order to present it in ways the artist has developed in his famous light installations. Several rooms also contain apertures orienting toward a specific part of the sky where a particular solar, lunar, or stellar phenomenon has occurred.[15] The massive amounts of soil which surround underground architecture have the ability to deaden any outside sound and light; and so, in the underground space, Turrell is able to have complete control over stimuli to the senses. The descent into the crater acts as a dark portal into a new world where the senses are first deadened and then assaulted with unbelievable sensory experience. *The visual and aural, and more generally sensory, stimuli in the place are so intense that you just have to yield to them, so as to awaken the more instinctive, animal side of your seeing and feeling.*[16] Turrell is especially interested in creating a tactile light: the idea that light can be synaesthetically transformed into something which can be almost touched and felt. Visitors to Roden Crater enter a fantastical realm created through the careful manipulation of their own sensory system.

Our cultural world is filled with images of fantastical realms which are sometimes accessed through the transition to the underground going back as far as mythical depictions of the underworld or hell. The imagery present in these cultural manifestations can lead to a perception of underground spaces with the weight of a mystical nature to them.

Fig. 3.26
'Drawbridges' Carceri d'Invenzione Print series, Piranesi

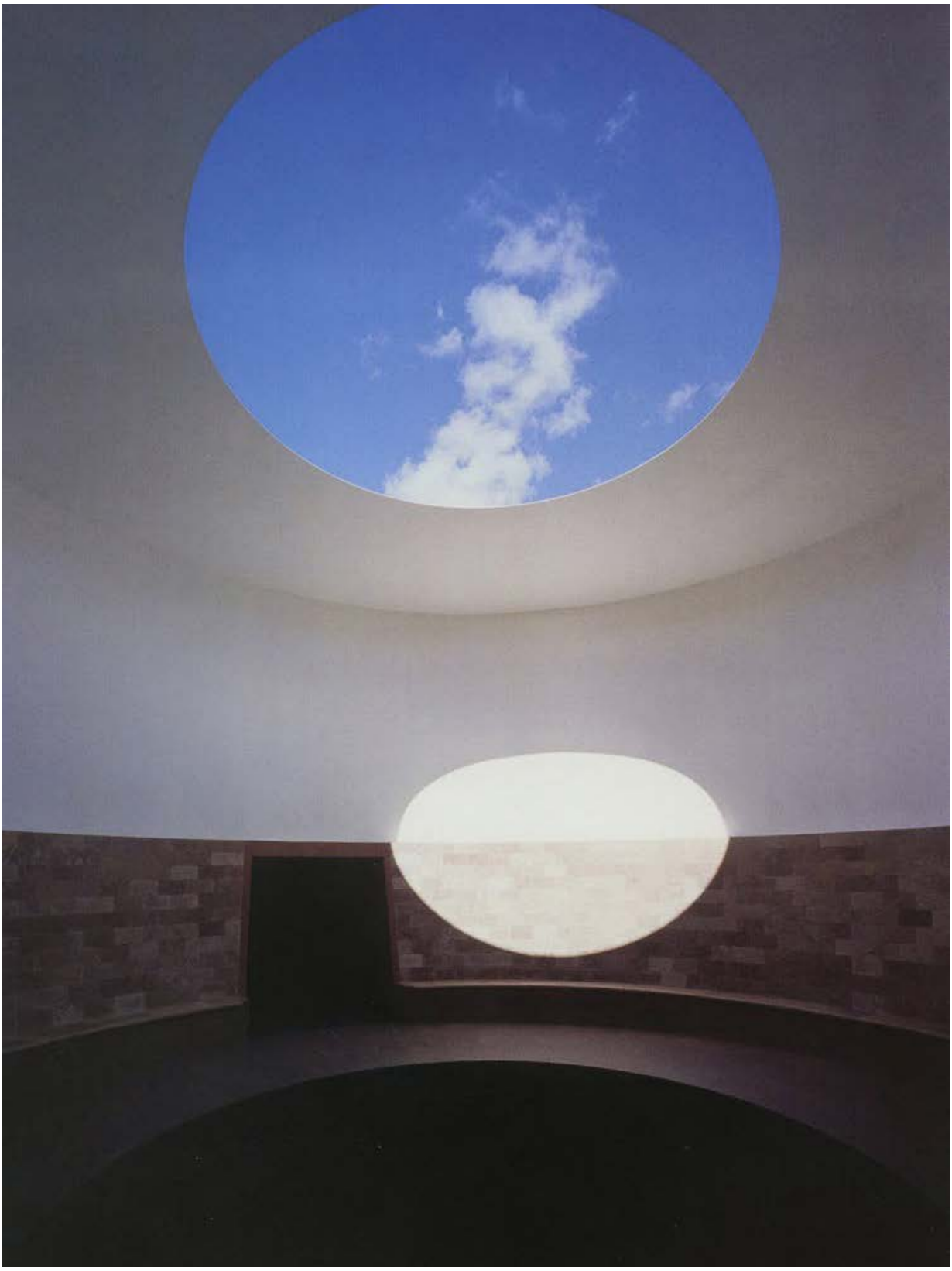




Fig. 3.28 - 3.29
(Clockwise from top left) 'Roden Crater Project' by James Turrell Alpha Tunnel Looking West Photo: Florian Holzherr; Alpha Tunnel Looking East Photo: Florian Holzherr; complete site plan

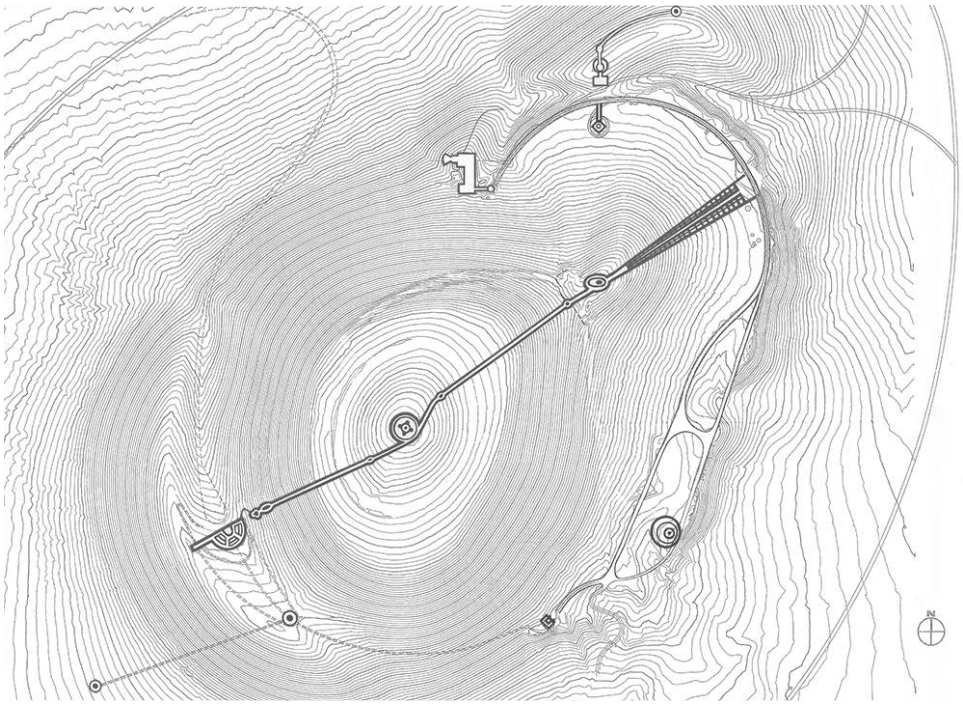
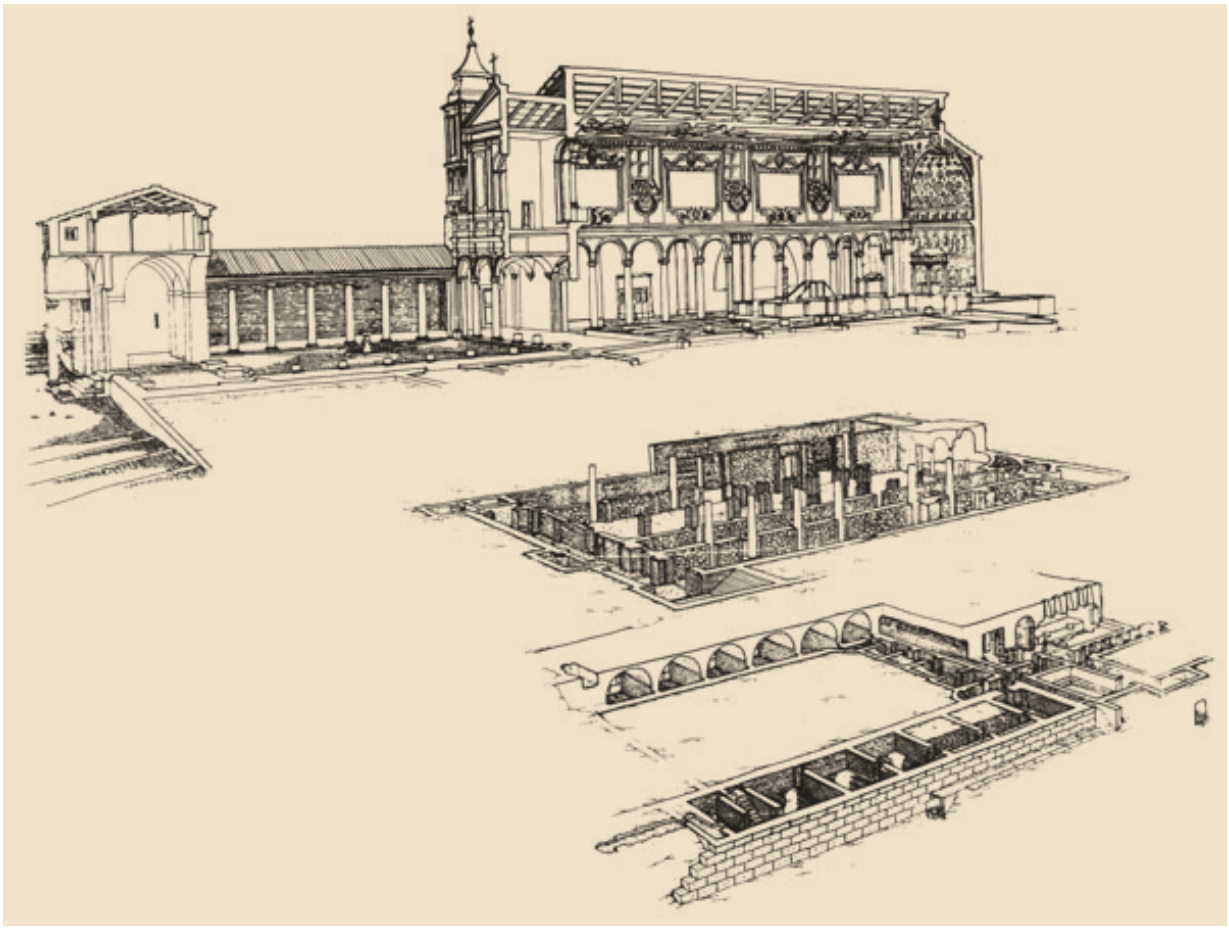


Fig. 3.27
Crater's Eye - 'Roden Crater Project' by James Turrell





3.3 THE UNDERGROUND CITY

ROME, ITALY

Less well known […] is Rome's underground realm of marble columns, early brick apartment buildings, and plaster walls frescoed with colourful scenes of ancient gods.
… Just as on the busy streets above, the past and present intersect everywhere underground.[17]

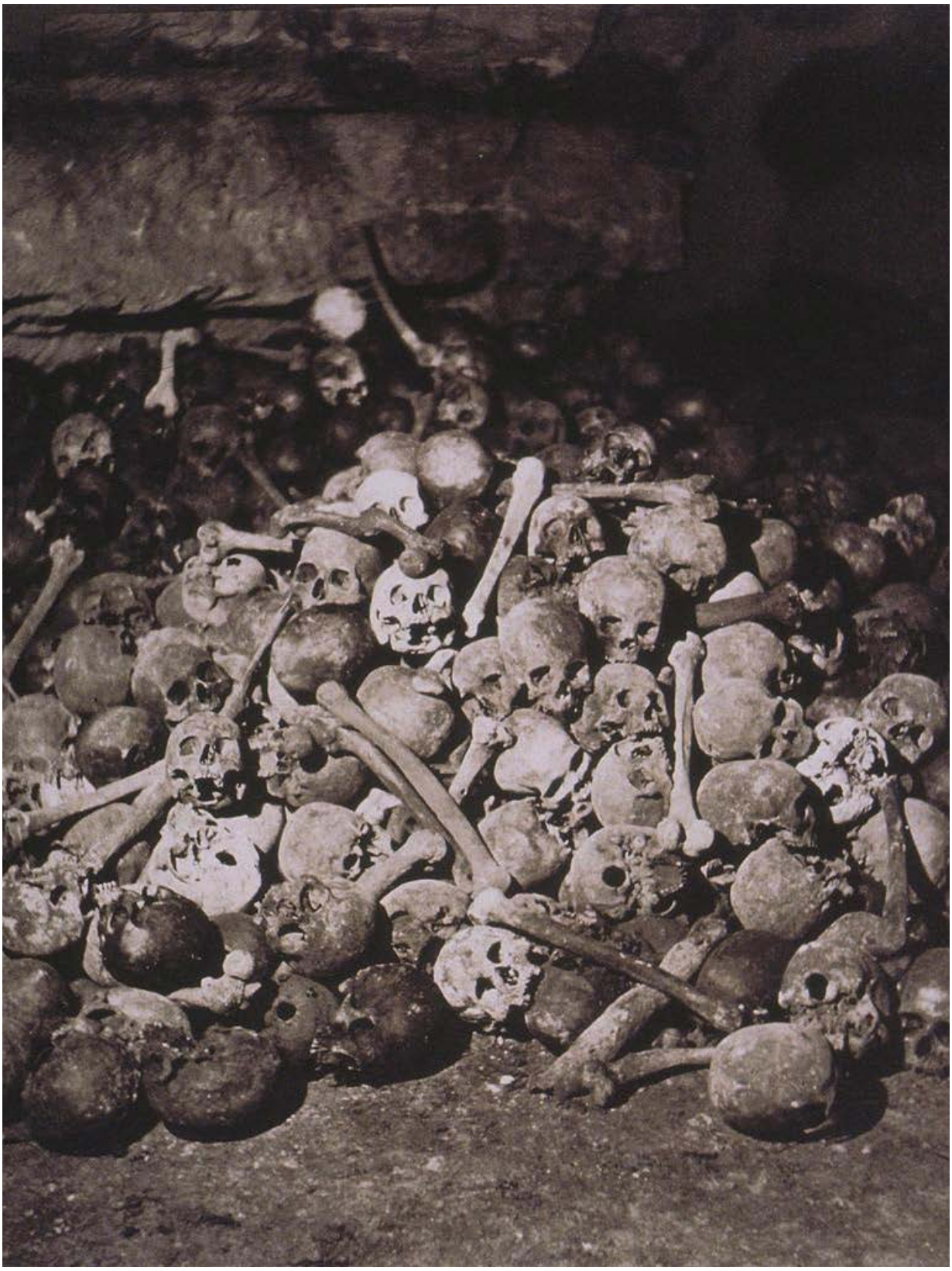
Below the streets and buildings of Rome lie the leftovers of an ancient city preserved in the earth. Since its founding in 753BC, through flooding, the rubble left from buildings destroyed in fire or war, and through the general accumulation of dirt and human debris, Rome has risen in elevation from thirty to fifty feet.[18] Underground, there is a labyrinth of archaeological finds: ancient apartment buildings, mithraic temples, Christian burial catacombs, and more. The density of the underground city and the Western cultural interest in the preservation of historic structures has led to difficulties in modern construction of buildings and underground infrastructural systems.

Fig. 3.30
San Clemente levels: mithraic temple, 4th century basilica, 12th century basilica

All over the city are access points into the underground labyrinth. These tunnels are explored by underground enthusiasts, archaeologists, as well as the military for defense purposes. The underground tunnels of Rome were used by Mussolini during the Second World War as a hiding place and for secret meetings. By digging down, one can see the change in architectural types and grade levels over thousands of years. One phenomenon which has allowed historians to see change over time is the construction of churches and religious institutions directly over the previous ones. San Clemente is an example where this has occurred. It began as a public building destroyed in Emperor Nero's fire of AD 64, a mithraic temple was built over the site in the first century; in the fourth century a basilica was built over the temple, and in the twelfth century another basilica was built over that. Ancient infrastructural structures can be found as well such as cisterns from the water distribution systems, and the Cloaca Maxima, which was the first sewer in history. These examples are just a glimpse at what has accumulated below grade as the city ages and grows in density.

Fig. 3.31
Rome: Mithraeum beneath S. Prisca: view of wall pantings

Construction in the historic city of Rome has many challenges and the interest in preservation of ancient structures is among them. Unlike most cities, Rome is unable to prepare a complete mapping of its underground city because of the vast amount of ancient structures and artefacts to be found. During excavation for new buildings they often find more structures preserved in the earth. Upon finding these structures, construction must come to a halt. The



ancient structures must be analyzed by an engineer to see if they will support the new building above, or the foundations for the new building must be moved in order to not put any stress on the old. Building infrastructural tunnels, especially transit tunnels, becomes even more difficult. The city's first subway line opened in 1955 and currently has two lines, with a third line under construction. The current network is 41.5 km long and covers the city in an X shape. The third line began construction in the 1980's, but the projected completion date has been delayed several times. While the metro tunnel itself can run deep enough not to hit any artefacts from the ancient city, the excavation for stairways and air vents which require a connection to the surface often run into difficulties. Rome's rich historic underground city creates even more problems for building in the modern city.

Over the almost three thousand years of Rome's lifespan there have been layers upon layers of history built and left behind in the city. The modern city holds a magnificent palimpsest of cultural artefacts both above and below ground. This creates a wonderfully intricate and intriguing city for the resident and visitor but also causes problems in new construction and the modernization of the city's infrastructure.

PARIS, FRANCE

Kings and emperors stepped into small boats that ran through the underground waterways to marvel at the tunnels. Engineers and politicians journeyed into Paris and returned home ready to transform their own cities.
… Paris's modern sewer system, which snakes beneath the sprawling city for more than 1000 miles, has expanded far beyond Haussmann's original canals, but his canals remain in use.[19]

Paris is a city with medieval origins and a modern, continuously updated, underground infrastructural network. Paris's underground is made up of a beautiful systematic sewage infrastructure, a comprehensive metro network, catacombs storing the bones of deceased Parisians hundreds of years old, and leftover cavities from the extensive mining of limestone and plaster in the city. The city's underground holds both a highly efficient infrastructure which moves both people and services around the city as well as very evocative and potentially dangerous forbidden underground spaces.

Under a Monarchic government, a massive comprehensive sewer and service system was able to be built in Paris. The first sewer was built as far back as the reign of Louis XIV: a ring sewer on the right bank; but the first vaulted sewer was built under Napoleon I. Still, populates of the city had to fetch their water

Fig. 3.32
Paris Catacombs, Nadar, Felix, 1820-1910




FIN DU TROTTOIR ROULANT
A 4 METRES

from the Seine and illness was widespread due to filth in the drinking water. In 1855, Napoleon III ordered the construction of new boulevards, aqueducts and sewers designed by Baron Haussmann and engineer Eugène Belgrand. The system was 600 km long by 1878 and continues to grow running directly below all major streets. The sewer tunnels are structured by vaulted brick; they carry a stream of sewage along the bottom with walkways on either side for inspection and maintenance. Drinking water is moved through pipes hung from the ceiling of the tunnel. Since the original construction more modern services have been added to the tunnels; they now carry telegraphs, telephones, electricity, pneumatic tubes, and fibre-optic cables. Paris's underground infrastructure system was and is a beautiful feat of engineering. Since its conception it has been a tourist destination, served by 'Le Musée des Égouts de Paris', or the 'Paris Sewer Museum.'

Fig. 3.33
Smoking Crack in the metro, by Thomas Dworzak, 2000, photograph

Paris's sewage system is not the only part of its underground which has seen interest and occupation. The city has a group of people who identify themselves as 'cataphiles'. Cataphiles descend for hours or days into the large network of tunnels leftover from mining, secret underground spaces used as hiding places during the Second World War, and catacombs. Their actions are highly illegal and dangerous to their own well-being; the police are constantly on the lookout for these renegades, gaining the nickname of 'catacops'. It is rumoured the French government has a map of the city's underground but keeps it highly secret due to fears of terrorists using the underground city in a coup d'état. The cataphiles get their name from the Catacombs of Paris. In 1785, Louis XVI ordered the Cemetery of the Innocents cleaned out and the contents put into abandoned limestone quarries just outside the city. "The labourers inside the long tunnels, with priests at their side to bless their acts, stacked bones in rows with aisles in between. On either side of these narrow aisles, the bones were stacked in piles from ten to a hundred feet deep. Facing the aisles, along the walkways, the stacks of bones were held back by walls made of skulls and femurs set in decorative patterns."[20] These graves hold the bones of around six million Parisians who died hundreds of years ago; this is more than double the city's current population of 2.6 million. Like the city's sewer system, the catacombs have become a tourist destination. It attracts people interested in the underground experience, the direct connection of underground earth to the graves of the dead. The French government keeps the Parisian underground city strictly 'under wraps'. These spaces, with strict historical ties, are ventured into only by guided tours or by the city's renegade cataphile group.

Fig. 3.34
Metro Station Chatelet-Les Halles, by Raymond Depardon, 1991, photograph

Paris has a modern, publicly designed and controlled underground with a rich connection to cultural history and interest in the mystery of its subterranean realm. The underground infrastructure caters to the dense living and working population in the city, providing clean water, electricity, telephone, internet, waste disposal, and modern transit services. The underbelly of the underground, highly policed, offers mystery, adventure and danger directly below the city streets.





NEW YORK CITY, USA

New York as we know it could not exist without the subway. ... A different New York would be here without it… You can't have the density of New York without the subway.[21]

Robert Olmstead, a former planning director of the city's metropolitan Transportation Authority

The subway entrance is a rift, a scar in the tissue of the city. It is the absence of a core sample, a seam where air enters and escapes- it is a breathing mouth. The veins and arteries of the New York subway system lie beneath the skin of the city, their vibrations pushing air through grates, providing warmth for the homeless and collapsing the length of the island into a matrix of excavations.[22]

New York City is the densest city in the United States; as such, real estate is incredibly valuable and limited, and a huge amount of infrastructure is required to provide services and transit to its inhabitants. The underground of the five boroughs of New York City is dense with infrastructural pipes, tunnels, and cables which allows for the density of people above ground. These invisible places are massive in size. They have seduced artists with their sublime nature and become a secret hideaway for the makeshift shelters of the city's homeless.

Fig. 3.35
East European couple sleeping in subway, by Richard Kalvar, 1973

New York City is made up of five boroughs: the Bronx, Brooklyn, Manhattan, Queens and Staten Island. The combined population of those five boroughs in 2012 was over 8.3 million people over a combined 783.8 square kilometer of land. Manhattan, the island, is the densest part of the city with a density of 25,846 people per square kilometer. Manhattan is the city's employment hub fed by the surrounding boroughs and towns, as well its tourist center seeing 52.7 million tourists in 2012 alone.[23] Under the streets of New York is a massive amount of infrastructure needed to sustain this density: the Holland, Lincoln, Midtown, and Brooklyn-Battery Tunnels carry cars between Manhattan and the boroughs, there are 90,000 miles of electrical cables and conduits, 600 miles of gas mains, tens of thousands of miles of telephone cables, water and sewer pipe, 100 miles of high-pressure steam pipes which supply heat to older homes, a growing number of fibre-optic cables, and three massive tunnels carrying water into the city from the Catskill Mountains (the older two are eighteen feet in diameter, and the third is a relief line twenty four feet in diameter).[24] Every day, the city's renowned subway system strains to carry the millions of passengers who rely on it to move around. According to 2007 census results, the 54.7% of the city's workers used transit in their daily commute. The Metropolitan Transportation Authority documented an annual ridership of over 2.6 billion, with the average weekday ridership at over 8.5 million. All infrastructural tunnels need to be large enough to be inspected and maintained, thus there are large tunnels which are usually unoccupied forming a great maze of tunnels below the earth.

Fig. 3.36
USA. New York City. 1973. Subway. by Rene Burri, 1973





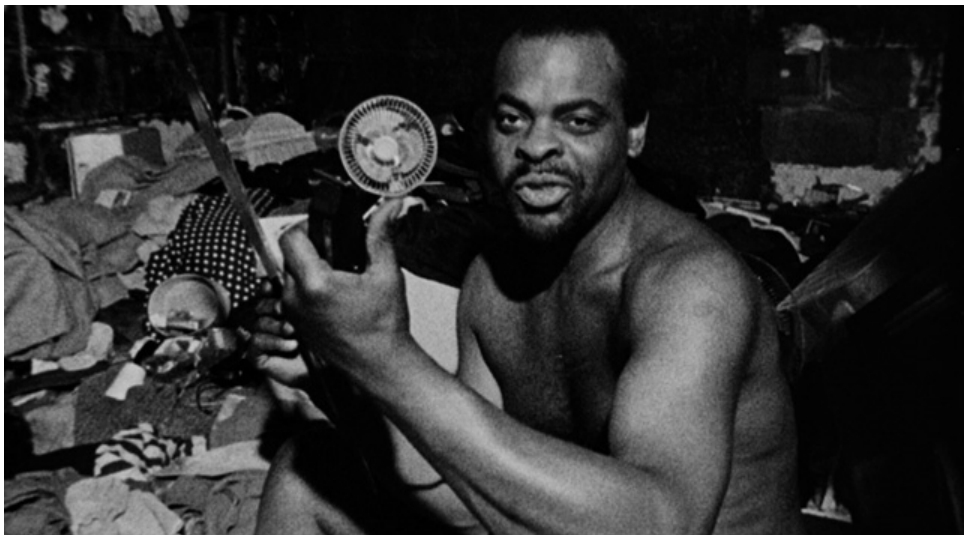


Fig. 3.39
Film Still: Dark Days

Fig. 3.37
'City Tunnel No. 3. Brooklyn, New York. 1998' from *Waterworks* (Plate 80), Photograph by Stanley Greenberg

These tunnels have become a subject of interest for artists and underground enthusiasts, as well as a protective hiding place for some of the city's homeless. Stanley Greenberg is an artist who photographs New York's uninhabited infrastructural tunnels, calling them 'Invisible New York' in the title of his 1998 published collection. Greenberg was given the opportunity to photograph the city's third water tunnel while under construction. He describes his experience: "… I had to wear a rain suit, steel-tipped boots, hardhat, ear and eye protection, and an oxygen cartridge. I then descended in the elevator (the "cage") about eight hundred feet, the light gradually disappearing until I reached the bottom."[25] We see in his description the massive scale of these hidden man-made structures. Despite the physiologically unpleasant conditions, these spaces have a sublime quality portrayed in print. New York's infrastructural spaces have also become a protective hideout for some of the city's homeless. A settlement of people living in a commuter train tunnel was documented in the 1994 documentary 'Dark Days' directed and produced by the filmmaker Marc Singer who lived with the group while filming. They argue that the underground spaces, while virtually devoid of sunlight and very dangerous (two people had died in the year the documentary was filmed: one from freezing to death, the other hit by a train), are safer than shelters. One of the main characters says at the beginning of the film: "You'd be surprised what the human mind and the human body can adjust to."[26]

New York City's underground contains a vast hidden landscape of infrastructural tunnels required to sustain the huge density of people living above ground. The monumental scale has a sublime quality, made all the more intriguing in that it was built by and for people. But this network also contains protected pockets where invisible members of the city can seek refuge.

Fig. 3.38
'City Tunnel No. 3. Queens, New York, 1997.' from *Waterworks* (Plate 79), Photograph by Stanley Greenberg

CONCLUSION

Imagery associated with the underground presents a cultural depiction of a place of danger, darkness, and death but also a place of magic, protection, and fertility. This imagery impacts the perception and approach to design of underground spaces. The archetypes studied: the underworld, the cave, the mine and the sewer; are identified as basic imagery associated with the underground. We readily perceive underground space with these images in mind: descending into the mine in Moscow's subway, and feeling the protection of the cave in Philip Johnson's underground art gallery. The perceptive impact of underground imagery is manifested in art, literature and film. The themes studied: the underground as a hiding place, the underground as a potential human habitat and the underground as a fantastical realm; pick up cues from imagery but also begin to speak to the physiological reaction to descending underground, particularly in conceptions of humanity moving underground and away from the sun. Cities and their underground counterparts are, of course, affected by our cultural values and imagery, as well as our cultural and biological functional necessities. These impacts were explored in the case studies of Rome, Paris, and New York. Each has rich cultural connotations and contexts as well as infrastructural requirements which, together, establish the forms of their underground cities as well as the role of the underground in their urban form. By exploring the meaning of the underground, the architect can ground their work in the cultural continuum of the city. An underground rapid transit station becomes more than a functional piece of infrastructure to get from one place to another. It is a creation of a self-made world, a product of the functional needs of the Western city as well as the cultural associations with the underworld.

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UNDERGROUND ARCHITECTURE

PART FOUR

Introduction

4.1 TRANSIT STATION DESIGN

Canary Wharf Tube Station
Metro Bilbao Underground Stations
Alameda Station
Lille Europe Station
Stockholm Metro Underground Stations
Eglinton West Station

4.2 COLLECTIVE SPACE

The Low Line Park
Temppeliaukio Church
Le Carrousel du Louvre
Toronto PATH
RÉSO: Montreal's 'Underground City'

Conclusion

INTRODUCTION

Architectural structures are simultaneously utilitarian constructions for specific purposes, and spatial and material images of our being-in-the-world. They are lived metaphors, that mediate between the world and the human realm of life, immensity and intimacy, past and present.[1]

-Juhani Pallasmaa

Phenomenologist Maurice Merleau-Ponty, author of Phenomenology of Perception, said "… there is no inner man, man is in the world, and only in the world does he know himself."[2] Architecture, as the form of our man-made setting, is a key to understanding how we see ourselves and our relationship with the world. This section will present several precedent studies selected to provide examples of how the cultural associations with the underground combined with their functional requirements can inspire the forms of built architectures.

Practically speaking, modern underground construction is considerably more difficult than typical built up construction. The first difficulty is the expense of moving large amounts of earth; drilling bedrock is even more expensive. The structural loads enacted by earth pressing on all sides require larger scaled structures; often, concrete is used as the foundation structural system for its mass and moisture/air barrier characteristics. In a space cut off from the sun and natural ventilation providing expected comfort levels requires intelligent environmental control design. The sun and wind above ground also provide directional markers. Without them, underground navigation becomes difficult. A common underground program is an intermodal transit station. This program magnifies the inherent issues with navigation underground as these buildings must be capable of moving large, concentrated volumes of people through them. The design of efficient circulation systems is both difficult and crucial. Lastly, the at-grade presence of an underground building must be considered. This is the access point for the building and often the only source of natural light. Access points must also provide proper egress for the building, and so, must be spaced and given volume to suit occupancy requirements. Most of these practical issues exist in built-up construction but are amplified below ground.

Fig. 4.1
opposite full-page image: Canary Wharf Station, concrete structure opens up to domed glass entrance

On top of the practical issues associated with underground design are the psychological issues associated with the underground. The negative affect on perception of underground architecture is inferred by a cultural repulsion

of dirt and decay. There are several common phobias associated with the underground: rupophobia, fear of dirt; taphophoia, fear of being buried alive; and claustrophobia, fear of having no escape and being in closed or small rooms (often experienced in windowless rooms). This culturally common fear creates a subconscious (or potentially conscious) hesitance to descent into the earth. However, with the advent of technologies which can better control the provision of comfort levels and the growing cultural realization of the importance of the underground city in the urban realm, there is a growing appreciation for the poetic possibilities in subterranean architectural design. The following precedents are expressions of these possibilities. Their conceptual motifs work with practical requirements to create a beautiful architecture evocative of the underground.

4.1 TRANSIT STATION DESIGN

CANARY WHARF TUBE STATION

Architect: Foster and Partners, London
Engineer: Ove Arup & Partners
Location: London, Great Britain
Construction: 1998
Depth: 27 metres
Average Ridership per weekday: 168,000 total entries and exits (2012)

I strongly believe in a future in which boundaries between various disciplines disappear. A quest for the integration of architecture and engineering can, for example, lead ultimately to the realisation of places that are very special because of their underground conditions, places that could never be confused with space in buildings above ground.[3]

Norman Foster

Foster's Canary Wharf Station is a poetic response to the physical phenomenon of buoyancy. Buoyancy is a structural load concern affecting underground construction. The mass of the earth, held back on all sides by subterranean structures acts a lot like water, pushing the structure towards the surface. The concept materializes into a space which feels like it is bubbling from the heavy, dark earth to the light and airy sky. The effect is made palpable through contrast in materials. A heavy concrete structure dominates the underground space, the arched concrete ribbed roof, shaped like a bird's wing dipping into a central spine soars with a motion into the light coming from the entrance hood. This rounded entrance hood made of steel and glass gracefully contrasts and completes the composition. The buoyant motion emphasizes an upwards motif towards a beckoning light.

The natural instinct to move towards light leads commuters through the station. Rays of light shine through the entrance and down onto the escalators which carry commuters out of the station to their destinations. In as much, the entrance hood is the defining character of the station. It becomes a beacon for the underground building as the only at-grade presence of the station in busy Canary Wharf.

The crux for Canary Wharf Station is the transition space between grade and the underground: the descent and the ascension. The underground space having the same proportions to a cathedral makes the imagery of the ascent to the light of day in the station appear to be an almost religious experience. The descent


CANARY WHARF STATION



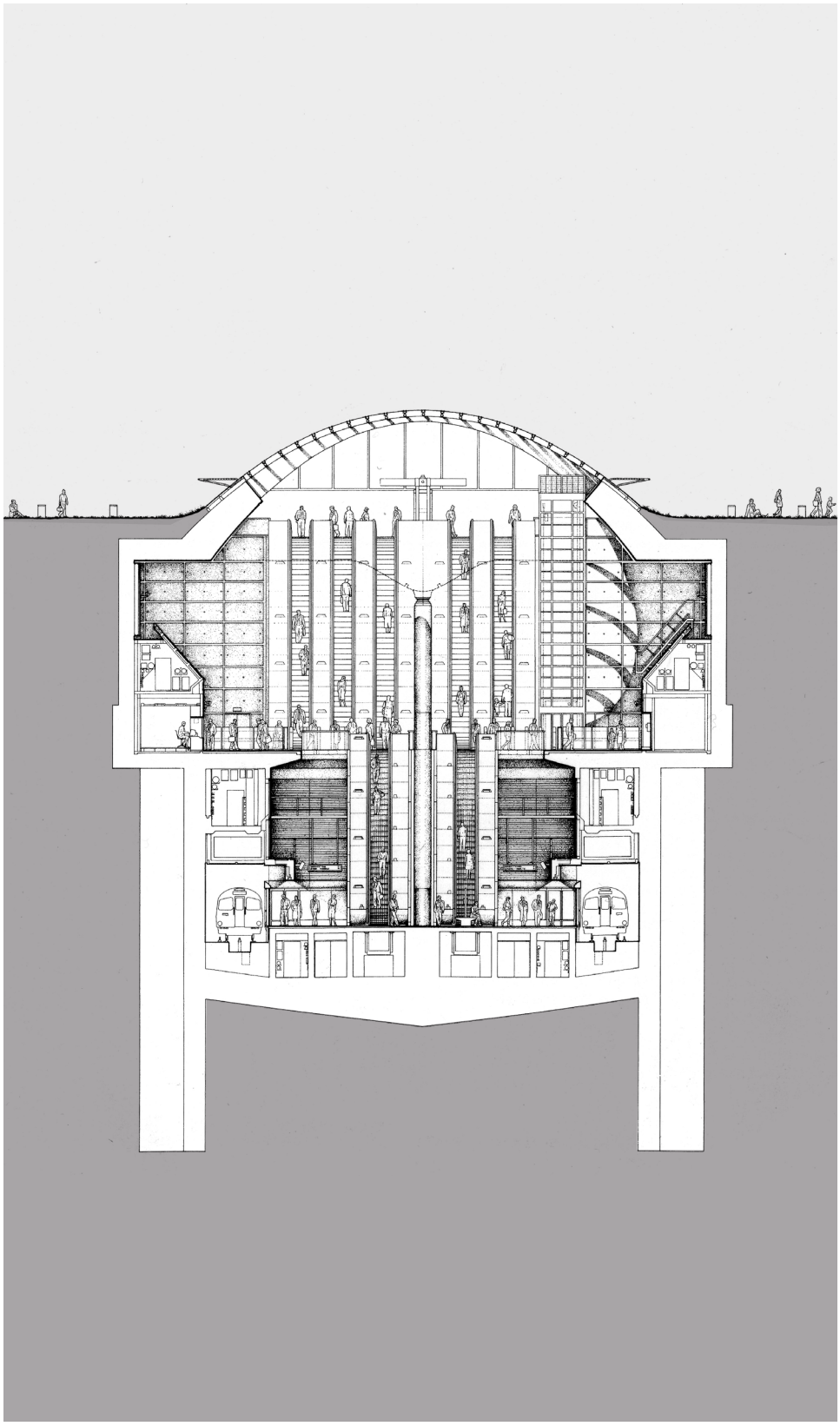


Fig. 4.4
Canary Wharf Station in section

Fig. 4.2
Street Level entrance to Canary Wharf Station

Fig. 4.3
Stairway to exit/from entrance







Fig. 4.7
"fosteritos", the curvy glass structures at the street level entry points for the underground stations

is a movement away from the glaring light into the shadows below, into a hi-tech concrete underworld. The contrast between the dark underworld station to the light filled bubble above the surface makes for a feeling of bursting above the surface or being enveloped in the darkness. Like water, the space seems to have a buoyant force which acts upon the commuter especially affecting this transition between above and below.

Fig. 4.5
Inside the underground station from ticketing level

METRO BILBAO UNDERGROUND STATIONS

Architect: Norman Foster & Partners
Location: Bilbao, Spain
Year: 1997
Total System Annual Ridership: 87,615,087 (2012)

When carrying out research into underground structures for this (Bilbao) project I discovered that many designers do everything they can to make the space look as if it's above ground. I object to that, because underground can create an extraordinary atmosphere of almost religious intensity.[4]

Norman Foster

Metro Bilbao's underground stations, also designed by Foster & Partners, celebrate a hi-tech underworld. In the station, one enters a large cavern which holds both a ticketing mezzanine and the train access platforms. The oval shape of the cavern, built with unfinished concrete, is designed for its efficiency in

Fig. 4.6
Inside the underground station from train entry level


Pasaży Ciudadela
Pasaży Ciudadela



acting with the static forces in the underground – primarily the buoyant forces already mentioned. In this subterranean realm, the massive scale of the concrete shell contrasts with the smaller human elements made of glass and gleaming brushed steel. The space recalls imagery from sci-fi underground human habitats. Movement through the space is highly efficient, commuters walk one by one through the turnstiles, they line up along the platform, the train rolls up, people enter, the train rolls away. Upon exiting commuters wait one by one on the escalator to grade level. There, they exit out of a 'fosterito': a glazed entrance hood (a smaller-scale precedent to Canary Wharf). Every station is the same, save for the name called out on the metro car intercom and perhaps a sign. And so, from anywhere in the city (at least anywhere with an underground metro station) one can descend below the earth and down the 'fosterito' escalator. The descent into the underground acts as a portal into a surreal sci-fi underworld which is mechanized to transport the modern commuter anywhere they want to go.

ALAMEDA STATION

Architect: Santiago Calatrava
Location: Valencia, Spain
Year: 1995
Annual Ridership: Line 3 20,497,465, Line 5 15,551,639 (2012)

Fig. 4.8
from central platform looking up escalator

Alameda is a glowing ephemeral space in Valencia's underground. The giant cavern's structure is treated with a similar level of ornate detail as a palace. After descending the dark stairs from the city, one finds oneself in a massive space; a massive honey-combed roof structure punctured with skylights hovers above. Walls covered in white mosaic tiles sparkle and shine in the light. The repetitive structure matches the cadence of the moving trains which carry people in and out of the station. The scale of the space is beyond human, but is at once a testament to human ingenuity. Two rapid transit lines kiss on a central platform making transfers easy and efficient. Standing on the central platform one hears the rumbling of trains going past, eyes following the rhythm of the structure; one basks in the warmth of light glowing from above. Occupying the interstitial space right along the grade line, Calatrava has created an underground cavern which celebrates the boundaries of physics and efficiency of technology: a man-made paradise.

Fig. 4.9
Roof structure rising above riders waiting for train





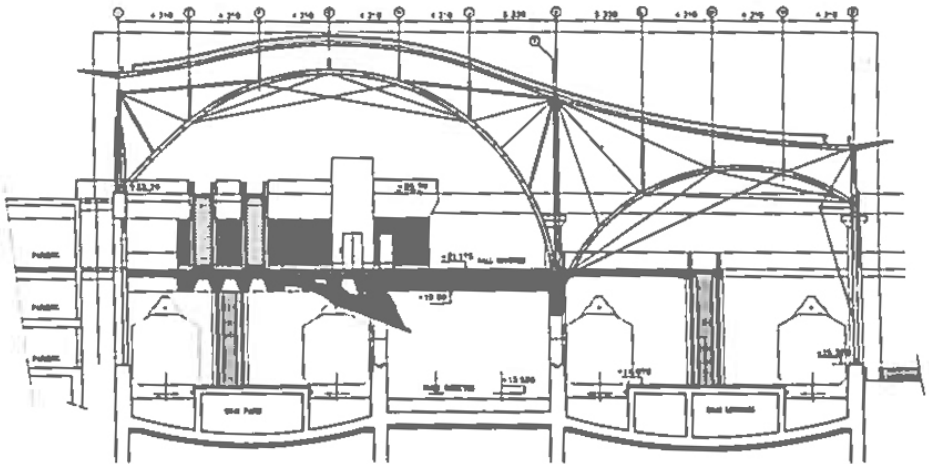


Fig. 4.12
Cross-Section

LILLE EUROPE STATION

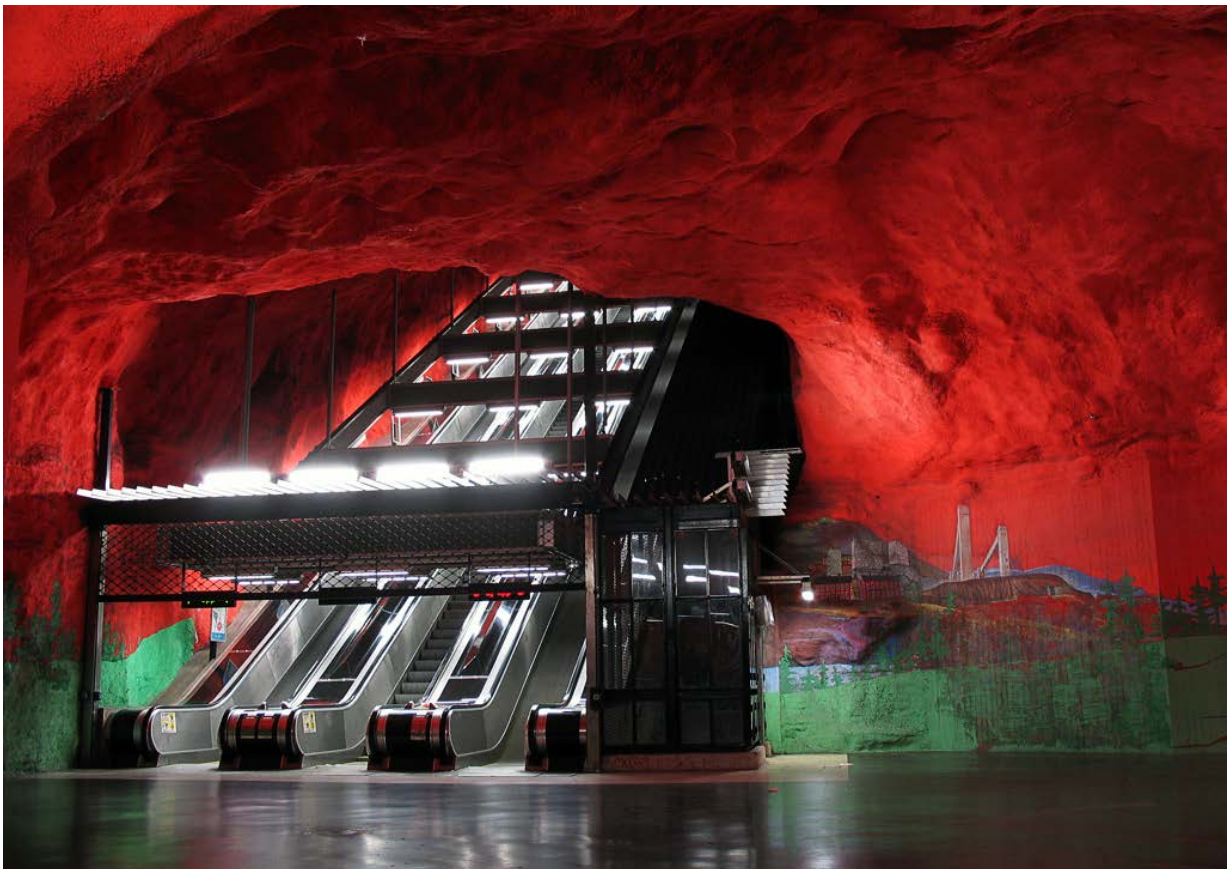
Fig. 4.10
exterior view of glowing undulating roof

Architect: SNCF Jean- Marie Duthilleul, in joint venture with RFR Peter Rice
Location: Lille, France
Year: 1994

The wave-shaped glass roof, designed by Peter Rice, is suspended by a network of cables to huge metal arches. An interplay of perforated fine metal sheets filters light from the changing skies of Norther France. At night, indirect lighting seems to set the roof afloat, bathing the entire station in a diffuse glow.[5]

Lille Europe TGV Station is animated by the dialogue between heavy and light elements. The concept appears to be inspired by the difference in material requirements for construction above and below ground for the building which spans both. Underground construction calls for comparatively prescriptive requirements: the structure must be continuous, it must be able to withstand a distributed load over its entire surface area, and it must stop the movement of earth and water. The typical material chosen for underground construction is concrete, and Lille TGV Station is no exception. What makes the station interesting is the intention of emphasizing the mass of the underground, rectilinear structure with a light, airy, undulating roof. The roof hovers slightly above a steel space frame. The open playfulness of the space frame and free form of the roof contrasts with the juxtaposed heavy concrete foundations of the building. Lille TGV Station occupies both above and below grade dimensions. Its subterranean foundations are used as a perceptual foil to the light, playful roof and space frame which animates the space; while one occupies the heavy concrete foundations one can experience the roof dancing above.

Fig. 4.11
Lille Station - interior



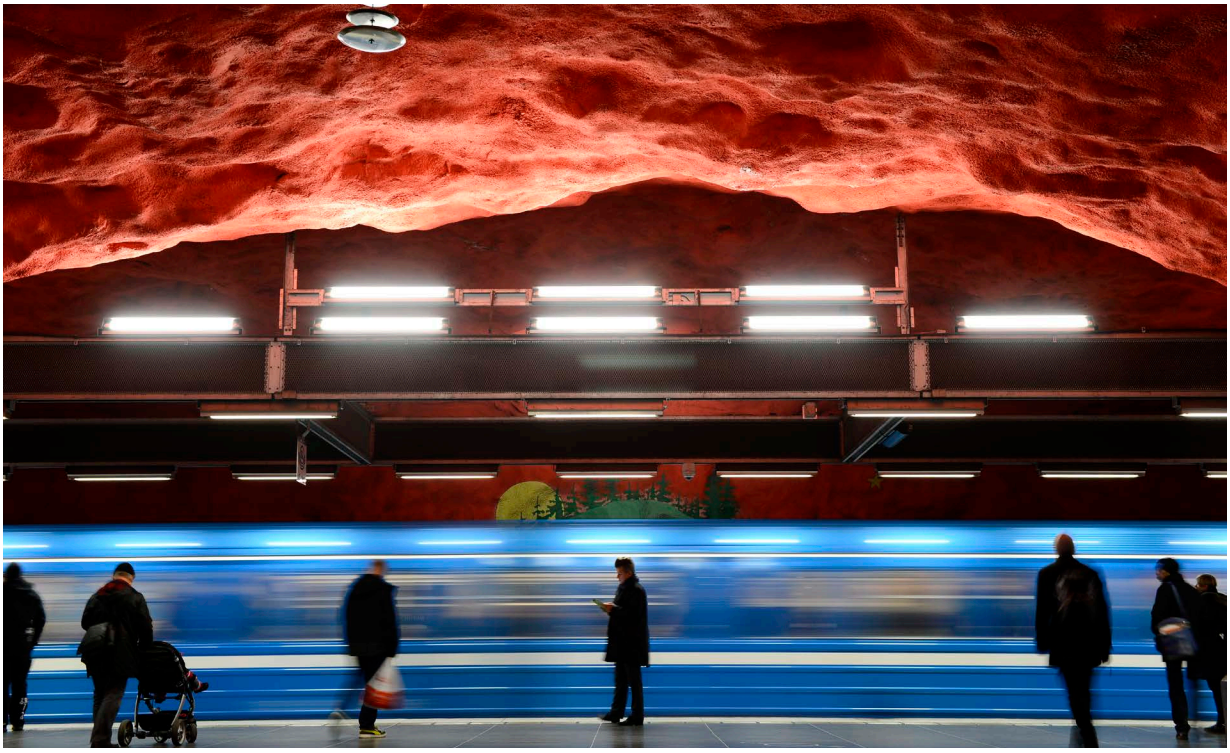




Fig. 4.15
Station T-Centralen



Fig. 4.13
Blue Line - Solna Centrum



Fig. 4.16
Stadion

Fig. 4.17
Tunnelbana

Fig. 4.14
Blue Line - Solna Centrum




DUPONT

STOCKHOLM METRO UNDERGROUND STATIONS

Location: Stockholm, Sweden
Year: 1978
Depth: 20-30 meters
Average Ridership per weekday: 21,510 (2011-2012)

Stockholm's underground Metro Stations were mined out of the rock which lies below the city surface. The surface of the mined rock is left crude and exposed creating a space which feels like a cave. The crude structure contrasts with the clean technological inserts: the escalators and elevators. The juxtaposition encourages a perception of the stations as natural cave formations taken over by man. These caves are given a powerful energy through the intervention of local artists. The underground metro stations are transformed into fantastical spaces through paintings and sculpture. The spaces are bright with colours. Each station has its own character; they are each a place in the city, making it easy for residents and visitors to remember where they are. These celebrated caves, born of fantasy, become surreal hidden worlds within the city. Descent into the earth opens up into a wonderful cave landscape rich with colour and animated with the movement of people and trains.

Fig. 4.18
"Spadina Summer Under" by James Sutherland

DUPONT TTC STATION

Architect: Dunlop-Farrow Architects
Location: Toronto, Canada
Year: 1978
Average Ridership per weekday: 17,660 (2011-2012)

You enter one of two glazed pavilions which provide access for Dupont TTC Station and descend the stairs into an urban cave. What is most striking is the determined circular motif. The floor and ceiling tiles are all tiny faded orange circles, all walls start and end rounded to the floor and ceiling, benches round out from the walls, and the artificial lighting system takes the form of multiple large, glowing circles projecting slightly from the walls and ceiling. The space recalls imagery from science fiction: the setting for a populous which has escaped a desolate earth to live underground. They adorn this setting with shrines to the nature they lost in the form of large tile-work murals of flowers. These murals, while remarkable, enforce the unnatural feeling of this underground space. Untouched by daylight for decades, the flowers feel cold, embalmed. This urban cave is a hidden gem in the city. The transition into its realm is fast and unexpected. The imagination is invited to think of escaping into this urban cave and exploring its depths.

Fig. 4.19
Dupont Station: bench curves out from the wall seemlessly





4.2 UNDERGROUND COLLECTIVE SPACE

THE LOW LINE PARK

Architect: James Ramsey of Raad Studio and Dan Barasch
Consultants: Arup, HR&A Advisors
Location: New York City, USA
Construction: Still in Planning Phase

The Lowline is a plan to use innovative solar technology to illuminate an historic trolley terminal on the Lower East Side of New York City. Our vision is a stunning underground park, providing a beautiful respite and a cultural attraction in one of the world's most dense, exciting urban environments.[6]

Fig. 4.20
Rendering from Low Line Park showing potential lighting conditions and use

Fig. 4.21
"Imagining the Lowline" exhibition: two-week long exhibit in Market Building D in the Lower East Side was aimed at sharing the ideas of the Lowline with the community to hear feedback and gain support to potentially move the project forward

The design for the proposed Low Line Park is an attempt to build technologically aided 'natural environment' in an abandoned underground trolley terminal. Visions for the park show lush trees, flourishing bushes, green walls in a bright, sunny space. People frolic through this underground oasis in the middle of crowded Manhattan. The main innovation for the park is the lighting scheme which proposes large white umbrella like structures which would reflect light through a narrow opening to the underground where it is then dispersed by a reflective molded ceiling. They conjure that with natural daylight plant life and park life will be able to blossom. The length with which they go to develop a scheme whereby nature is possible underground is a response to the cultural hesitance to dwelling underground. The presence of nature reassures that the physiological necessities (air, light) typically lacking in underground space are accounted for. The project looks to combat the typical negative associations

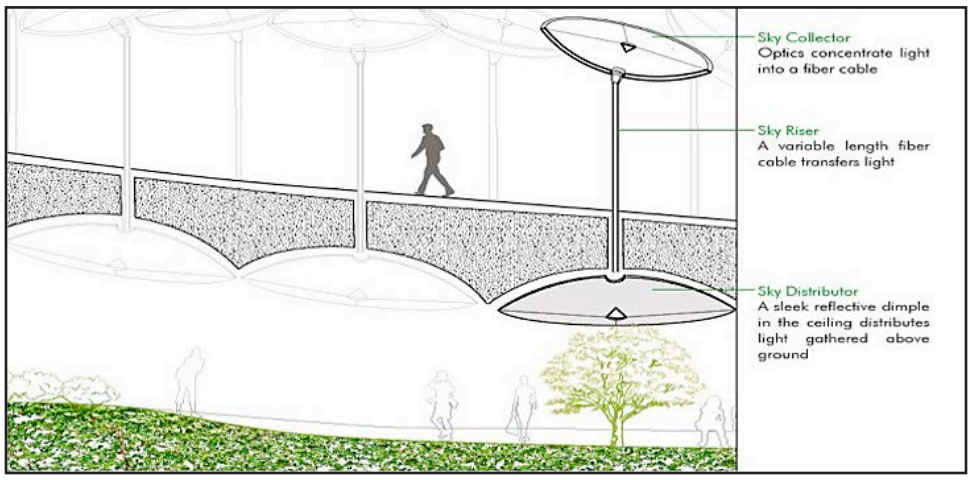
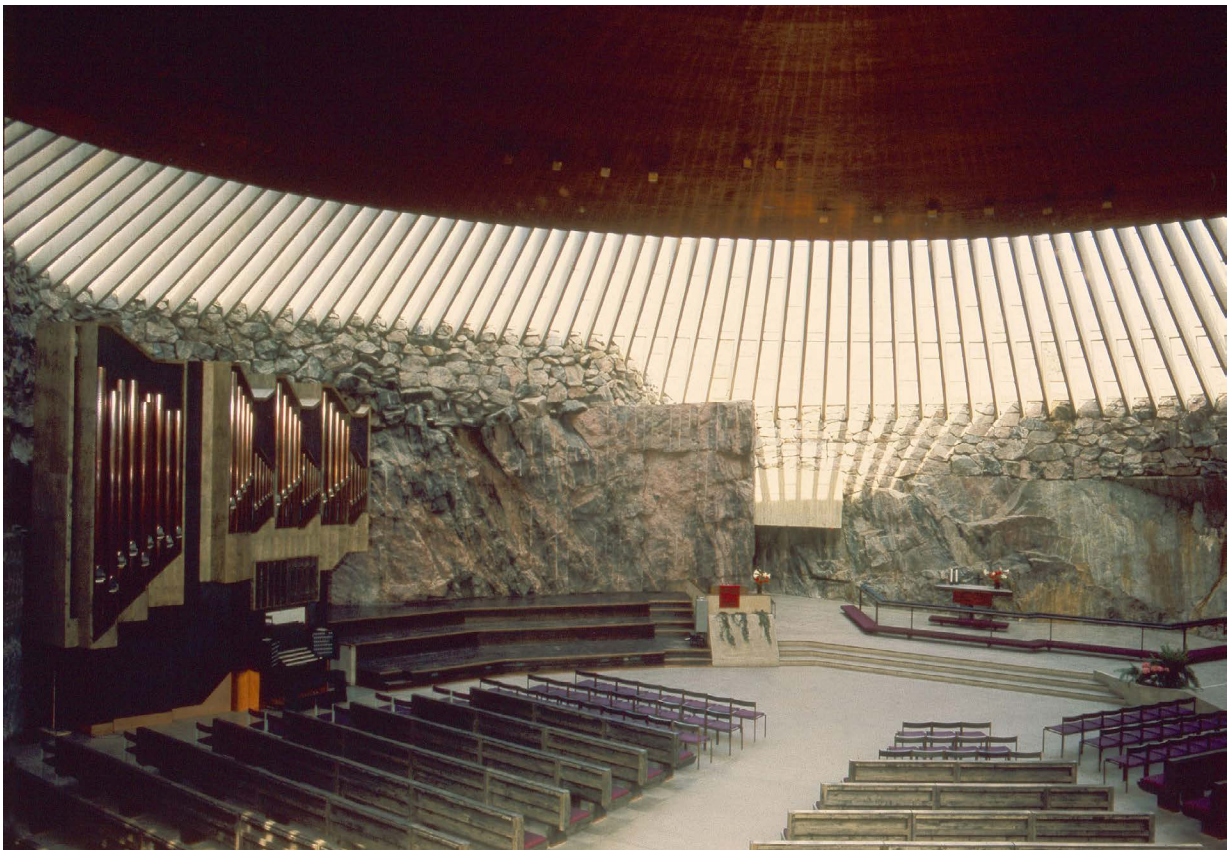


Fig. 4.22
daylight strategy diagram





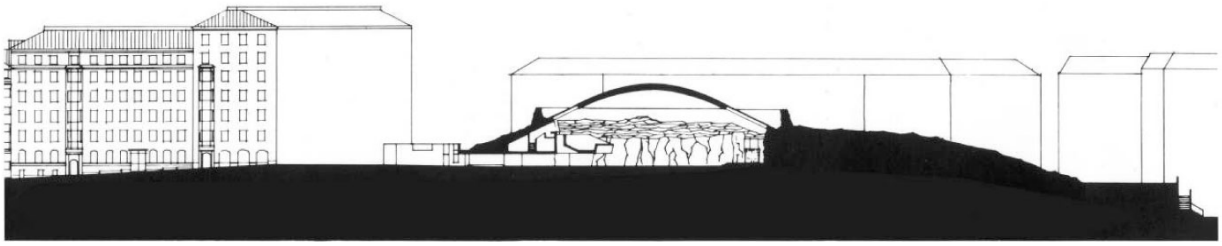


Fig. 4.25
Church section through entrance

with the underground (repulsion of dirt, decay) and perhaps replace them with potentially positive associations. This secret garden evokes connotations associated with the fertility of earth rather than darkness, uncleanliness and death.

TEMPPELIAUKIO CHURCH

Architect: Timo and Tuomo Suomalainen
Location: Helsinki, Finland
Construction: 1961 - 1969
Depth: 6 metres

Fig. 4.23
Church Interior

The Temppeliaukio, built to designs by Timo and Tuomo Suomalainen, was hewn from rock using elementary tools, and roofed with a copper dome. A skylight running around the entire circumference forms the transition between dome and rock, so the roof appears to float. The naked rock has been left exposed and unfinished and water is allowed to seep in and trickle down the walls. Only a few small fissures caused by dynamite have been repaired, and a single large crevice has been used to create the altar.[7]

The design of Temppeliaukio Church is founded in the relationship between mass and light; this relationship is used to create a space of worship. The church has been dug out of a stone hill in the city of Helsinki. Upon entering the mass of the stone portal, one moves from the darkness of the entry into a light filled congregation space. A copper dome hovers above the stone chasm, supported by the almost invisible skylight structure. The composition beckons the parishioner or visitor to look upwards, towards the light: a religious architectural motif. The movement of the structure from the depths of the earth to the light of the sky, recalls the Christian dualities of Heaven and Hell, God and the Earth. The space is silent except for the sound of water trickling through the stone walls and rustling of lips in prayer. Temppeliaukio church is allowed an evocative religious space through its placement in the underground. The heaviness of rock and silence of the earth become key features in the composition of the structure and celestial atmosphere.

Fig. 4.24
Aerial View of Church at night







Fig. 4.28
The Louvre Pyramid

LE CARROUSEL DU LOUVRE

Fig. 4.26
Louvre underground entrance

Architect: I.M. Pei, Marcary, Duval, New York
Engineers: Sogelerg, Serete, RFR Peter Rice
Location: Paris, France
Construction: 1988 - 1993

Formally, it [the pyramid] is the most compatible with the architecture of the Louvre…, it is also one of the most structurally stable of forms, which assures its transparency, as it is constructed of glass and steel, it signifies a break with the architectural traditions of the past. It is a work of our time.[8]

I.M. Pei

The stark, clean geometry of Le Carrousel du Louvre contrasts with the ornate baroque style of historic Paris. The shift below ground signals a shift into the contemporary present. I.M. Pei's iconic glass pyramids mark the transition point and mediate the juncture between old and new. The urban realm of the Louvre courtyard extends seamlessly into the underground plaza which connects the new entrance to the Louvre with a shopping mall and the Paris Metro. Underground, museum-goers are directed from the metro station through the underground pedestrian street by light emanating through the inverted pyramid then the larger grand pyramid. The shift between above and below ground is used here as a marker between two different realms. Above is the realm devoted to the French pride in its ornate historic architecture. Below is a realm which celebrates the clean lines and geometry of modernity made possible by the advent of technology. The incredible engineering of the glass pyramids stands as a testament to human intelligence and craft in a contrasting fashion compared to the detail in the Louvre facade which hugs the courtyard where they sit.

Fig. 4.27
the inverted glass pyramid


TD WATERHOUSE TOWER
PATH
ROYAL TRUST TOWER
TORONTO DOMINION BANK TOWER
CANOE BYMARK · DUKE OF DEVON ·
95 WELLINGTON WEST
CANADIAN PACIFIC TOWER



TORONTO P.A.T.H.

Location: Toronto, Canada
Construction: first section opened in the 1970's

RÉSO: MONTREAL'S 'UNDERGROUND CITY'

Location: Montreal, Canada
Construction: began in 1962

PATH is downtown Toronto's underground walkway linking 28 kilometres of shopping, services and entertainment. Follow PATH and you'll reach your downtown destination easily in waterproof comfort.[9]

Toronto and Montreal both have underground pathways linking buildings in their downtown cores. They are two of 51 similar systems in the world, two of the 6 in Canada. The infrastructure was built in order to allow employees and residents protection from inclement weather between destinations. Toronto's PATH system has grown to 28 kilometres in length, holding approximately 1,200 shops and services, and 125 grade level access points. Réso, also known as Montreal's Underground City, network is comprised of 32 kilometers of. For people unfamiliar with the seemingly endless pathways, they become an underground labyrinth.

Fig. 4.29
PATH walkway and shopping below Toronto's TD Centre

"We are talking about a completely climate-stabilized, surveilled, artificially lit human-maintained system."[10] The constant levels of lighting, climate, even sound control, mean that spaces blend. One walkway is undifferentiated from another. A new visitor is left meandering along this maze, looking for an exit, hoping it's one close to their destination. This strategy is to the benefit of the retail stores which line the walkways; the longer people spend in the never-ending shopping mall, the more likely they'll spend money. These systems are examples of what can go wrong when a technologized environment is taken too far. Natural changes in environment: the movement of the sun, the shifting of wind directions, reverberations of sound; allow for a sense of navigation and placement in a larger world. Underground, these stimuli are deadened by the mass of the earth and the potential environmental controls. Perceptively, people lose a sense of place and direction making them uncomfortable.

Fig. 4.30
Montreal RÉSO underground food court and subway access

CONCLUSION

The perception of architecture is affected by the psyche and cultural memory. Architecture which responds to cultural expectations of utility combined with poetic and sensual motifs found in cultural memory has the potential to form incredible experiences. These precedents respond to and are inspired by the poetic and practical potentials of underground construction. As environmental control technology improves and people realize the eminence of the underground in the urban experience, more and more projects of this calibre of precedent will develop.

The studies shown represent examples of four phenomenal themes: the transition as a portal, the man-made technological cave, the cave as a fantastical realm, and the dialogue between heavy and light elements. Canary Wharf, Temppeliaukio Church, and le Carrousel du Louvre emphasize the transition into the underground as a portal into another realm. Perceptually, the earth is occupied differently than above – one occupies a hollow rather than a construct. This opposing nature in dwelling creates a transition point which has been taken advantage of by the designers of these precedents. The transition can be exaggerated into one not just between above and below but between a metaphorical heaven and hell, or past and present. Metro Bilbao's Underground Stations and Dupont TTC Station both express themselves as man-made technological caves invoking imaginings from science fiction. Here, the underground is devoid of nature and under complete technological control. But designer beware, this metaphor can be taken too far and form an unpleasant space as seen in underground walkways PATH and RÉSO. The cave image can also move in another direction in the creation of a fantastical realm, as seen in Stockholm's underground stations and Alameda Station. Hidden underground, these worlds open up to the user. Finally, Canary Wharf and Lille TGV Station are inspired by the dialogue between heavy and light elements in architectures which transition between above and below ground. There is a differing in scales of structural requirements between structures acting under earth loads versus exterior structures under weather loads and interior structures under human live loads. This change in scale is experienced by dwellers perceptually through the phenomenon of body mimesis (as defined in Chapter 2). These precedents of underground architecture celebrate the subterranean condition and find inspiration in it. What's formed is architecture unique to the mode of dwelling and experiencing the underground.

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URBAN INFRASTRUCTURE

PART FIVE

Introduction

5.1 CATALYSTS IN AN EVOLVING CITY

Change in Population
Toronto Official Plan
Transportation Network
The Eglinton Crosstown LRT

5.2 URBAN DEVELOPMENT

Yonge-Eglinton Centre
Demographics and Employment
Amenity Distribution
Eglinton Avenue
The Future Yonge-Eglinton Centre

5.3 A NEW YONGE-EGLINTON STATION

Programmatic Requirements
Building Code and Accessibility
Underground Construction

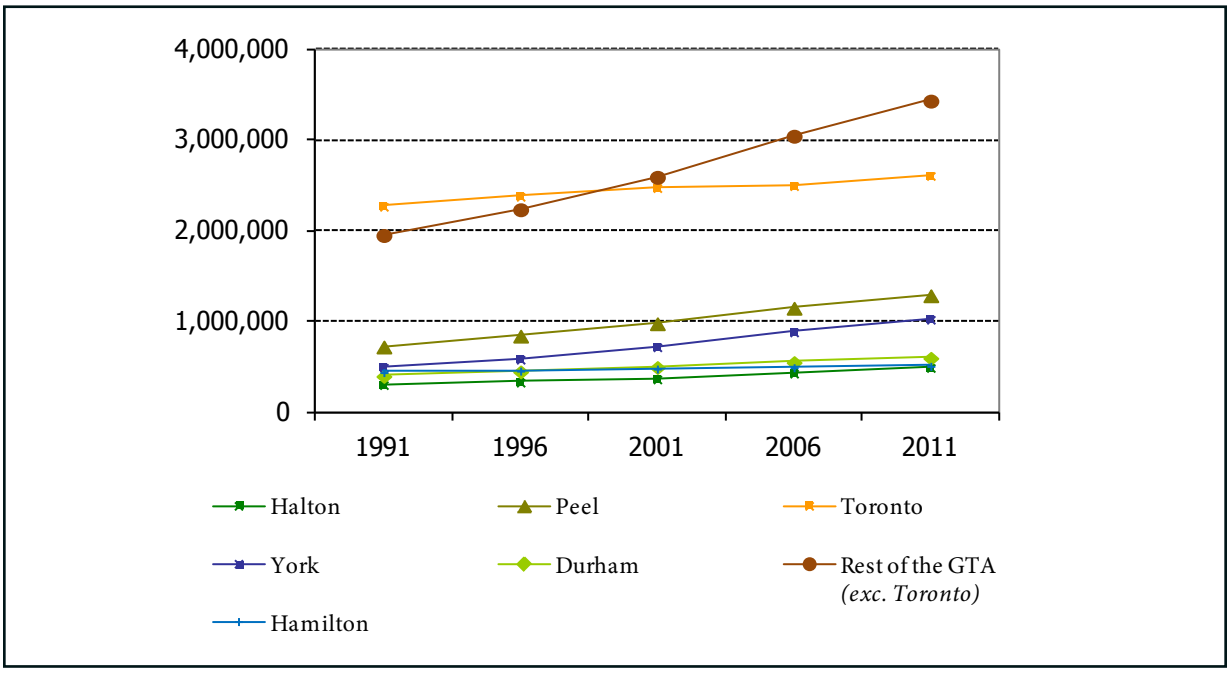
Conclusion

INTRODUCTION

The urbanite's most common experience of the underground is of the transit station. Below the earth, the fast-moving trains do not disrupt the regular flow of the streets. Toronto's underground city consists of its system of underground pathways (the PATH), the basements of houses and towers, parking garages, service infrastructure, and subway tunnels and stations. Amongst Toronto's population of 2.6 million people, rapid transit stations see upwards of 1.3 million fares and transfers on the average weekday.[1] Daily, large amounts of the city's population spend time in these subterranean spaces. Descending into the subway station, pushing onto a subway car, and traveling through the black subway tunnels, has become a major part of the urban experience. It is how people interact with the city, how people move around. This infrastructure structures how people get to work, where people choose to live, where people play.

Transit expansion plays a major role in the urban planning of the city. The thesis project site is at the intersection of Yonge Street and Eglinton Avenue in Toronto. Below ground, the existing Yonge Subway line will intersect with a new underground LRT at Eglinton. This new LRT has the potential to revolutionize Eglinton Avenue. Already, it is a major thoroughfare for cars and one of the busiest bus routes in the city. New transit infrastructure and policy instituted by city planners will encourage development along the Avenue. This has enormous potential for Yonge-Eglinton Centre. A new development at this intersection, holding connections to the existing Yonge subway line and the future Eglinton LRT, will be a part of the future of the city.

Greater Toronto Area Population Change 1991 to 2011



City of Toronto Population Change 2006-2011

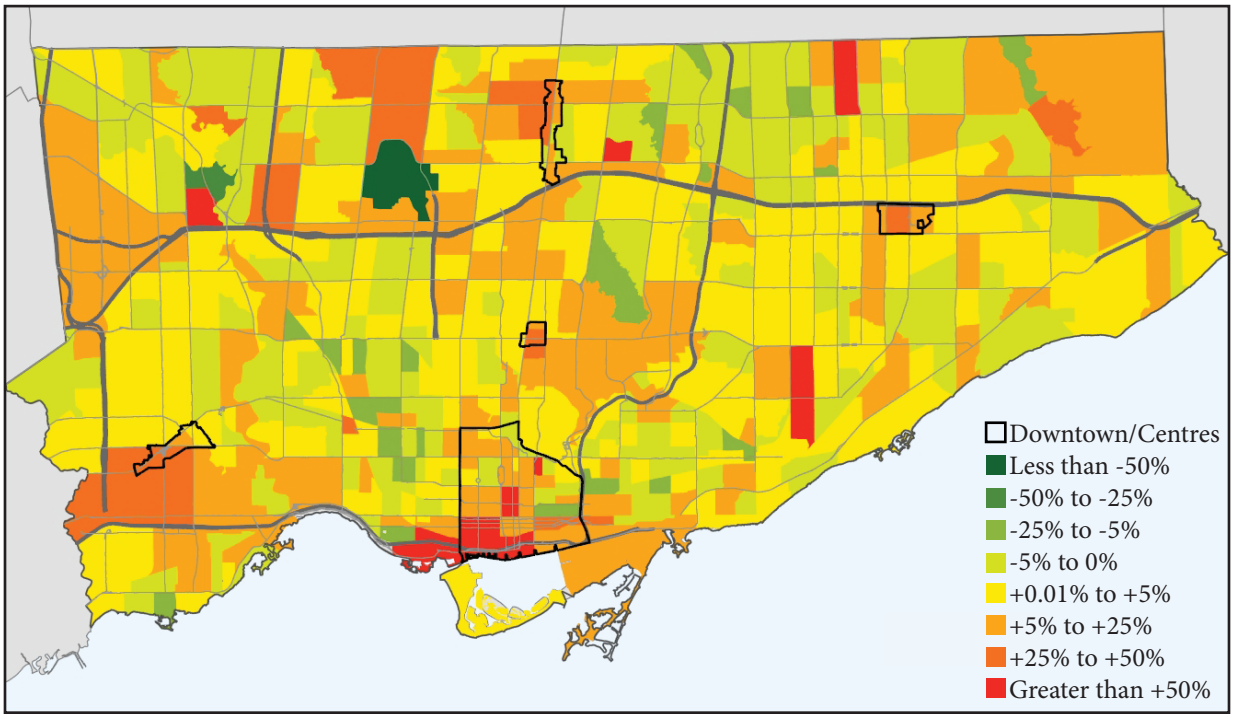


Fig. 5.1
(first page spread)
Satellite view: Yonge-Eglinton, Toronto (www.google.ca/maps)

5.1 CATALYSTS IN AN EVOLVING CITY

CHANGE IN POPULATION

Toronto's population is growing fast. Toronto's current population, according to the 2011 census, is just over 2.6 million residents.[2] The rate of growth from 2006 to 2011 was five times that recorded from 2001 to 2006.[3] If this trend continues, the population of Toronto is expected to grow to 3 million residents by the year 2031.[4] On top of that, the greater region's population is growing even faster. Many people living in the Greater Toronto Area drive or take GO Transit to work in the city during the day, returning home at night. So, more and more people are in Toronto every day, more and more jobs are being created in the city, more and more homes are being built. These new developments have to find space to be built within the city's set boundaries and with access to the infrastructure which provides services to buildings and allows people the transportation necessary to reach them. To foster further growth, city planners define strategies which direct development to ideal locations. These strategies are outlined in the Toronto Official Plan.

Fig. 5.2
Greater Toronto Area Population from 2011 Census Backgrounder, City of Toronto

TORONTO OFFICIAL PLAN

The Official Plan is about making the right choices and shaping Toronto's collective future. [5]

The Toronto Official Plan is tasked with shaping growth in the city. Its listed focuses and values are: vibrant neighbourhoods, affordable housing choices, 'walk-able' streets, a comprehensive and high quality affordable transit system, a strong economy offering fulfilling employment, a clean environment, green spaces and public squares, recreational opportunities, a beautiful waterfront, cultural facilities, beautiful architecture and urban design.[6] An important part of this document is the 'Urban Structure Map' (Fig. 5.4) which diagrams the 'avenues', 'centers', employment districts', downtown core and green space system. These are identified as areas with existing density where further population and employment growth are encouraged. The thesis site, Yonge-Eglinton Centre, is one of the 'centers' noted in the map and lies at the intersection of two 'avenues': Yonge Street and Eglinton Avenue. The document defines centers as: "places with excellent transit accessibility where jobs, housing and services will be concentrated in dynamic mixed-use settings with different levels of activity and intensity."[7] Here, planners promote a mixture of job and population growth. It defines its avenues as: "important corridors along major streets where reurbanization is anticipated and encouraged to create new housing and job opportunities while improving the pedestrian environment, the look of the street,

Fig. 5.3
City of Toronto Population Change 2006-2011

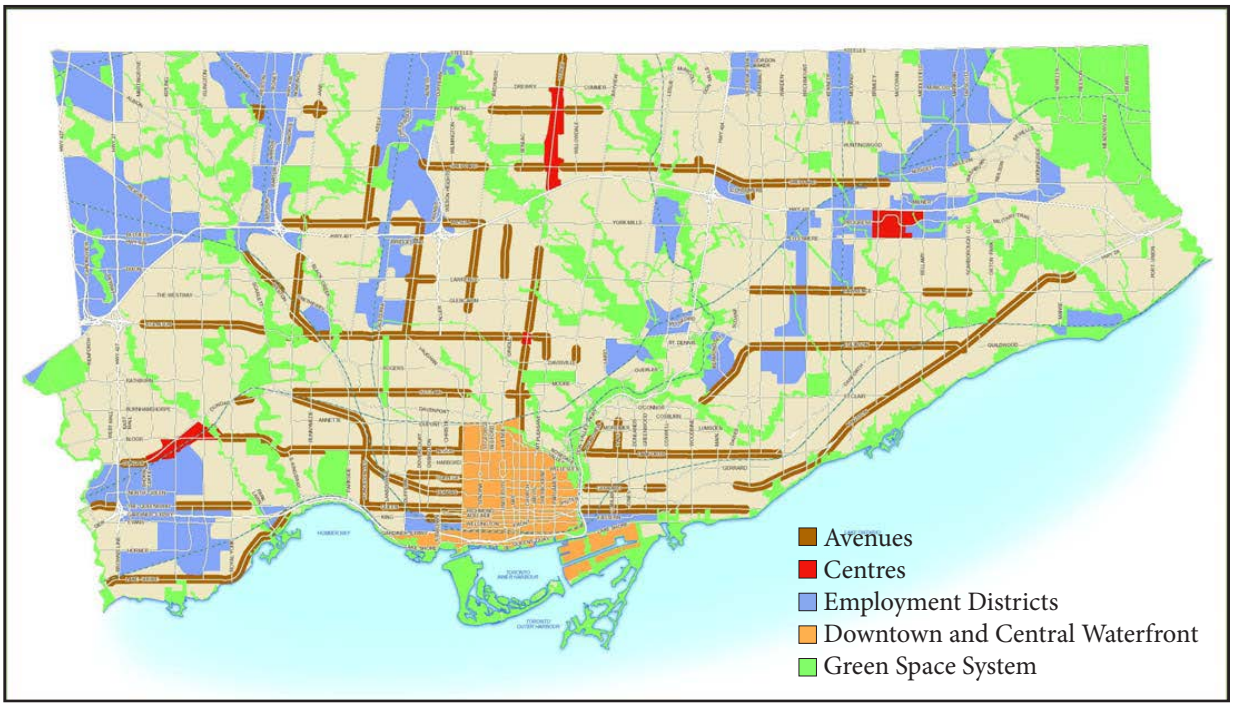


Fig. 5.4
Toronto Official Plan
Urban Structure Map

shopping opportunities and transit services for community residents."[8] Here, planners promote primarily residential growth. City planners are focused on encouraging transit use in the city by fostering densification along transit routes and expanding the rapid transit network. In a city with the density Toronto is working towards, transit is planned as the main method of travel.

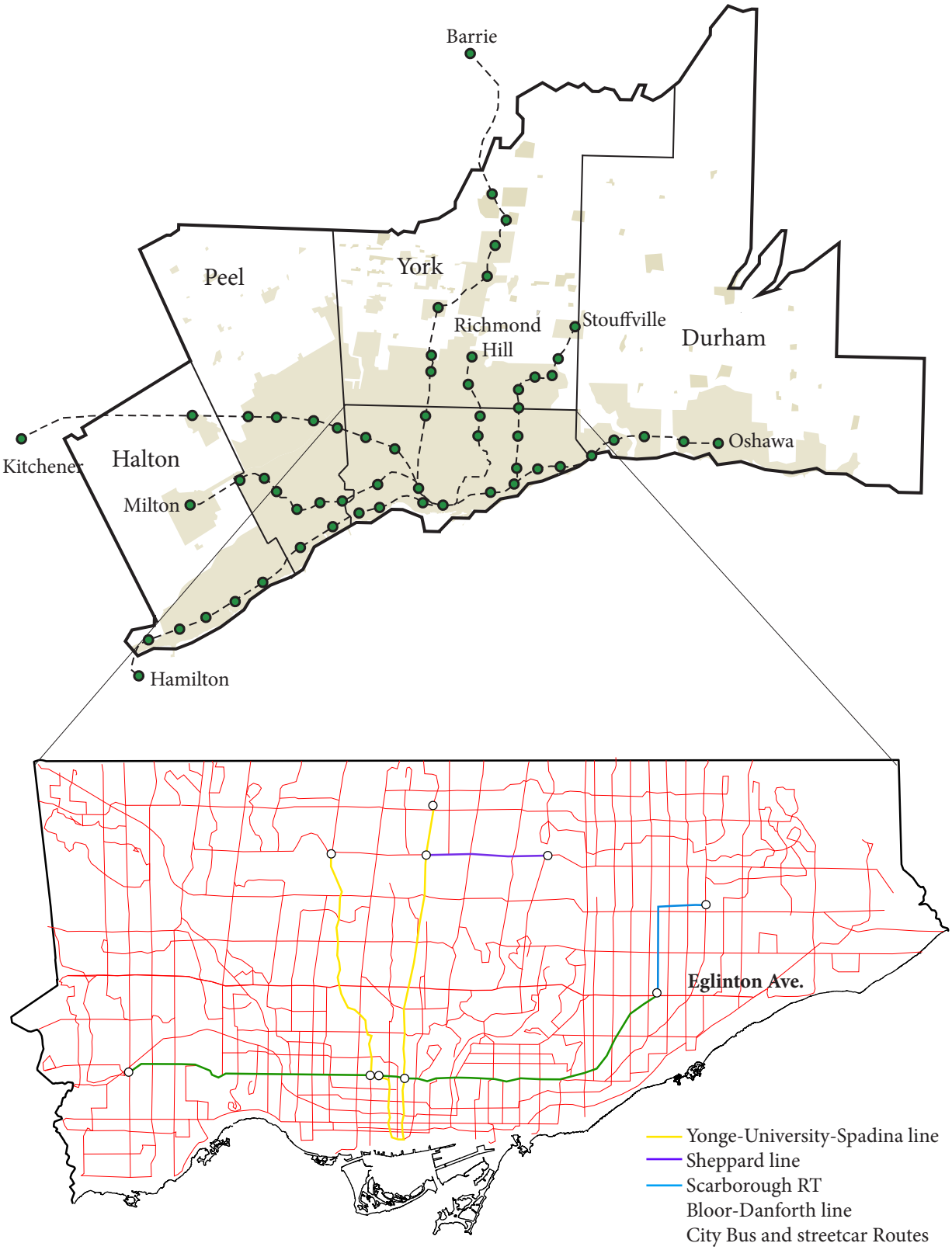
TRANSPORTATION NETWORK

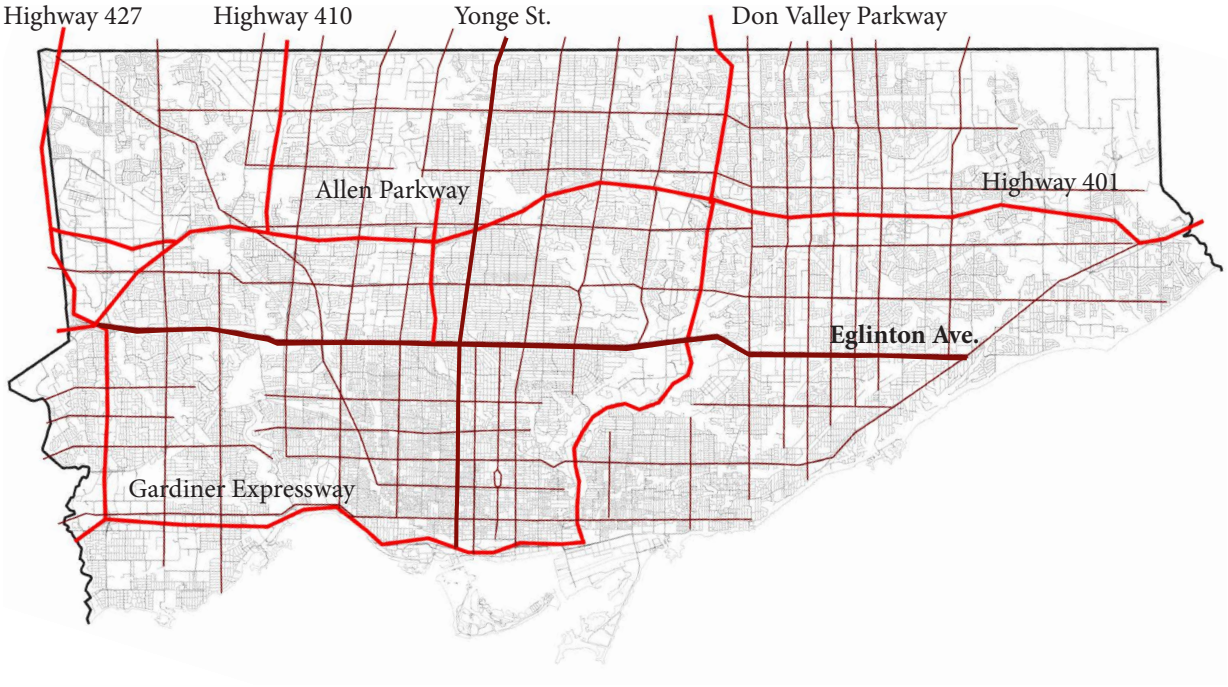
The transportation network is developed in a reciprocal relationship with the development of jobs and homes: as new infrastructure is built, new buildings are built along it to take advantage of its proximity; as buildings are developed for proximity to other amenities, infrastructure is built to accommodate. Because of this relationship, the transportation network is a key factor in urban planning. The Official Plan defines the key elements of the City's Transportation network as: subway, LRT, streetcar and bus lines; the GO Transit rail network; expressways and major streets; railway corridors and railway yards; the city-wide bikeway network; a system of sidewalks, pathways and trails; and potential use of hydro corridors for transit facilities, bikeways and walkways.[9] While many people walk and bike as their main travel methods, the travel methods which affect the larger shape of the city tend to be transit and vehicular.

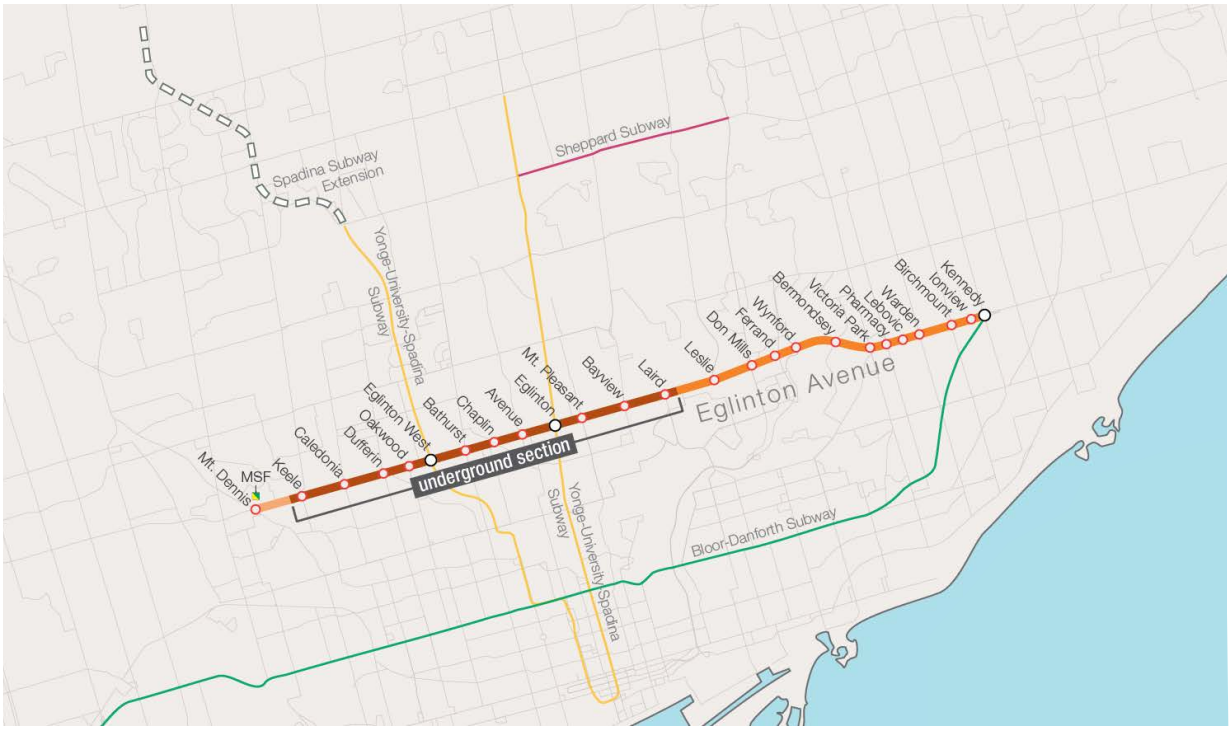
Fig. 5.5
(opposite, top)
GTA Go Rail lines

Fig. 5.6
(opposite, bottom)
Toronto TTC subway, bus, streetcar routes

The first subway built in the city was the Yonge line, originally running


Barrie
Peel
York
Richmond Hill
Stouffville
Durham
Oshawa
Kitchener
Halton
Milton
Hamilton
Eglinton Ave.
Yonge-University-Spadina line
Sheppard line
Scarborough RT
Bloor-Danforth line
City Bus and streetcar Routes


Highway 427
Highway 410
Yonge St.
Don Valley Parkway
Allen Parkway
Highway 401
Eglinton Ave.
Gardiner Expressway


Spadina Subway Extension
Sheppard Subway
Yonge-University-Spadina Subway
Mt. Dennis
MSF
Keele
Caledonia
Dufferin
Oakwood
Eglinton West
Bathurst
Chaplin
Avenue
Eglinton
Mt. Pleasant
Bayview
Laird
Leslie
Don Mills
Ferrand
Wynford
Bermondsey
Victoria Park
Pharmacy
Lebovic
Warden
Birchmount
Ionview
Kennedy
underground section
Eglinton Avenue
Yonge-University-Spadina Subway
Bloor-Danforth Subway

from Union Station at the south end to Eglinton Station at the north end, now extended north to Finch. Later, an east-west line was built along Bloor Street and Danforth Avenue, and another north-south line was built along University. 55% of Yonge-Eglinton Centre residents take public transit to work,[10] making it one of the most transit oriented neighbourhoods in the city. Transit users coming from outside of the city take GO Transit. GO had 65.5 million total boardings in 2012 with a daily average of 187,000 boardings.[11] The majority of incoming GO Transit traffic comes in at Union Station and spreads out from there. From Union Station commuters are walking distance to the downtown financial district.

The major highways which carry people in and out of the city form a ring: the Gardiner Expressway in the south, Highway 27/427 in the west, Highway 401 in the north, and the Don Valley Parkway in the east. The Allen Parkway was intended to descend into the city centre but ends abruptly at Eglinton Avenue. Within the city, roads follow a grid pattern defined by several main arterials running both north-south and east-west. Eglinton Avenue is the longest continuous road spanning the city east-west; it intersects with all three north-south highways.

Fig. 5.7
Expressways and Major streets Toronto

THE EGLINTON CROSSTOWN LRT

The new Eglinton Crosstown LRT is under construction. This new rapid transit line will vastly improve transit times north of Bloor. This Light Rail Transit line will run 19 kilometers along Eglinton Avenue between Weston Road and Kennedy Station. The transit expansion project was put in place by Metrolinx, Ontario's transportation authority, as part of 'the Big Move': a 25 year, $50 billion transit plan for the Greater Toronto and Hamilton Area. The Eglinton LRT will link with 54 bus routes, three subway stations, and intersect GO Transit rail lines at four places. The new line will replace the existing buses which run along Eglinton Avenue, both some of the busiest bus lines in the city. A rapid transit line will allow for much higher capacity along the corridor encouraging densification of homes and employment along. Encouraging densification along Eglinton will potentially shift the pattern of growth north, away from the downtown core where transit is already reaching capacity and overcrowding has become a common issue. The new LRT has a capacity of 15,000 passengers per hour, per direction.[12] This is more than what the buses currently operating can offer and allows the roads to move much faster without buses clogging them up. The increased capacity means more people can easily get in and out of the area, making the area more desirable for employment, housing, and potentially cultural attractions.

Fig. 5.*8*
Eglinton Crosstown LRT map


Ward 104
Mount Pleasant West
Ward 100
Yonge-Eglinton
EGLINTON
YONGE

Fig. 5.9
Satellite view: Yonge-Eglinton, Toronto (www.google.ca/maps)

5.2 URBAN DEVELOPMENT

YONGE-EGLINTON CENTRE

Yonge-Eglinton Centre lies at the intersection of two important streets in the city: Yonge Street, which was the centre of radiating development historically in Toronto; and Eglinton, a street which spans the city east-west connecting all cities which amalgamated in 1998 to form present-day Toronto. It was originally the end of the first subway line in the city and will connect to the newest rapid transit line in 2020. The neighbourhood is covered by two wards: Yonge-Eglinton and Mount Pleasant West. The area is made up of tall apartment towers on its east side and low-rise residential on the west; main streets are commercial or mixed-use buildings. The neighbourhood has begun seeing a relatively steep rise in population; census records show a rise of 25-50% in population between 2006 and 2011.[13] Yonge-Eglinton Centre is at the cusp of a potential shift in character and growth in density fed by rapid transit development.

EMPLOYMENT AND DEMOGRAPHICS

As housing development is increasing in Yonge-Eglinton, so is the availability of employment. The neighbourhood has seen an increase in employment since 2011 to 17,700 jobs, the majority of which are in the office sector.[14] 35% of residents work in the downtown core,[15] the rest work in the neighbourhood, elsewhere in the city, and a few work outside the city. The median household incomes for the neighbourhood ranged from $40,000 to $99,999 in 2011. Meaning residents of the neighbourhood tend to be more affluent than the average Torontonian. Residents of the area also tend to be younger than the average; the median age is relatively low at 34.1 to 39 years of age.[16] The community has the highest percentage of renters in the city.[17] Sometimes called 'Yonge and Eligible', Yonge and Eglinton is a neighbourhood with the potential for growth. Its residents are young; they have good jobs, and with those qualities can bring the needed vitality to an 'up and coming' area.

AMENITY DISTRIBUTION

The downtown is the major destination in the city, attracting people from all over the city and even the region with its cultural attractions found largely in the Entertainment District. Here you'll find theatres, performing arts centres, four major league sports teams, and several other attractions. Downtown attractions are accessible by transit and to the large number of people who reside downtown.

Fig. 5.10 Eras of Growth, Toronto

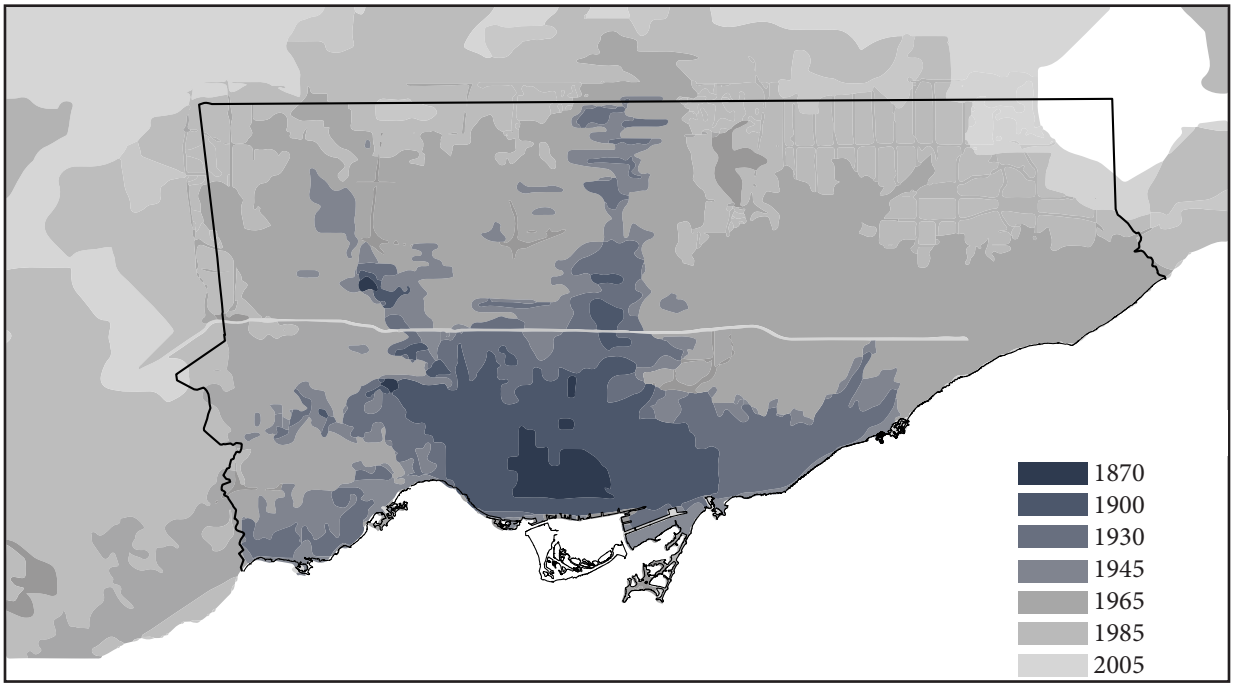


Fig. 5.11 Employment Concentration City of Toronto, 2012

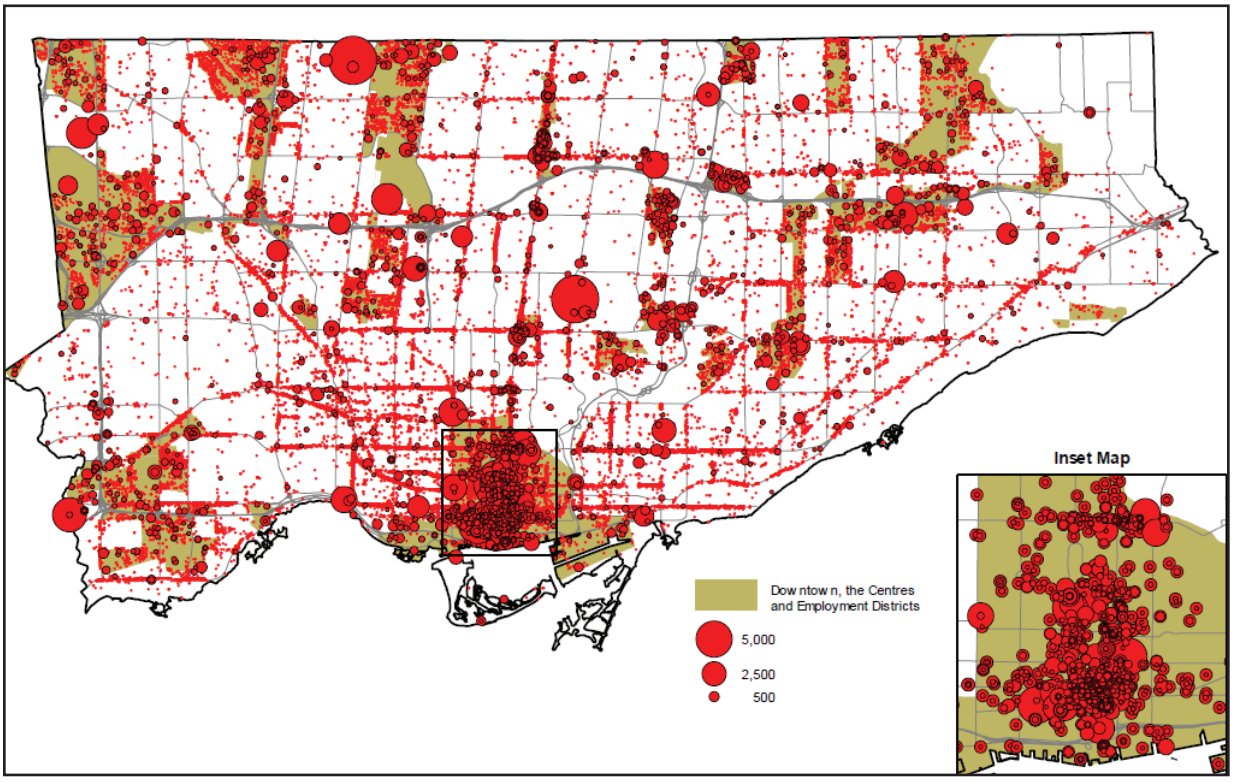


Fig. 5.12 City of Toronto Median Household Income, 2010

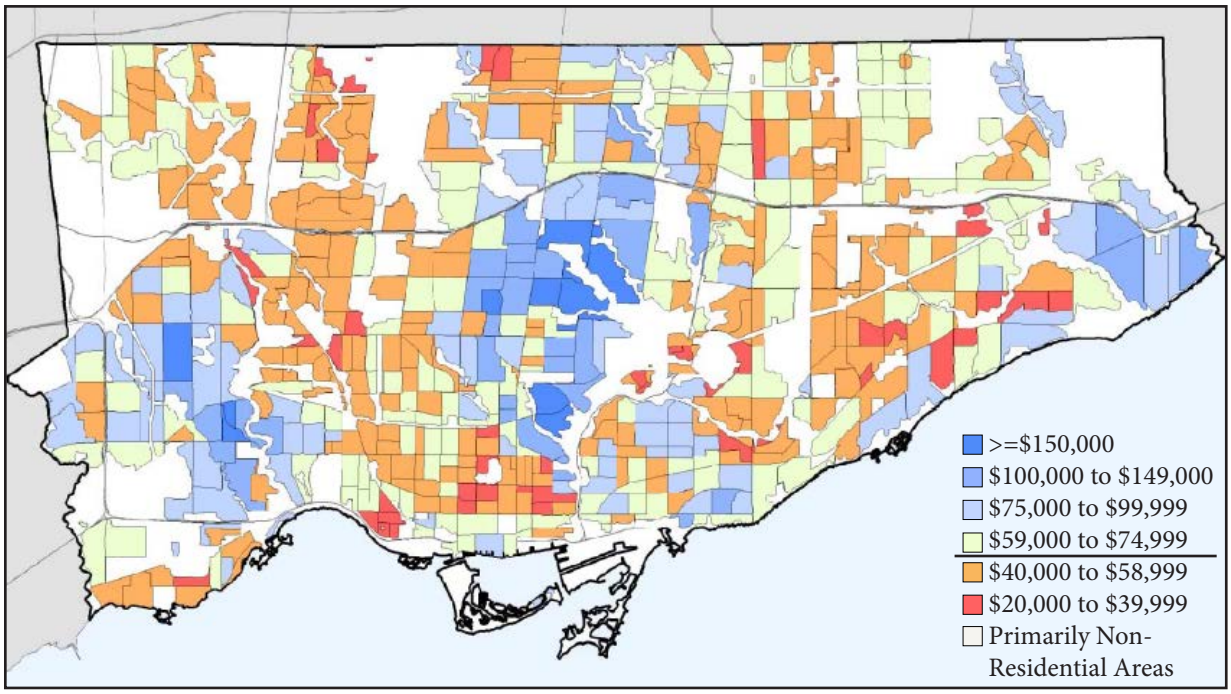
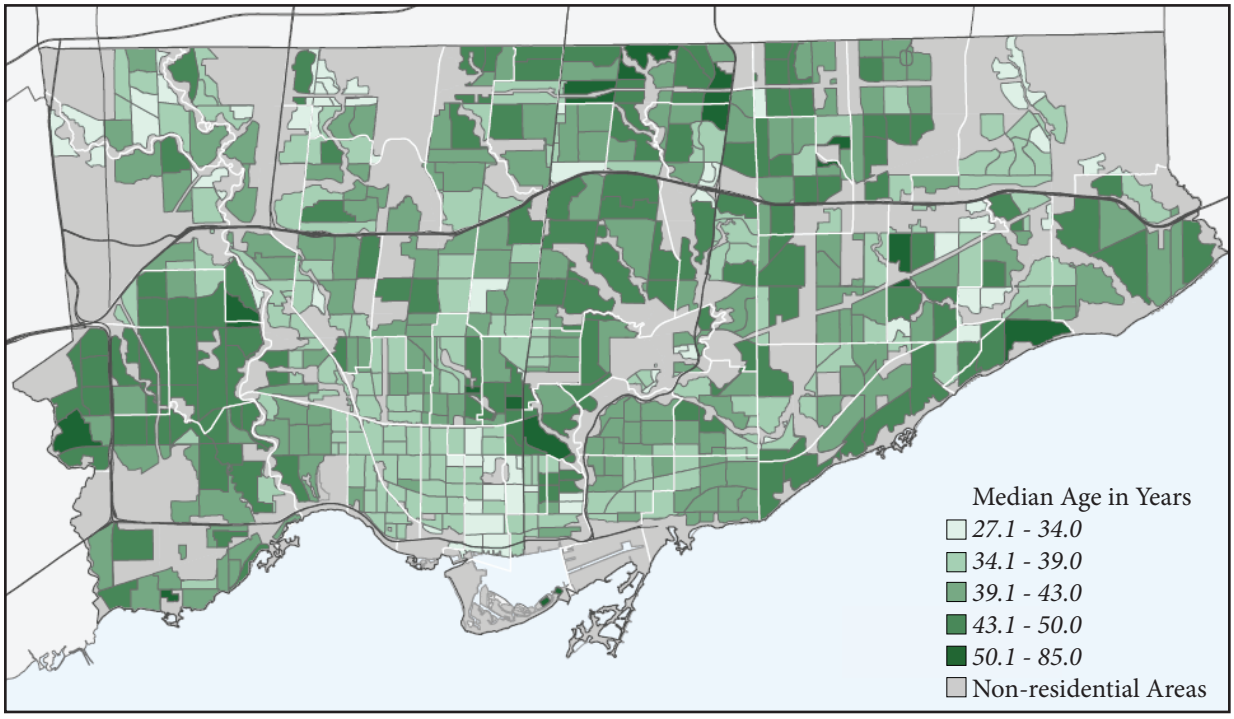
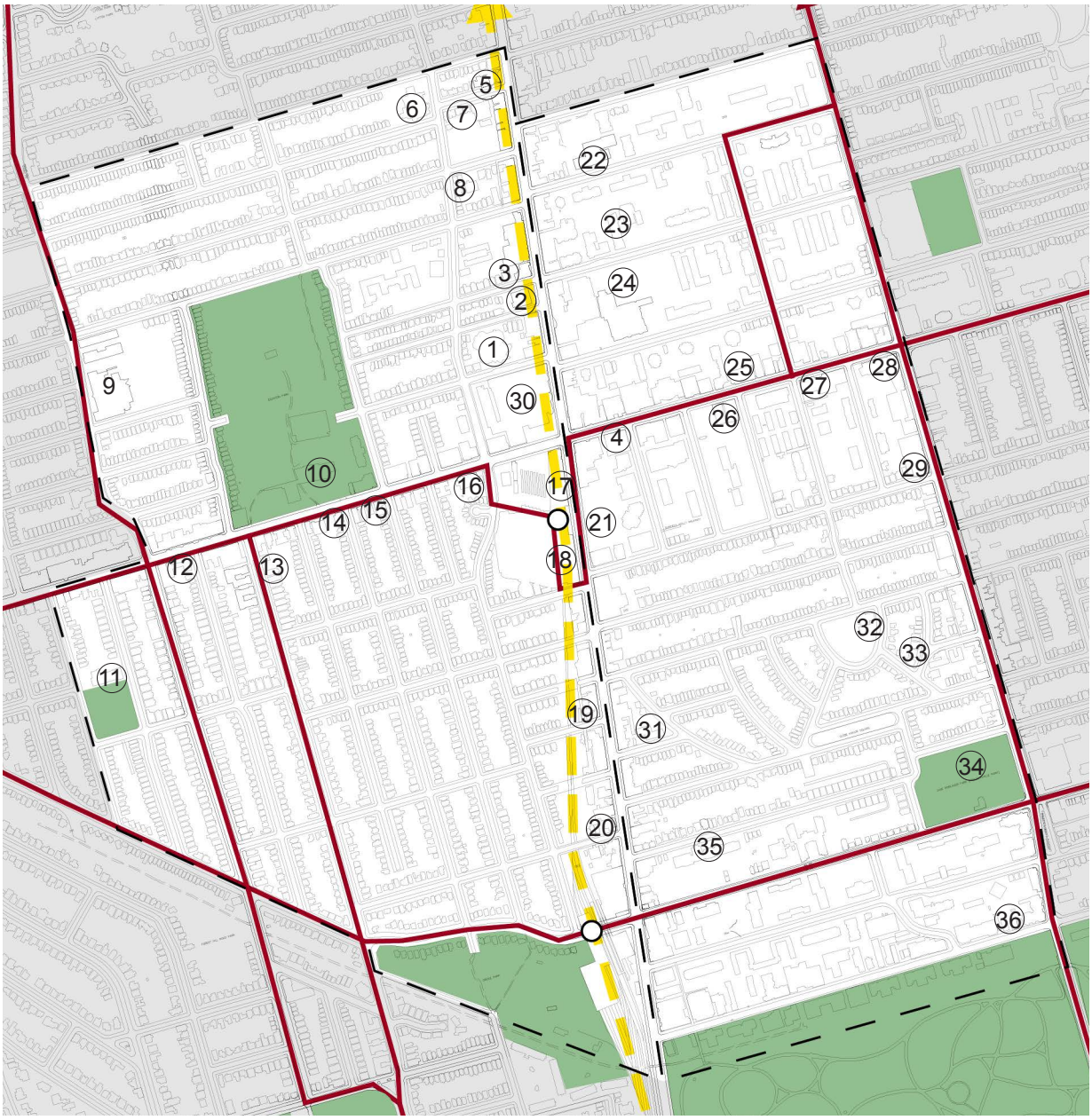


Fig. 5.13 City of Toronto Median Age





Key to Map:

1.Toronto Public Library, Delisle Youth Services; 2.Toronto Postal Station K; 3.Toronto Fire Station 134; 4.The Salvation Army; 5.Upper Yonge Village Daycare Centre; 6.St. Clement`s Anglican Church; 7.St Clements School; 8.Apostolic Church; 9.Marshall Mcluhan Catholic Secondary School; 10.North Toronto Memorial Community Centre; 11.Oriole Park Jr Public School, Children`s Majic Moments Child Care; 12.Petro; 13.Student Homestay Services; 14.Eglinton Veterinarian Facilities, Unity Church of Truth, Morley Bedford Funeral Services; 15.Toronto Independent High School; 16.Toronto Police 53 Division; 17.Movie Theatre; 18.TV Ontario; 19.Toronto Wedding Chapel; 20.Aboriginal Housing Support Centre; 21.Birmingham International College of Canada; 22.John Fisher Jr Public School; 23.St Monica Child Care Centre, Separate School, and Roman Catholic Church; 24.North Toronto Collegiate Institute; 25.Central Eglinton Community Centre; 26.Toronto School of Business; 27.Philippine Consulate General; 28.Eglinton Jr Public School; 29.Sobey's; 30.One Channel, Movie Theatre, Metro; 31.United Church; 32.Church of the Transfiguration; 33.Manor Montessori School, Mother Nature Daycare; 34.June Rowlands Park, Davisville Tennis Club; 35.Davisville Jr School, Metro Toronto School for the Deaf, Spectrum Alternative Senior School; 36.Moorelands Community Services

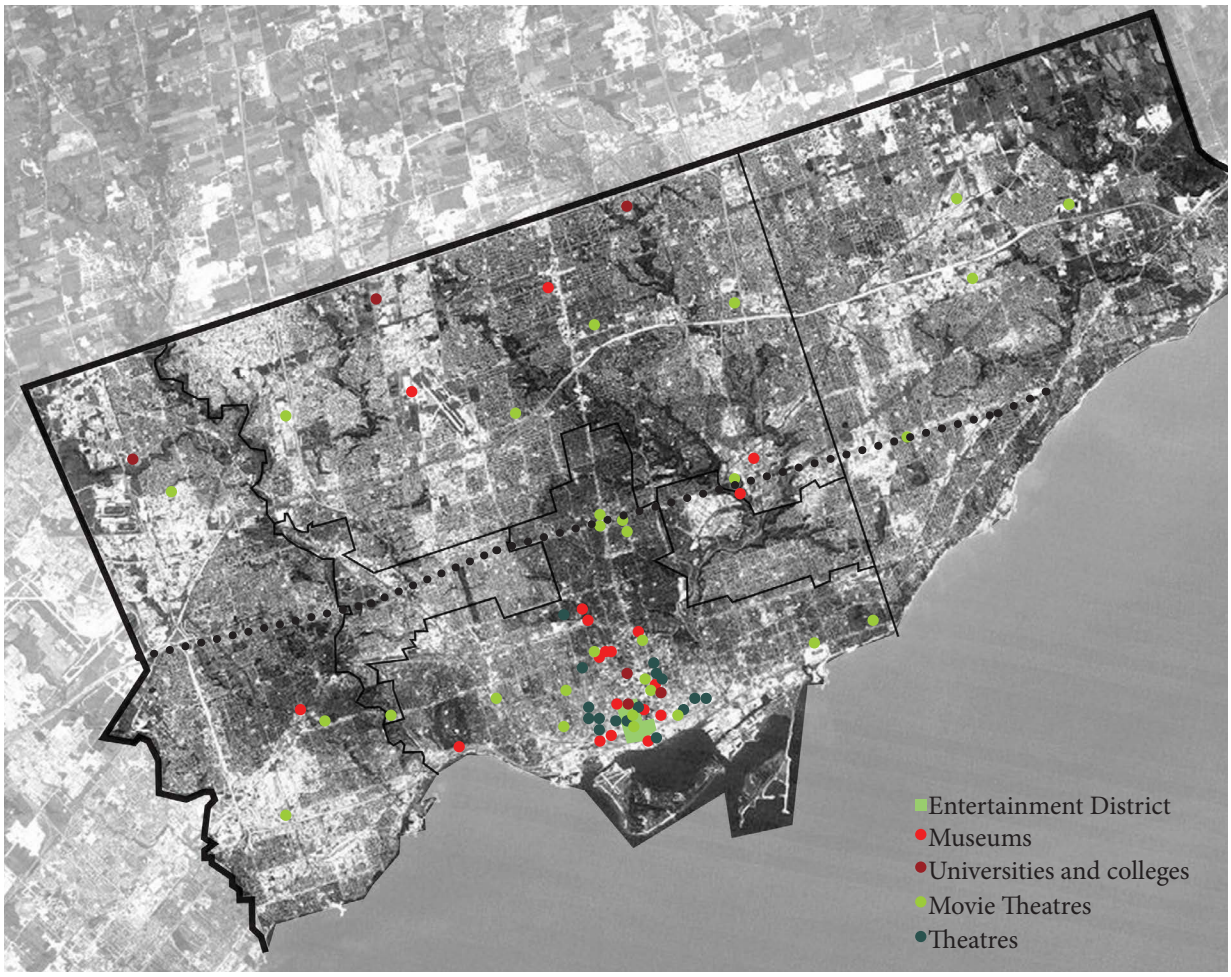


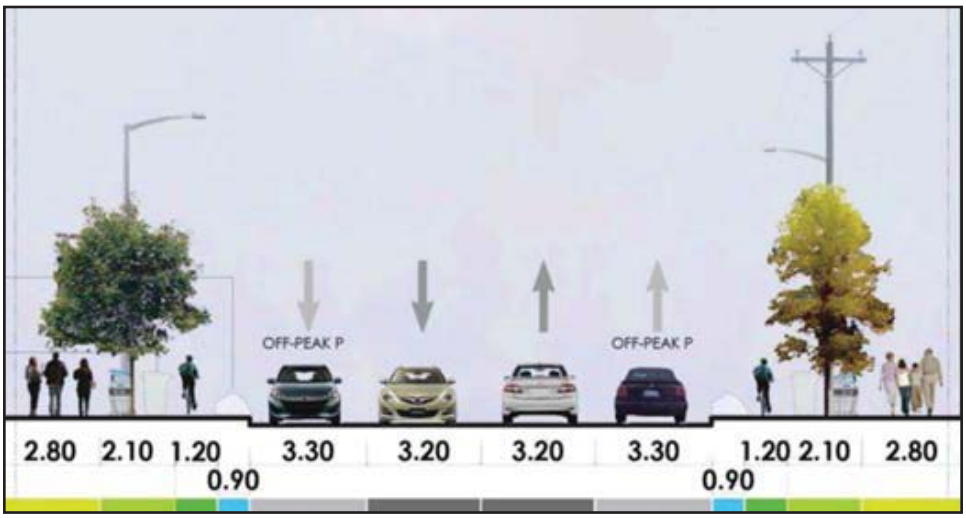
Fig. 5.15
Cultural and Entertainment based amenities in Toronto

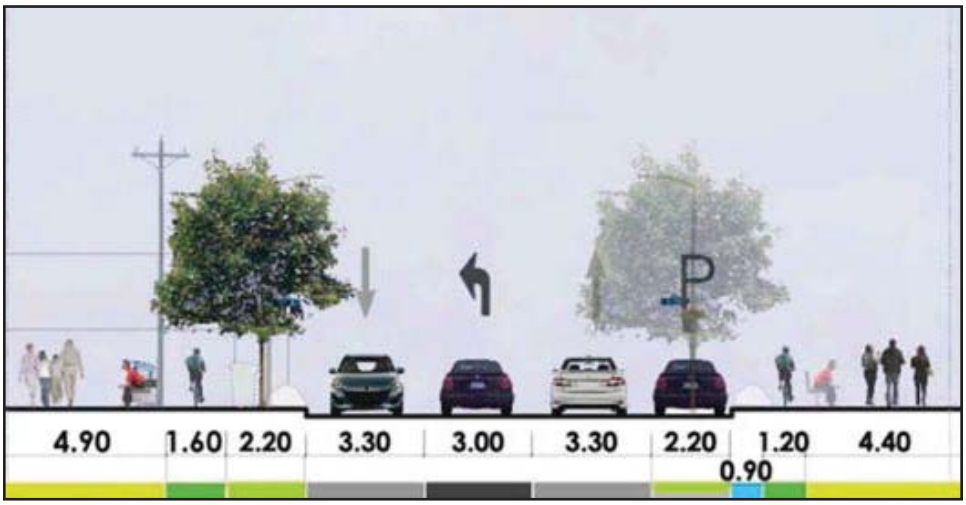
Other cultural attractions are more accessible by car, with locations close to major roads and highways. Residents of Yonge-Eglinton are well served by social and public amenities (libraries, post, police, schools, etc); these are mostly distributed close to main arteries of Avenue Rd, Yonge St, Mount Pleasant and Eglinton. People leave for the downtown core to find entertainment and cultural amenities, museums and theatres, and more shopping.

EGLINTON STREETSCAPE

With the development of a new LRT, the Eglinton streetscape is also slated for major changes. A team from urban design firm planningAlliance conducted the "Eglinton Crosstown LRT Corridor Planning Feasibility Study". The study includes recommendations for addressing the urban design of Eglinton Avenue as development proceeds spurred by the new rapid transit connection. The recommendations with respect to built form along the avenue

Fig. 5.14
Mapping Amenities Yonge-Eglinton Centre


OFF-PEAK P
OFF-PEAK P
2.80 2.10 1.20 0.90 3.30 3.20 3.20 3.30 0.90 1.20 2.10 2.80


P
4.90 1.60 2.20 3.30 3.00 3.30 2.20 0.90 1.20 4.40



include: encouraging mid-rise development along Eglinton through as-of-right zoning, implementing a built-form pattern, integrating LRT stations into development, transitioning into neighbourhoods, enhancing community facilities and public spaces, and to reinforce local character areas and heritage.[18] The recommendations with respect to 'Greening' include: creating a network of public open and green spaces, growing 'great' trees on sidewalks, connecting Eglinton to Humber and Don River Valley trails, implementing green transit and infrastructure, and coordinating public art.[19] Finally, the 'Travelling' recommendations include: creating a street useful to pedestrians, bicyclists, transit-users and drivers alike, right-size travel lanes, providing wide sidewalks, building a continuous protected cycling lane, maintaining parking supply, extending the network of rear laneways, and implementing boulevard guidelines for character areas.[20] The general intention is to create a streetscape which is equally designed for all to use, one which is 'green', and one which encourages mid-rise mixed-use development.

Fig. 5.16(a)
Typical four-lane street configuration, from "Eglinton Connects Recommendations"

THE FUTURE YONGE-EGLINTON CENTRE

CD Capital and Freed Developments will be making a billion-dollar commitment to the neighbourhood over the next five to ten years. 'We currently have four towers plus some retail that we're doing as a first phase,' he says. 'We're big believers that, if you look back ten years from now, it's going to be one of those moments where if you're not in, you're going to say 'Geez, I wish I had invested there.' I'm not going to say it's the new Yorkville, but there are some pretty smart people that invested in Yorkville a long time ago and it was transformed, and I believe in a similar way this LRT line will turn Yonge and Eglinton into a place that is much more valuable five, ten years down the road.' Mr. Cowan says.[21]

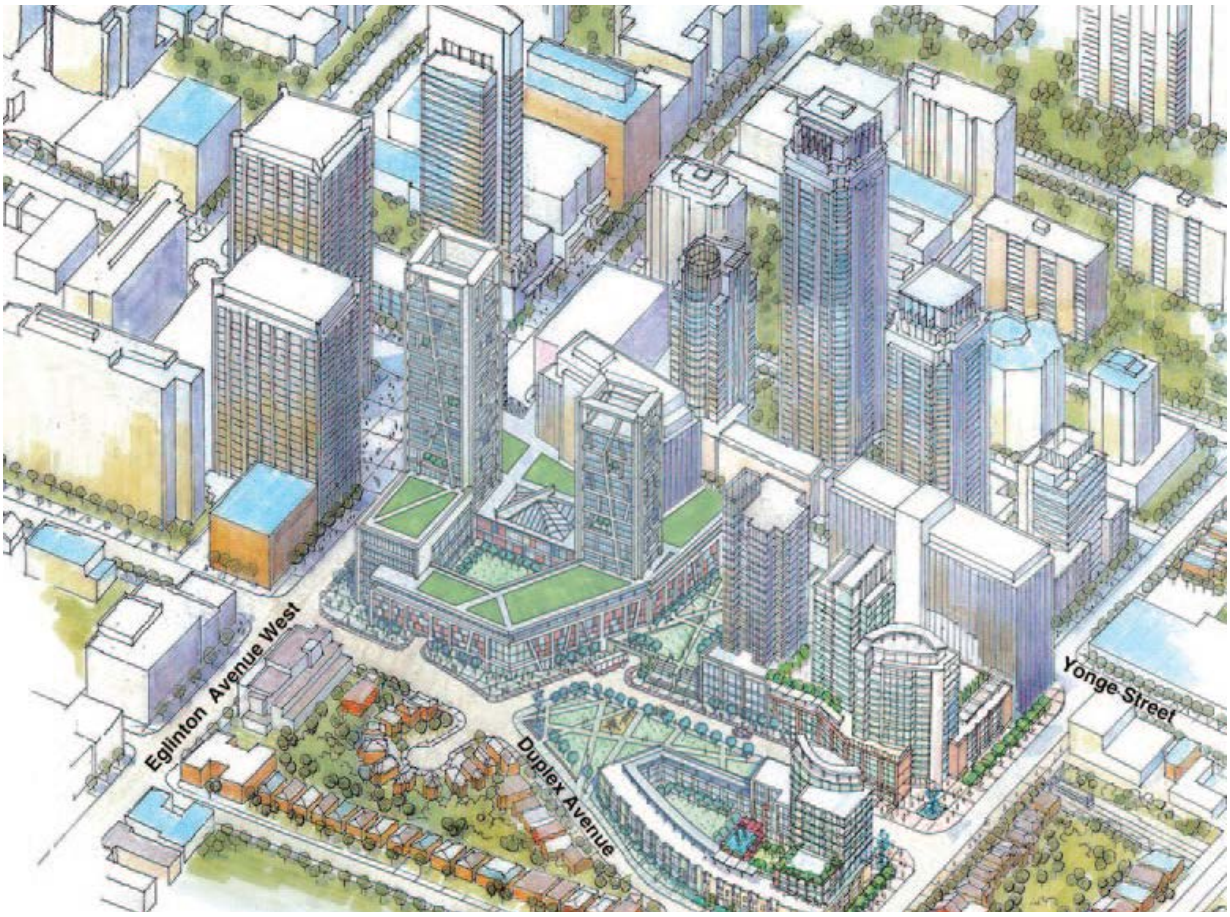
Fig. 5.16(b)
Typical three-lane street configuration, from "Eglinton Connects Recommendations"

Yonge-Eglinton Centre has the potential to become a northern 'downtown' hub for the city fed by its existing Yonge Street connection and densification along Eglinton. The existing downtown core is having issues with strain on its infrastructure – namely transit. For years, Torontonians have been asking for a downtown relief line but one is not yet in the books. There is overcrowding on the subways, buses and streetcars in the downtown core and its peripheries. Yonge-Eglinton Centre can be developed as a secondary hub in the city, taking on some of the cultural attractions typically reserved to the core, in order to relieve some of this strain and take on some of the density which will inevitably come from population and job growth predicted in the city.

Developers are taking notice of the potential for the area. Namely, RioCan has begun construction on the $100-million renovation and addition to the existing 1970's partly underground mall and office towers called 'Yonge-Eglinton Centre'. The overhaul includes the glazed recladding and skyward extensions on

Fig. 5.17
Vision for street life on Eglinton where LRT is underground




Eglinton Avenue West
Duplex Avenue
Yonge Street

two existing office towers, the addition of over 3,700 square meters of commercial and retail space, and the construction of a three story glass cube on the existing plaza to house the entrance to the mall, office towers and subway connection.[22] As mentioned in the opening quote, CD Capital and Freed Developments will be building a billion dollars' worth of condos in the neighbourhood over the next five to ten years.[23] The developers who began investing here have already started to see pay off. In North Toronto, the average selling price per square foot for new condos was reported in 2013 to have risen 18 per cent in the previous three years, to $636.[24]

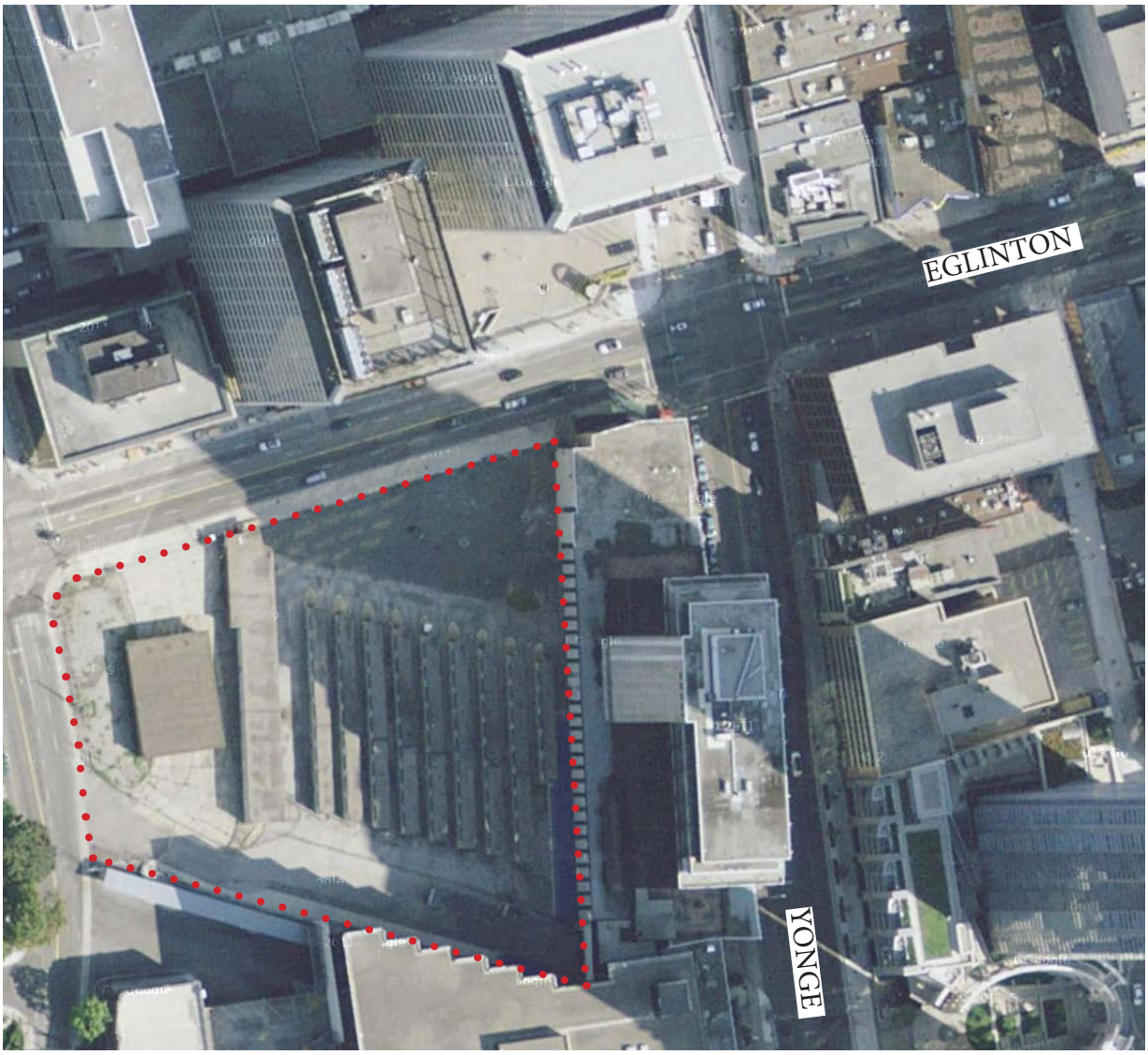
The Toronto Transit Commission owns a piece of land on the south-west corner of the Yonge and Eglinton intersection which is an incredible opportunity for the city to design a development which will connect directly to transit and foster the blossoming of the neighbourhood. This lot is the site for the thesis design project. In 2009, the city released a document titled "Yonge Eglinton Centre: Urban Design Guidelines". The document provides a list of explanations of urban design guidelines as well as a vision for development on the south west corner of the intersection.[25] The document calls for high-rise commercial and mixed-use towers with a focus on a pedestrian oriented streetscape for the neighbourhood. Images of the south-west corner envision high-rise towers on the east side of the site planted in a mid-rise platform which mediates with the low-rise residential character to the west. The city's intentions for the development and for further development in the area are for a hub dense with high-rise residential developments and office employment. But the area has the potential to be more than that.

Fig. 5.18
RioCan rendering for Yonge-Eglinton Mall at major intersection

In 2016, the Eglinton Tunnel Boring Machines from the west and east are scheduled to meet at the Yonge-Eglinton site. Metrolinx will build a shaft on the site to extract the machines and construct a new Eglinton Station. The time this construction is already happening is the perfect opportunity to reflect the newly invigorated life this Centre will be infused with, through new rapid transit, with development above and below ground which will house programmatic attractors which bring people from outside of the area to enjoy a renewed Yonge-Eglinton Downtown Centre.

Fig. 5.19
Vision for development from "Yonge-Eglinton Centre: Urban Design Guidelines"




EGLINTON
YONGE

5.3 A NEW YONGE-EGLINTON STATION

PROGRAMMATIC REQUIREMENTS

The proposed development at Yonge-Eglinton Station will be a part of the evolution of the neighbourhood into a destination in the city. The thesis proposes a development which rises above grade as well as straddles the grade line, and descends underground. The development will house office space in tower(s), an event/gallery space, a high-end restaurant hub, an underground parking garage, and a sunken public plaza, all connecting to the new intermodal interchange transit station. The intent is to design a cultural hub which connects seamlessly with rapid transit. New office space will add to the number of jobs found in the area. The event/gallery space and high-end restaurants will attract people from outside of the direct neighbourhood and signal the development of further similarly programmed projects. The underground parking will add convenience for the office workers and visitors alike. Finally, the sunken public plaza will connect all programs to the transit station and provide some open space to an intersection with very little.

Fig. 5.20
Photomontage: Existing Condition of South-West corner of Yonge at Eglinton

The new transit station will be designed for a similar capacity to Bloor-Yonge Station, where the Yonge subway line meets the Bloor-Danforth line. In theory, this is approximately the growth in density that can be predicted to occur at Yonge and Eglinton.

The transit station will require several ancillary facilities for proper function:

- Transit personal offices,
- Fare collection point
- Lounges and restrooms,
- Maintenance and janitorial rooms,
- HVAC and mechanical rooms,
- Storage facilities,
- and public toilets

The transit station will also house several public amenities for convenience:

- bicycle parking,
- commercial shops (including a newsstand, coffee outlet, other food vendors)
- an information kiosk
- and connections to the existing underground pathway system linking the station to the mall and four street corners

Fig. 5.21
Aerial view: South-West Corner of Yonge at Eglinton, thesis project site





Streetcar: 46 seated; 74 maximum



Bus: 36 seated; 48 maximum



Subway: 66 seated; 167 maximum (1,000 for a 6-car train)



Subway: 64-68 seated; 180 maximum (1,080 for a 6-car train)

BUILDING CODE AND ACCESSIBILITY

The new transit station must follow a comprehensive set of stringent codes and laws associated with function of use, safety and security, structural integrity, and accessibility. The Ontario Building Code (OBC) is the main standard for construction requirements. This document provides standards for construction and design; it contains a special section, Section 13 in Part 3 of Division B, outlining specific requirements for Rapid Transit Stations. Transit Stations, as a part of the public realm are also required to follow strict accessibility guidelines: the City of Toronto's Accessibility Guideline, the Ontario Accessible Built Environment Standard, and the Ontario Human Right's Code. As a society, we hold a growing value on the sustainability and accessibility. This means construction is expected to be durable, energy efficient and accessible for all, including those with disabilities. In Appendix A, a list of prescriptive requirements for Transit Station Design which affect the overall design and layout directly can be found. Requirements are largely concerned with the effect of large numbers of people circulating through at once; but a major concern also is the potential for a train fire in the very contained space. In this instance, all passengers on board the train would have to seek egress from the subterranean platforms, the fire and smoke would have to be contained and put out. While this sort of occurrence happens extremely rarely it is a driver for functional design, particularly after the events on September 11th 2001.

Fig. 5.22
New Eglinton LRT vehicle designed by Bombadier. Capacity: 163 maximum (490 maximum with 3-car train)

The functional requirements of transit stations have often been the primary driver behind their design. As seen in the precedent studies of the previous chapter, this does not have to mean the end of creativity and conceptual exploration. Inspiration can be drawn from the technical difficulties associated with underground architecture. The repetition of the structural system can mimic the rhythm of the train's sounds and movement. The mass of a concrete shell can contrast with the lightness of human scaled inserts such as stairs and railings. The multiple required circulation elements can inspire a playful subterranean labyrinth. The role of the architect is to find the beauty possible amongst the systems of utilitarian needs.

Fig. 5.23
Capacity of transit vehicles, from TTC.ca

UNDERGROUND CONSTRUCTION

Modern underground construction is a feat of engineering. The existing 1954 Yonge line was built using a cut and cover technique while the new Eglinton line is being built using tunnel boring machines (TBMs) called binocular construction. In the cut and cover construction technique, a trench is excavated, the planned structure is built and the excavated fill is used to recover the tunnel.[26] This is typically done along streets on more shallow builds such as a subways or


DENNIS
LEA
ON
MBER
Ontario
METROLINX



sewer systems. In the Crosstown Project, the tunnel boring machines Metrolinx are using are about 81 meters long and weigh 511,000 kilograms. They are creating tunnels 6.5 meters in diameter, at a rate of 10 meters per day. The scale of these machines (as seen in the images on the opposite page) is really incredible. The TBM propels itself forward by pushing on precast concrete liners, which it places on the tunnel walls as it drives through. This all occurs 16-20 meters below ground, creating barely a rumble above ground.[27] This technique is convenient to use in denser urban areas as it does not disrupt the ground level save for a few shafts for entry and exit of the TBMs. In the case of the Eglinton LRT, the tunnels also had to be quite deep to be built below the existing Yonge-University-Spadina Subway connections at Allen Road and Yonge Street. As technology improves, underground construction becomes more convenient.

Fig. 5.24
Tunnel Boring Machine for use on Eglinton tunnels, *humans for scale* (press photo)

Fig. 5.25
Tunnel Boring Machine being built in the pit at the western most end of the Eglinton tunnel

CONCLUSION

In a dense city like Toronto, urban planners design infrastructure to access the city primarily through public transit. Density of this level does not support widespread car use. And so, rapid transit expansion, a key figure in the accumulation of the underground city, is also important in the urban plan of a city. The design of Yonge-Eglinton Station affects not only its local neighbourhood, but also the future of said neighbourhood, and the future of Toronto. This building should be designed to accommodate growth, to nurture said change.

Major growth is expected to occur along Eglinton Avenue in the form of population density, and employment. This growth has the potential to create Yonge-Eglinton Center as a secondary downtown core in the city, fed by growth along Eglinton and its connection to the current core at Yonge. The redevelopment of Eglinton Station, to include a cultural attractor as well as address the functional requirements of the growing users of the station with the addition of the connecting line, is a strategic initiative designed to foster this potential. This will allow density to spread farther north from the already dense and growing downtown.

ENDNOTES

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2. City of Toronto, *2011 Census: Population and Dwelling Counts Backgrounder* (Toronto: February 8, 2012): 1.
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13. City of Toronto, "Map 2 – City of Toronto Population Change 2006 -2011" in *2011 Census: Population and Dwelling Counts Backgrounder,* 11.
14. Profile Toronto, *Toronto Employment Survey 2012*, prepared for Toronto City Planning (Toronto: February 2013): 6.
15. Profile Toronto, "Table 6 – Work or School Location" in *Living in Downtown and the Centres*, 14.
16. City of Toronto, "Map – City of Toronto Median Age" in *2011 Census: Age and Sex Counts Backgrounder* (Toronto: May 29, 2012): 15.
17. Tara Perkins, "Yonge and Eglinton's billion dollar makeover," *The Globe and Mail*, May 31, 2013, http://www.theglobeandmail.com/news/toronto/yonge-and-eglintons-billion-dollar-makeover/article12296984/.
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25. Toronto City Planning Urban Design, *Yonge Eglinton Centre: Urban Design Guidelines* (Toronto: January 2009).
26. John Carmody and Raymond Sterling, *Underground Space Design: A Guide to Subsurface Utilization and Design for People in Underground Spaces* (New York: Van Nostrand Reinhold, 1993): 70.
27. "Tunnel Boring Machines Backgrounder," Metrolinx, Eglinton Crosstown, accessed June 23, 2014, http://www.thecrosstown.ca/the-project/fact-sheets/tbm.

EVOCATIVE INFRASTRUCTURE

PART 6

6.0 EVOCATIVE INFRASTRUCTURE

6.1 THE URBAN CAVE

Design Concept
Poured Models
Structural Concept

6.2 AN INTERMODAL INTERCHANGE

At-Grade Plan
Below Grade Plan

6.3 EXPERIENTIAL DETAILS

Sunken Garden
Nature on Display
Undulating Roof
The Old and the New

6.4 CONCLUSION

The alienation provoked by contemporary buildings is further compounded by the way they are assembled by factory-made components in contrast to the hollowed-out cave or hut that has been scooped and moulded by hand in a way that we cannot resist empathising with.[1]

Peter Buchanan

The aesthetic of the cave has to do with its statics; the pressure from the surrounding masses of earth engenders the doubly-curvatured surfaces. … it is a cave.

…

The differences between constructing upon and up above the ground and digging out in and down into the ground are obvious. In the ground, Cartesian geometry has lost its specific constructive reasons.[2]

Kjeld Vindum

Fig. 6.1
(opposite, full page)
Poured form making





6.0 EVOCATIVE INFRASTRUCTURE

The following images are model and collage explorations of the underground condition and the urban cave.

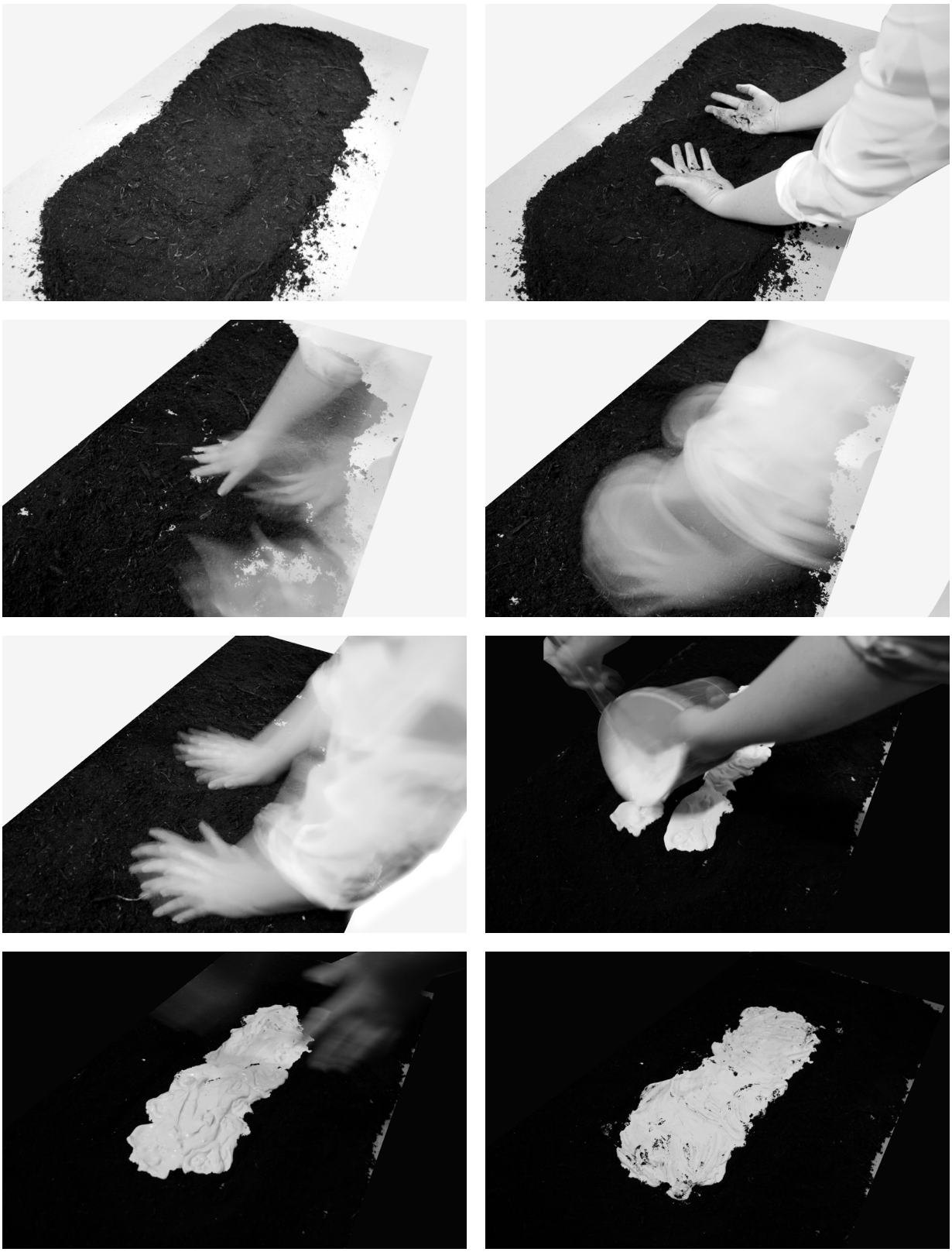
Fig. 6.4 - 6.19
(page 135-136)
Making of the Cave

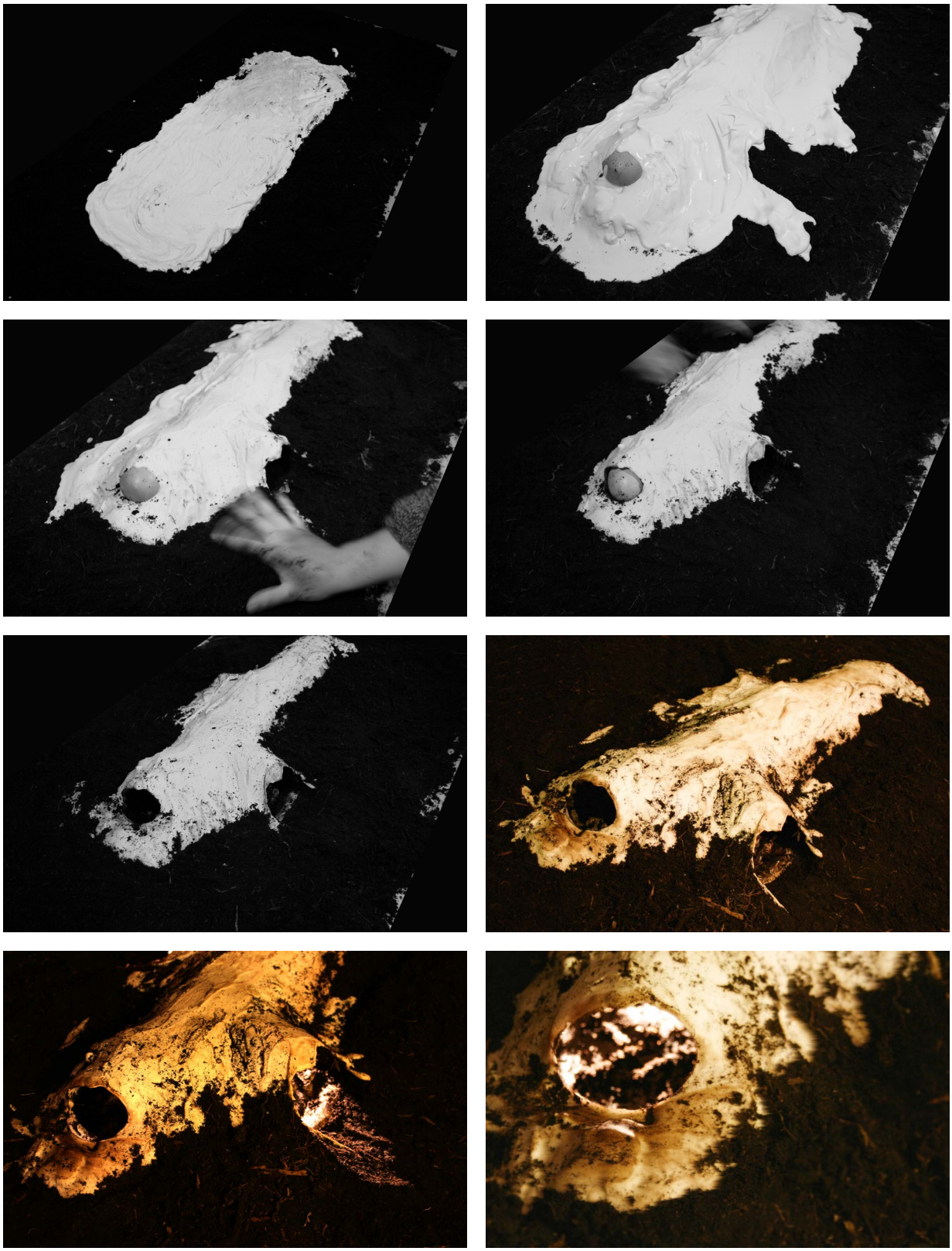
Fig. 6.20 - 6.23
(page 137-138)
Occupying the Plaster Cave

Fig. 6.24- 6.25
(page 139)
Vignettes: Ofelia encountering the memories of the urban cave

Fig. 6.26
(page 140)
Collage Section: A rift in the surface

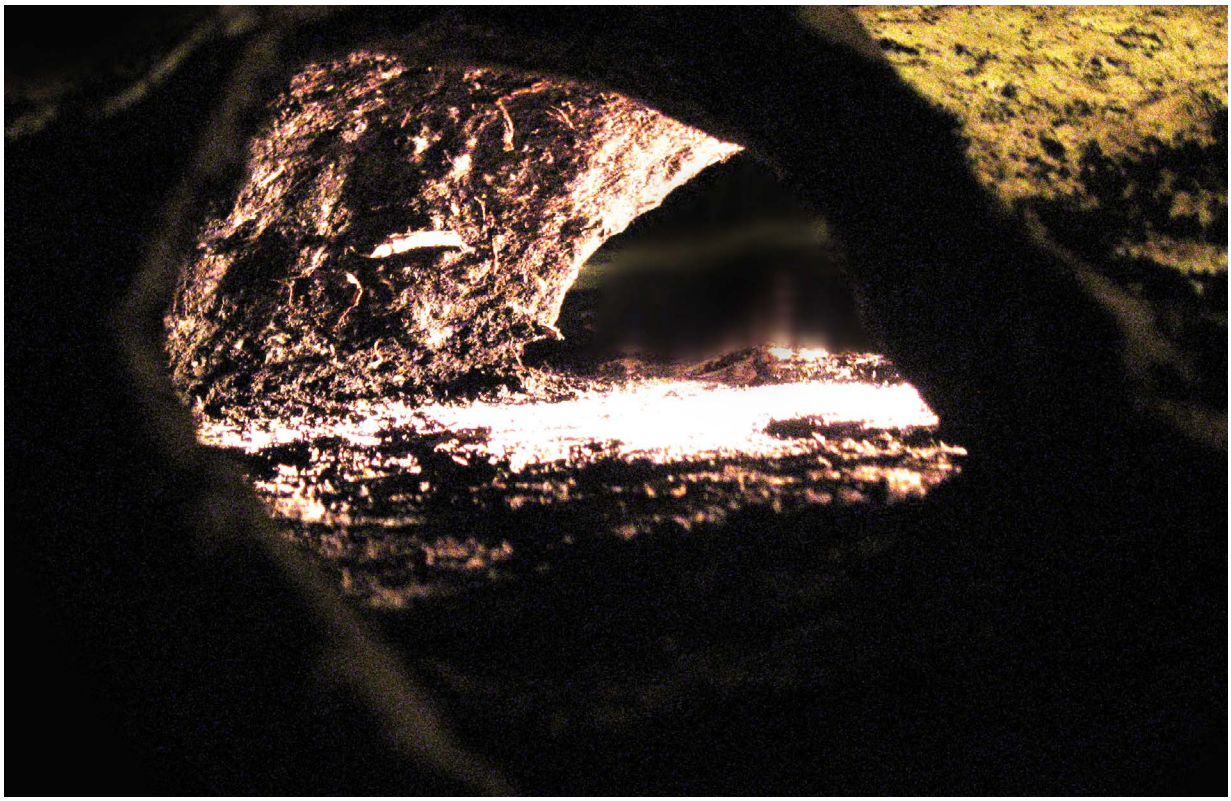
Fig. 6.2 - 6.3
(opposite)
Vignettes: The Earth formed cave

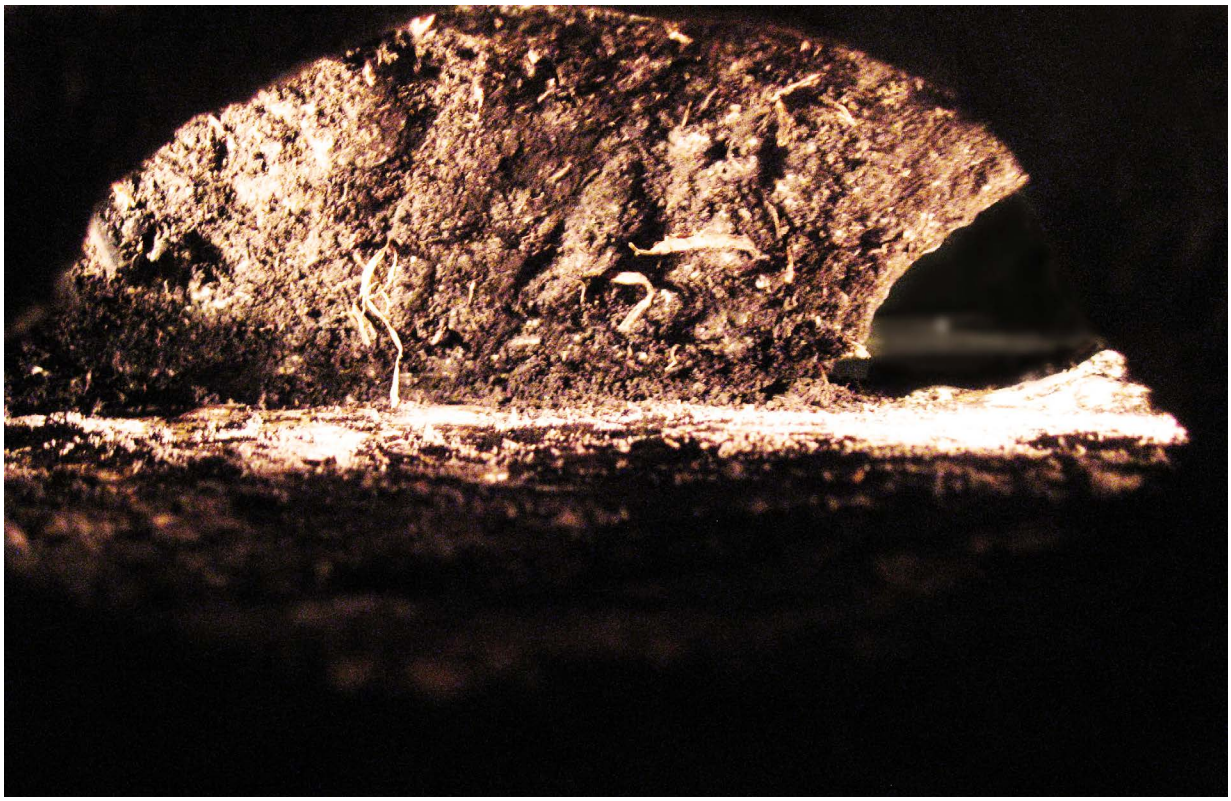








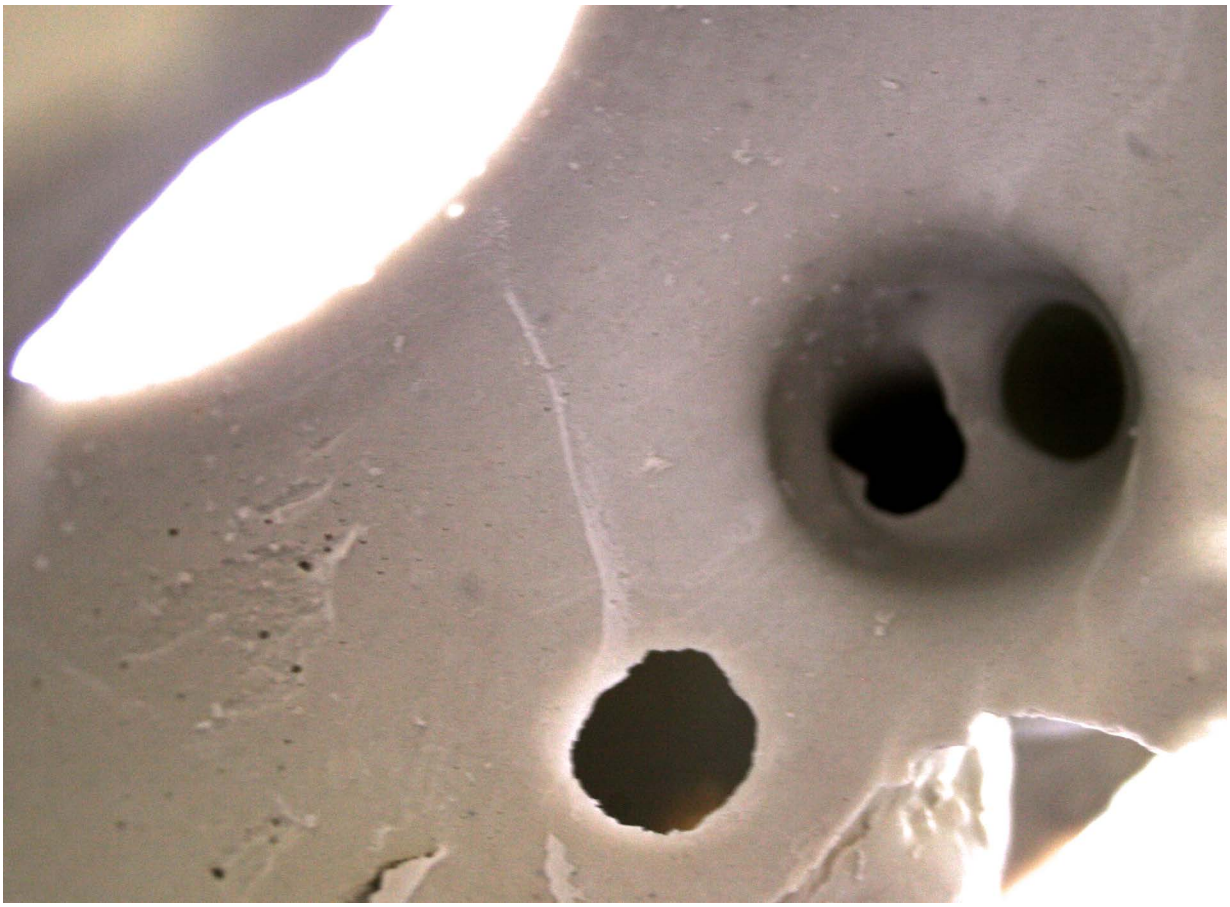


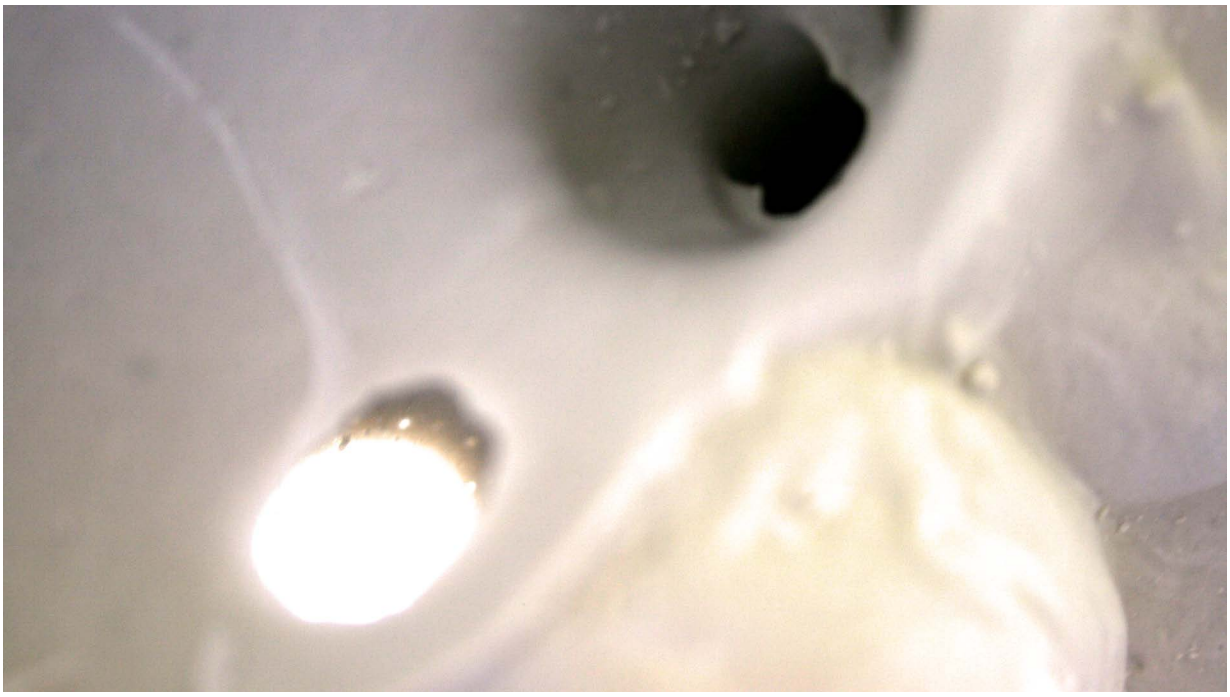





CAUTION
CAUTION







6.1 THE URBAN CAVE

DESIGN CONCEPT

The intent is to create an architecture which celebrates the underground condition; an architecture which takes advantage of the evocative qualities inherent in the underground. The Urban Cave sits just below the surface. You are led to its depths by the sound and sight of water flowing downwards with gravity. The spaced is carved from the earth; its limits are defined by a fluid, playful concrete shell. The concrete thickens under the weight of the earth, becomes a mere line towards openings to the sky. Light penetrates the openings and resonates on the surface of the shell, the form glows.

You are at home grounded in the earth. While your body is grounded, your mind is free to wander amidst the white noise of the rumbling subterranean trains and bustling commuters. The forms blur as they move swiftly past. In a moment you become connected to the architecture. Your body occupies the curve of the window sill, the undulating roof. You see the smooth wall descend past the edge of the steel floor platform and run your hand along its surface. A moment later, you see your train arriving reflected in the glass rail. You return to your commute; grab hold of the shiny, cold steel railing and descend to your platform.

POURED MODELS

I explored the potential spaces possible in a poured concrete shell structure through test plaster models. In these models, balloons are placed to form cavities and plaster is poured over them into a mould. The balloons have to be held down as the buoyant force in the liquid plaster pushes the bubbles to the surface. The cavities formed were then held in the sun light and photographed. Images were manipulated to contrast the light and dark tones in order to emphasize the light and dark areas. The resultant images are evocative depictions of glowing space. The contrast between the glowing white openings and dark shadowy cavities is dramatic. This is the sort of effect I am looking to achieve in moments in the transit station. The concrete shell will be the focal point of the spatial composition. Human structures (stairs, floor platforms, elevators) will be designed to be as light as possible. They will float within the glowing curvaceous spaces of the concrete shell which holds back the surrounding earth.

Fig. 6.27 - 6.28
Manipulated images from plaster models





STRUCTURAL CONCEPT

The urban cave juxtaposes the mass of a subterranean structure with the light efficiency of human scaled inserts. The all-encompassing mass of the cave is expressed through an undulating concrete shell. The shell envelopes you as you descend into the earth, opening into a large cavern holding the train platforms. The smooth, playful curvaceous concrete shell is juxtaposed with the light steel interior structures: a response to the rigorous utilitarian spatial planning requirements for transit station design.

The sculptural shell is both formed with and carved from the earth. The proposal is inspired by the Teshima Art Museum in Japan by architect Ryue Nishizawa of Japanese architecture firm Sanaa. Like the Teshima Art Museum, the proposal begins with forming the negative space of the underground cavern out of packed earth. Then, preformed rebar is laid and tied. The concrete is poured over the formed negative space, and after the concrete sets, the earth is excavated revealing the cavern. The result is a sculptural three dimensional massive form, massive both in scale of depth and in scale of shape. Its form is a response to the fluid motion of people and trains moving through the space. Its size is a reaction to the large forces acting against it: gravitational forces act uniformly against the entire form, the buoyant force of the earth pushes the cavern in from all sides, and the live loads effected by weather and people above act on protruding elements. Part of the power of the underground structure is the hint of the sublime present in its overpowering scale. The scale is beyond that of human empathy. The dweller feels beautifully small. The concrete form contrasts with the sharp, Cartesian lines of the steel inserts: vertical circulation elements, raised floor platforms, and train platforms. The clean lines of these elements respond to the functional requirements for the circulation of transit stations. Together, the dual structural systems sing. Each complements and reinforces the spatial particularities of the other. The ways in which they work together are first laid out in the new station plans and examined in the details which follow.

Fig. 6.29 - 6.30
Precedent: Teshima Art Museum by Ryue Nishizawa of Sanaa

EGLINTON

YONGE

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6.2 AN INTERMODAL INTERCHANGE

AT-GRADE PLAN

The proposed massing plan above grade is designed with the intent of creating some open space in a densely built up neighbourhood, to signal the presence of development below, and to foster the vision for Yonge-Eglinton Centre as a secondary downtown. The plaza is hugged by a ten storey office building with restaurant units on the ground floor on its southwest side and an event / gallery space on the south side. The existing building on Yonge can be re-clad with a more porous cladding material like glass facing the plaza. The alteration of this building, to give it a more modern cladding and potentially add some storeys, is in keeping with the development happening all around it in the neighbourhood. The existing entrance to Eglinton station will be maintained for its ideal location right at the corner of the intersection. A second entrance will be built accessed from the sunken garden.

The plaza is activated by the undulating form of the concrete shell below. The shell folds up to form the roof of the Gallery and the platform for the office tower. The shell folds down into a ramp which turns into a sunken garden. This sunken garden provides access to the underground station. A water feature begins the flow of water from grade level, trickles down the ramp and ends in another water pond at the lower level. The sound and sight of water moving with gravity leads the commuter down, it acts as a haptic signal of the development below grade.

KEY:

1. *Restaurant Leasable Unit*
2. *Ramp to Underground Parking Garage*
3. *Office Building Lobby*
4. *Storage / Mechanical*
5. *Gallery / Event Space*
6. *Sunken Plaza and new Entrance to Station*
7. *Existing Entrance to Station*
8. *Service Lane*

Fig. 6.31
Yonge-Eglinton
Centre At-Grade Plan

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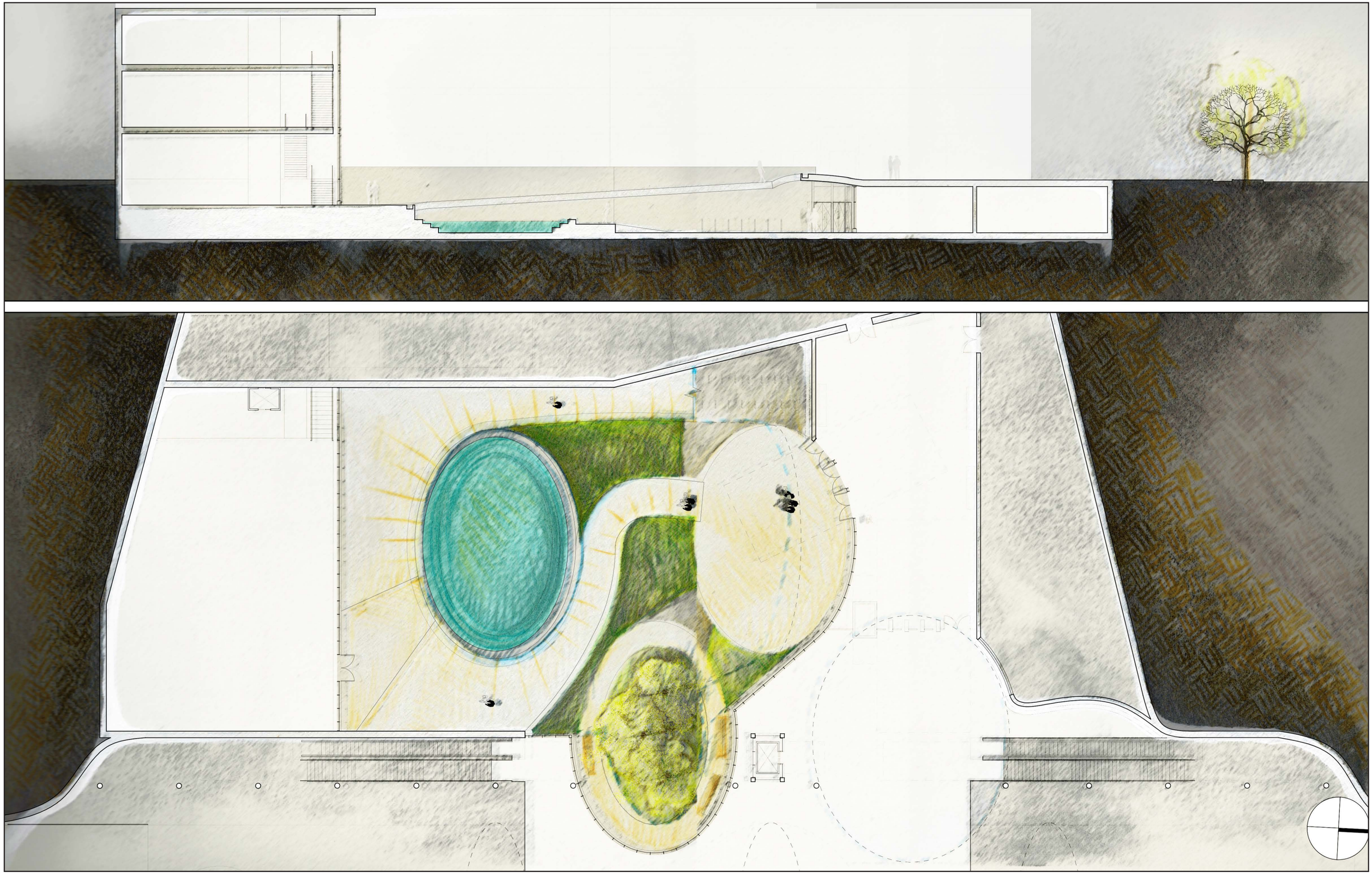
BELOW GRADE PLAN

Below grade the undulating form becomes the roof of the urban cave. The sunken plaza provides access to the lower level of the event / gallery space, the underground parking garage and the transit station. Both rapid transit lines run parallel in a large cavern. The Yonge line needed to be moved from its current track due to complaints of overcrowding on the small sixty year old platform in the existing station. The proposal maintains the existing station as an emergency track (or possible film set like Lower Bay Station) but moves the main track right outside of the foundations of the existing building. There, with the tracks running side-by-side, commuters on the Southbound Yonge line can transfer to the Eastbound Eglinton line simply by walking across the platform. Commuters making other transfers are able to see with ease which track they must get to in order to catch their train. The circulation system of the station becomes extremely efficient and easy. The layout of skylights above adds another dimension to the circulation system, guiding commuters up from the train platforms. The central supervising station sits at the new entrance to the station with a view overlooking the train platforms. This space was designed as if it was carved from the flow of circulating passengers. The wave form of the roof undulates with the rhythm of their movement. Rifts in its form open into skylights, setting it aglow.

KEY:

1. *Parking Garage*
2. *Gallery / Event Space*
3. *Entrance from Sunken Plaza*
4. *Central Supervising Station*
5. *Westbound Eglinton Platform*
6. *Eastbound Eglinton & Southbound Yonge Platform*
7. *Northbound Yonge Platform*
8. *Bus Access Dock*
9. *Existing Yonge Station Mezzanine level (renovated)*
10. *Existing entrance from Yonge at Eglinton*
11. *Security Office*
12. *Yonge-Eglinton Centre Mall*
13. *Public Restrooms*
14. *Leasable Areas*

Fig. 6.32
Yonge-Eglinton Station Below Grade Plan



6.3 EXPERIENTIAL DETAILS

SUNKEN PLAZA

You are led from the sound of cars whizzing past and people bustling around you on the sidewalks into a quiet, sloped plaza by the sound of water rustling downwards. You follow the sparkle of the water in its descent to a pond in the sunken garden. You sit on the step next to the pond running the tips of your fingers along the surface of the water. You walk further along the slow ramp and sit in a covered opening which straddles the space between the garden and the transit station. As you sit you watch commuters come and go through the doors to Yonge-Eglinton Station. You look up at the building sitting opposite when you hear the sound of music. You see a pianist performing for a small audience. The slow cadence of the music matches the movement of the commuter's legs as they saunter up the ramp, enjoying the sun reflected off the water. You dwell in this sunken garden, occupying the space between the city above and the transit station below. Grounded, you allow yourself to be enveloped by the concrete architecture.

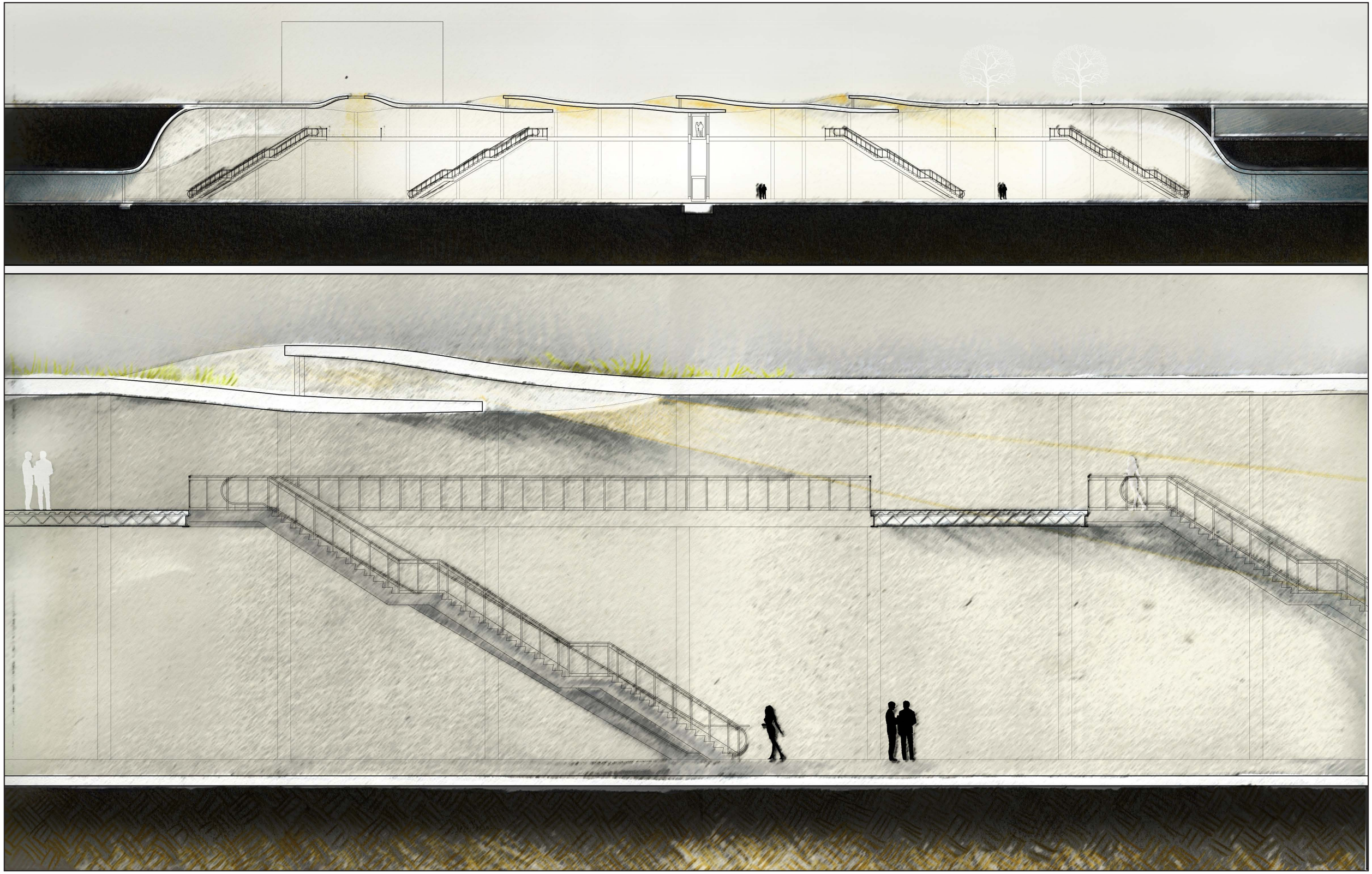
Fig. 6.33
Section, Below Grade
Plan of Sunken Plaza



NATURE ON DISPLAY

Sitting in the shade of some trees in the sunken garden you realize you are in a display case of sorts. You are in a rounded space, surrounded by glass windows with a small collection of small trees and greenery in the center. Through the glass is the transit station. You see yourself looking into the glass trying to catch the glimmer of moving people and trains on the other side. As your eyes become acclimated you see past your own reflection in the glass and in the flickering shadow of the tree's body of leaves you begin to see details in the station. But this glazed space is not meant for you to look in; it is meant for commuters to look out. In this urban cave, there is no sign of nature but the reflections off the surface of the ponds and these trees on display. You feel vulnerable. As you look further, you see the soft glow of light emanating from an undulating roof. The sensual flow of the roof beckons you inside to explore further.

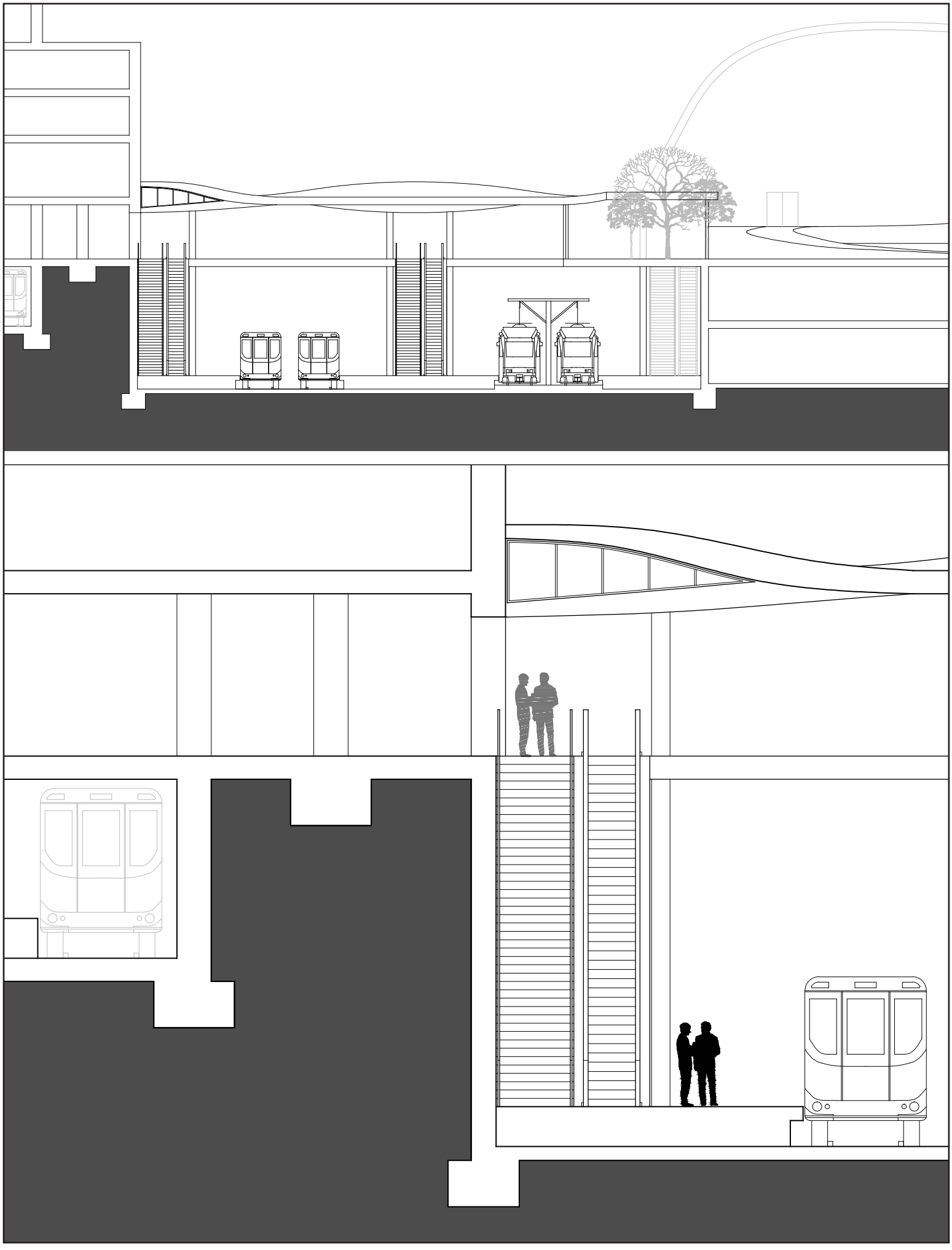
Fig. 6.34
Axonometric Drawing showing relationship between sunken plaza and mezzanine level



UNDULATING ROOF

You are captivated by the sensual power of the curvature of the roof. You begin to feel an ache in your neck and a gust of air signals someone bustling past you; you realise you have been standing watching the curve of the roof's lines for longer than intended. The glow of sunlight emanates out of its folds. It softly reflects off the surface of stair treads, glimmers on the stainless steel handrails and glass baluster. You see the light glowing on the faces of commuters as they become visible rising up on the escalators. The light leads them up from the darkness of the depths of this cavern: from the train platforms below. You feel small surrounded by the swell of these enormous concrete waves. You realize these were the forms which swell up to form the terrain of the plaza off of Eglinton. The same swells where you saw people laying, enjoying the sun, are now reflected above you. Below ground they take on a different nature. They envelope the space rather than frame it. You follow the shell as it descends past the edge of the steel floor platform, down into the dark lower platform. Here, the roof becomes wall where it flows into the darkness of the train tunnel.

Fig. 6.35
Sections cutting through Undulating Roof



THE OLD AND THE NEW

The organic form of the roof ends abruptly at the juncture between the new and the old Eglinton Station. The mezzanine level of old Eglinton Station remains a part of the new larger station, a reminder of the sixty year old vision of underground architecture. The heavy rectilinear, low-ceilinged, fluorescent-lit old space stands as a vast contrast with the new curvaceous structure with sleek steel interior inserts. You watch people streaming from the darkness of the old station into the new open cavern. Here, the condition of being underground is not a negative one. There is protection and sensuality to the underground condition. There is no lack of daylight, space does not feel claustrophobic. The space breathes; it swells with people and seamlessly expels them. They act as a fluid, carving their way through the space; they move against the force of gravity: out of the earth.

Fig. 6.36
Sections showing undulating roof and its connection to the existing building

6.4 CONCLUSION

The intention of the thesis, as stated in Part One, is to discover what makes an underground architecture which celebrates the conditions inherent in it being there. Through a phenomenological exploration, it was found that inspiration can be found in complimenting the evocative potential in underground occupation with the functional requirements society assumes for construction. The design proposal works to create an architecture where these dual motivators complement each other to form a complete system. The proposal seeks a sensual transit architecture inspired by the perceptual subterranean experience where one feels grounded, protected in an urban technological cave.

Cultural imagery associated with the underground influences the perception and experience of subterranean architecture. Through exploration of the spatial archetypes associated with the underground and their depictions in examples of art, film and literature, it was found that the underground carries with it a very strong cultural weight. Negative associations, which have plagued the construction of underground architecture in the past, include bleak darkness, danger, repression, disconnect from nature, repulsion of dirt, and the inevitability of death and decomposition. While these can be difficult to overcome, there is also a certain magic to the underground found in its more positive associations. These include: fertility of the earth, protection offered by the cave, the advent of technology, and the possibility of a fantastical realm past the portal demarcated by the grade line.

As technology improves and cities continue to grow in density, the affectations associated with the underground are shifting towards the positive and the urban realm is descending below grade. Architectural precedents from the last few decades show underground architectures which celebrate the experiential potential in subterranean design. The archetypical underground construction is breaking from its traditional dark box. Precedents find inspiration in the differences between design above ground and below: the ability to carve three dimensional space from the earth, the notion of attracting light into space versus filtering it, and the bodily relationship to an architecture which is at a scale unfamiliar to or larger than the occupant. The investment in these incredible and sometimes high budget pieces of architecture proves recognition of the importance of the underground city in the urban realm of the modern Western metropolis.

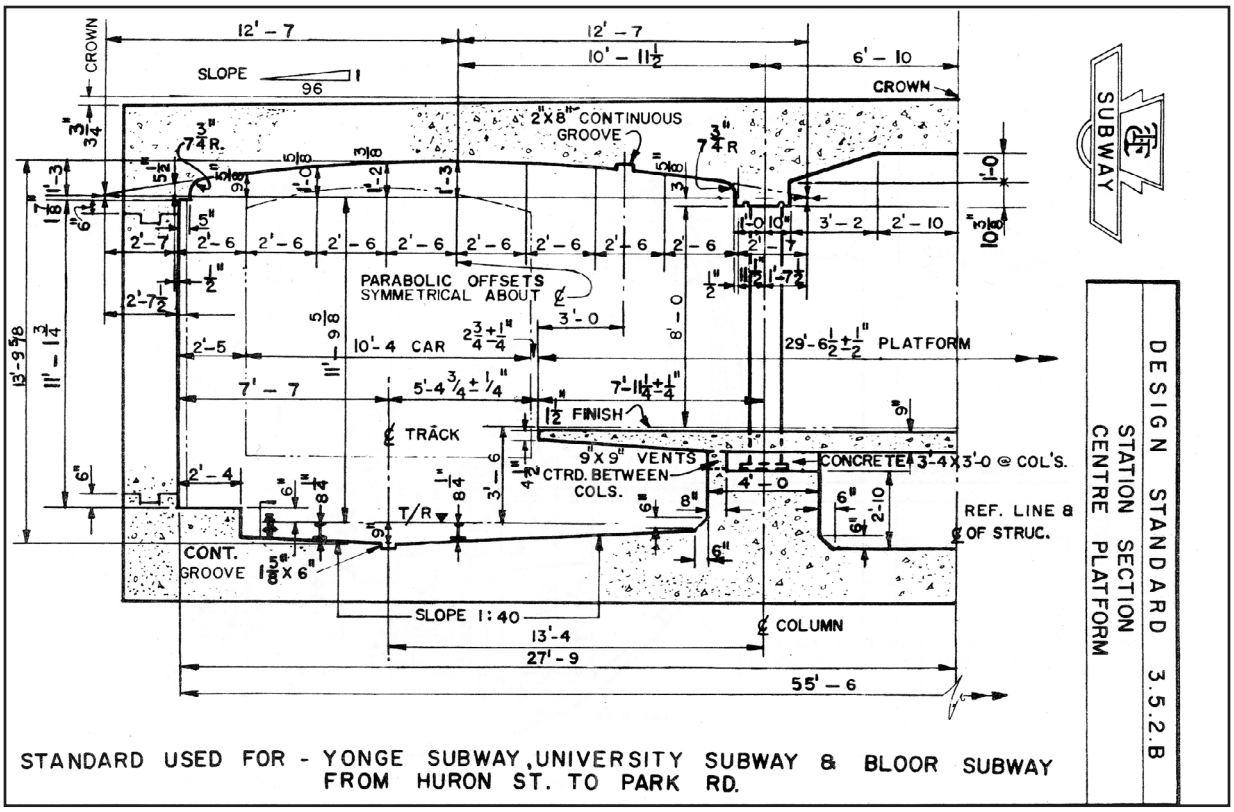
This relationship is explored in more specificity at the thesis site, Yonge-Eglinton Centre, in Toronto. Toronto's underground city houses primarily city infrastructure: rapid transit, pedestrian pathways, and utility distribution. As such, it plays an important role in the city's urban plan. The new Eglinton LRT

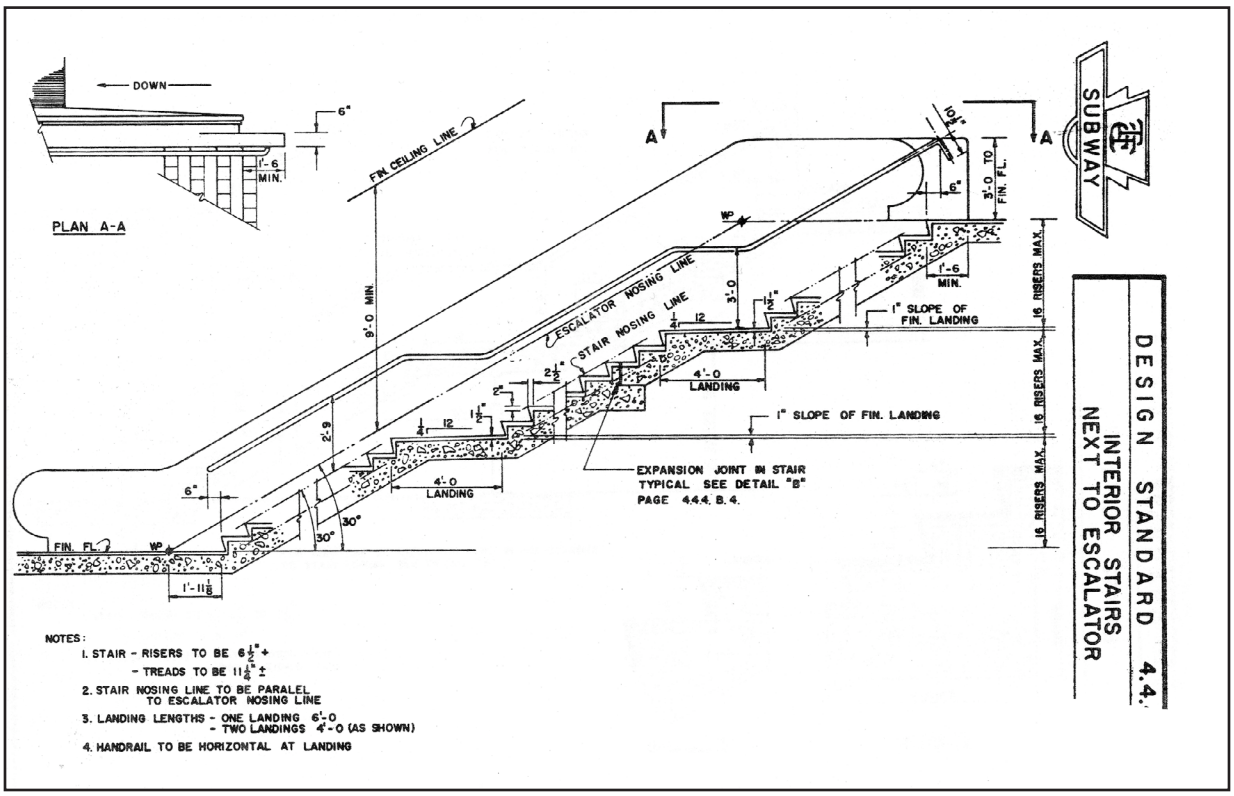
will provide rapid transit north of the existing downtown core. Its connection to the historic Yonge Subway line at Yonge Street has the potential to be a catalyst for the transition of the local neighbourhood from being a city center into a secondary downtown core. The proposed new transit station will be at the heart of this development. Its role in this pursuit is to be efficient, safe, and capable of managing whatever future occupant capacity growth in density in the neighbourhood and larger area can bring.

The design proposal responds to these issues through the concept of the urban cave. The cave is created through a playful, curvaceous concrete shell. The concrete shell formalizes the image of the cave in the architecture while also maintaining the structural integrity required to withstand the force of the earth pressing in on all sides. This contrasts with the lightness of steel and glass interior structural inserts (floor platforms, vertical circulation elements) which efficiently build the systems which enable the circulation of trains and commuters through the building. Daylight glows from rifts in the undulating roof, leading commuters from the darkness of the train platform to exiting at the mezzanine level as well as lessening the requirement for artificial lighting. The cavity of the cave is seemingly carved from the flow of people and trains, like streams of water, through its interior. Water, as the only sign of nature in a cave, is used as a motif throughout the public portions of the development. Water in a small pond is used as a gathering point in the open plaza off Eglinton. The trickling of water leads commuters down the long ramp to the sunken garden where it, again, becomes a gathering point, reflecting light into the spaces around. The urban cave celebrates the experiential possibilities unique to underground occupation, coupling them with the practical difficulties commonly associated with it, to exemplify a modern subterranean architecture.

ENDNOTES

1. Peter Buchanan, "Return to Mother Earth," *Daidalos:Architektur Kunst Kultur,* Issue 48 "Sous Terrain / Under Ground" (June 15, 1993): 50.
2. Kjeld Vindum, "A Cave for Jorn," *Daidalos,* Issue 48 (June 15, 1993): 63.


DESIGN STANDARD 3.5.2.B
STATION SECTION
CENTRE PLATFORM
SUBWAY
12'-7
12'-7
10'-11½
6'-10
SLOPE 1/96
CROWN
2"X8" CONTINUOUS GROOVE
PARABOLIC OFFSETS SYMMETRICAL ABOUT
10'-4 CAR
29'-6½±½" PLATFORM
½" FINISH
TRACK
9"X9" VENTS CTRD. BETWEEN COLS.
CONCRETE 3-4X3'-0 @ COL'S.
REF. LINE & OF STRUC.
T/R
CONT. GROOVE 1⅝X6"
SLOPE 1:40
13'-4
27'-9
55'-6
STANDARD USED FOR - YONGE SUBWAY, UNIVERSITY SUBWAY & BLOOR SUBWAY
FROM HURON ST. TO PARK RD.


DESIGN STANDARD 4.4.
INTERIOR STAIRS
NEXT TO ESCALATOR
SUBWAY
PLAN A-A
DOWN
FIN. CEILING LINE
ESCALATOR NOSING LINE
STAIR NOSING LINE
4'-0 LANDING
1" SLOPE OF FIN. LANDING
EXPANSION JOINT IN STAIR TYPICAL SEE DETAIL "B" PAGE 4.4.4. B.4.
FIN. FL.
WP
16 RISERS MAX.
NOTES:
1. STAIR - RISERS TO BE 6½"+
- TREADS TO BE 11⅛"±
2. STAIR NOSING LINE TO BE PARALEL TO ESCALATOR NOSING LINE
3. LANDING LENGTHS - ONE LANDING 6'-0
- TWO LANDINGS 4'-0 (AS SHOWN)
4. HANDRAIL TO BE HORIZONTAL AT LANDING

APPENDIX A
TRANSIT STATION DESIGN: PRESCRIPTIVE REQUIREMENTS

The following are the prescriptive requirements for Transit Station Design which affect the overall design and layout directly. Standards are primarily paraphrased from the *2012 Ontario Building Code* , queuing area requirements (pg 162) reference *Building Type Basics for Transit Facilities* by Kenneth Griffin.

FIRE AND SAFETY REQUIREMENTS

- An underground station or an underground portion of a station shall be of non-combustible construction; all floor, wall, and roof assemblies shall have a fire resistance rating not less than 2h.
- Building will be sprinklered in all areas except service booths/kiosks under 20m2
- Openings for stairways and escalators used by passengers are permitted to penetrate the fire separations.
- Elevator shafts are permitted to penetrate the fire separations provided they are enclosed by: a fire separation having a fire resistance rating not less than 1h, or wired glass assemblies.
- Design will follow Safety within floor areas requirements from section 3.3.1
- Design will follow Service Room requirements from section 3.6.2
- A vehicle (bus) terminal shall be sprinklered and be separated from the rapid transit station by a fire separation having a fire-resistance rating not less than 1 h or by wired glass assemblies, with wire glass doors equipped with self-closing devices
- Access to Adjacent Building: where an access is provided between a rapid transit station and an adjacent building, the station and the building shall be separated by a fire separation having a fire resistance of not less than 2 h; the access shall be through a vestibule that is separated from the station and from the building
- Each rapid transit station shall be monitored by a central supervising station (the operation centre where the transit agency controls and co-ordinates the system-wide movement of passengers and vehicles from which communication is maintained with supervisory and operating personnel of the transit agency and with participating agencies when required)

Fig. A.1
Design Standards: Station Section Centre Platform from TTC Subway Design Guide (1954-1976)

Fig. A.2
Design Standards: Interior Stairs next to escalators from TTC Subway Design Guide (1954-1976)

OCCUPANT LOAD AND EGRESS

- The platform occupant load for each platform in a rapid transit station shall be the greater of the a.m. or p.m. peak period loads
- These will be based on the simultaneous evacuation of the entraining load (number of passengers boarding a train at that station) and the link load (the number of passengers on board the train(s) travelling between two stations) for that platform
- The entraining load for each platform shall be the sum of the entraining loads for each track serving that platform and the entraining load for each track shall be based on the entraining load per train headway multiplied by: (a) a factor of 1.3 to account for surges, and (b) in the peak direction for each route an additional factor of 2 to account for missed headway
- The link load for each platform shall be the sum of the link loads for each track serving that platform and, the link load for each track shall be based on the link load per train headway multiplied by: (a) a factor of 1.3 to account for surges, and (b) in the peak direction for each route an additional factor of 2 to account for missed headway
- Egress: each platform in a rapid transit station shall be served by no fewer than two means of egress that are independent of and remote from each other from the platform to the exterior of the station; at the platform level, the distance separating the egress facilities shall be the greater of one car length or 25 m; means of egress from platforms shall be located so that the travel time from the most remote point on a platform to a protected route does not exceed 4 min based on travel speeds of: 38 m/min for horizontal travel, and 21 m/min for vertical rise
- Egress Capacity: the required aggregate egress capacity from each platform shall be determined by dividing the platform occupant load by the required platform clearance time; where two platforms are considered as one platform the required egress capacity for each platform shall be determined separately
- The minimum width of means of egress facilities serving platforms shall be,
    - 1 750 mm for corridors and ramps,
    - 1 750 mm for stairs,
    - 430 mm for turnstiles,
    - 500 mm for fare collection gates,
    - 600 mm nominal width for escalators, and
    - 900 mm for a door leaf.
- The minimum width of platforms shall be: 3.2 m for side platforms, and 6.4 m for island platforms
- Escalators forming part of a required means of egress shall have a vertical rise not more than 12 m between floors and landings

SANITARY FACILITIES

- A washroom for each sex, containing at least one water closet and one lavatory, shall be provided in each rapid transit station for use by employees
- In each rapid transit station located at the end of a line, a washroom for each sex, containing no fewer than three water closets and two lavatories, shall be provided for use by the public
- A barrier-free path of travel shall be provided to the washrooms

BARRIER-FREE DESIGN

- The requirements from OBC Section 3.8 apply to rapid transit stations
- At least one barrier-free path of travel shall be provided from an entrance (a) into the fare-paid area, and (b) to each platform
- Where it is necessary to change elevators to reach the entrance, the elevator system shall be designed so that not more than one change of elevator is required between (a) a platform and a fare-paid area control, and (b) the fare-paid area control and the entrance

QUEUING AREAS

- Queuing Areas must be offered at all circulation elements separate from the normal path of travel to accommodate crush effect.
- Stairs: At base and top of stairs equal to width of stair or 8', whichever greater
- Escalators: At base and top of escalators minimum 30' queuing and runoff space
- Elevator: 1.5 times the depth of the car or 10', whichever is greater
- Fare gates: 25' on both 'paid area' and 'free area' sides

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