PENNSTATE

Innovation Park
at Penn State

329 Innovation Boulevard

State College, PA

AE Senior Thesis Final Report

Preparded By:

Jeremy R. Powis

Structural Option

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Advisor: Professor M. Kevin Parfitt

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BUILDING DESCRIPTION:

329 Innovation Boulevard is a completed design for multiple commercial tenants. It is located in the Innovation Park at Penn State, State College, PA. The building is four stories tall, with a mechanical penthouse located on the roof. The total height is 58', and the footprint is 21,000 SF. It is a steel framed structure with a concrete composite flooring system. The veneer includes brick, aluminum panels, and glass curtain walls. It typically follows the style of the current buildings of Innovation Park.

PROJECT GOALS:

329 Innovation Boulevard has become a "business incubator" due to its close proximity to The Pennsylvania State University. Many start-up businesses may be interested in locating to the park, making space grudgingly unavailable. The current floor plan of 329 can most likely accommodate 2-3 tenants per floor. With large spaces already being provided with the existing framing system (consisting of moment frames), the only way to create more leasable space is to go up.

A theoretical two-story expansion of the pre-built building was proposed. This expansion would have numerous effects on the various systems of the building, but three were looked at: the structural system, the façade system, and the mechanical system. Knowing that any expansion will ultimately cost more money, the new systems would have to be reasonably economical.

STRUCTURAL DEPTH:

The expansion of 329 Innovation Boulevard would entail the redesign of the framing members – gravity and lateral. The lateral system was changed from moment frames to braced frames. This interfered with the open space previously provided, but was ultimately more cost efficient. Generally, the beams slightly increased in size, and the previously designed columns were able to withstand the new loads created by increased wind pressure (higher elevation). The braced frames consisted of HSS shapes ranging from HSS6x6x3/8 to HSS9x9x3/8. The new connections were designed and consisted of ¼" welds with lengths of 6-8" on all four sides of the braces. This bracing system created an extremely

rigid structure and yielded minimal deflections, but cost less than an expansion with moment connections.

ARCHITECTURAL BREADTH:

An architectural breadth study was performed to analyze the façade of 329 Innovation Boulevard. A new façade was designed to maintain the mold established by the existing buildings in the park. A thermal and moisture analysis was performed on the new façade. Although the new façade achieved thermal comfort levels, it manufactured additive costs.

MECHANICAL BREADTH:

Due to increased mechanical loads from the expansion of the building, a redesign of the mechanical system was performed. The existing system of heat pumps is set up to be "built-out" and is temporary. Research done showed office buildings leaning towards VAV mechanical systems, and after comparing the pro's and con's, it seemed to make sense to redesign the system as VAV. The appropriate equipment was sized after finding the loads through Trace 700. The loads were created by parameters and values set forth by ASHRAE. Although the VAV system may be more costly upfront, it will yield savings in maintenance and operational costs.

FINAL RECOMMENDATION:

After exploring the redesigns of three systems of the building multiple conclusions can be deducted:

- A two-story expansion would require redesign no matter what, but a redesign of the lateral resisting system may be more cost efficient. The braced frames yielded cheaper costs for raw materials over moment frames. My lateral system is not the most efficient (due to so little deflections) and may be worth further investigation.

- The original gravity framing members were marginally affected and would involve little redesign work.

- The savings from the structural redesign may be absorbed in the costs of the proposed façade and mechanical system, but they both are efficient, and the mechanical system produces minimal costs in the long-term.

PROJECT BACKGROUND

329 Innovation Boulevard is a completed design in terms of the design phase, and is currently undergoing the construction phase. The structure will house multiple commercial tenants. It is located in the Innovation Park at Penn State, State College, PA. It will face Innovation Blvd. directly across from 328 Innovation Boulevard, which hosts the buildings designers, L. Robert Kimball & Associates. Due to the fact that tenants have not currently leased the provided space, the building utilizes an open floor plan to help facilitate any possible tenants.

The building is four stories tall, with a mechanical penthouse located on the roof. The total height is 58', and the footprint is 21,000 SF. It is a steel framed structure with a concrete composite flooring system. The veneer includes brick, aluminum panels, and glass curtain walls. It typically follows the style of the current buildings of Innovation Park. 329 Inn. Blvd. provides a pre-engineered bridge for pedestrian usage, which leads to an entrance on the second floor.

329 Innovation Boulevard

Building Information

Owner:	C. B. Richard Ellis
Architect:	L. Robert Kimball & Assoc.
Construction:	Leonard S. Fiore, Inc.
Structural:	L. Robert Kimball & Assoc.
Mechanical:	L. Robert Kimball & Assoc.
Electrical:	L. Robert Kimball & Assoc.
Building Size:	87,000 SF
Building Height:	4 Stories (58')
Project Cost:	Private
Delivery Method:	Design-Bid-Build
Construction Start:	August 2007
Construction Finish:	Late 2008

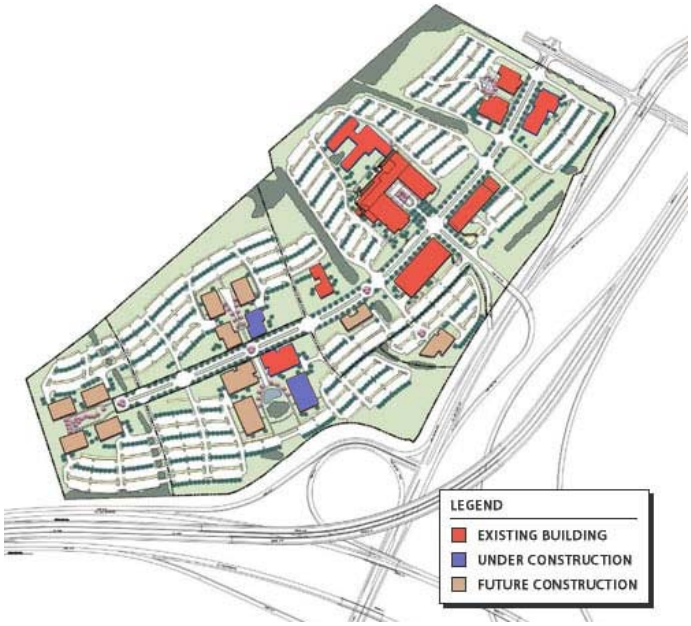
SITE LOCATION

329 Innovation Boulevard is located in Innovation Park. Innovation Park itself is located adjacent to the Pennsylvania State University, which is one of its major selling points. Due to the close proximity of the school, Innovation Park prides itself as a prime location for businesses due to easy access to the research and technology resources of the University and its well-trained and skilled workforce.

"I can't think of a better place to operate a high-tech engineering business. Not only are we practically next door to Penn State's $26 million nanofabrication facility, we're within a five-hour drive of Philadelphia, Pittsburgh, Washington, D.C., Toronto, and New York"

Bob Burlinson, President and CEO, NanoHorizons

The image to the right is the master plan of Innovation Park. The orange buildings are the existing, the purple are the buildings under construction, and tan are the sites of future construction. The purple building located just below the orange building is the recently finished 330 Innovation Boulevard. The other purple building is the site of 329 Innovation Boulevard.



CONSTRUCTION

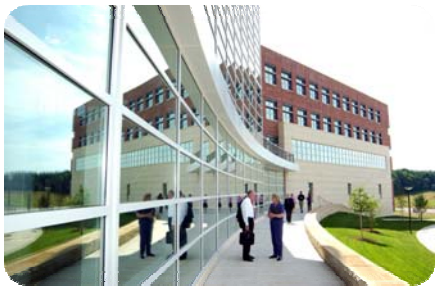
The constrution of 329 Innovation Boulevard is underway, and will be completed later this year. By the looks of the master plan, a lot more of construction will be taking place, as Innovation Park looks to double its number of buildings. Here are a few pictures of the current construction of 329 Innovation Boulevard:

Photographed By: Jeremy R. Powis, Spring 2008

GENERAL ARCHITECTURE

The architecture of 329 Innovation Boulevard is heavily influenced by the surrounding buildings. The first building built in Innovation Park was the Penn Stater which is a Conference Center/Hotel. Even though Innovation Park is located down the road of the actual campus of Penn State, the influence of the school's architecture has spilled over. Penn State has multiple architectural themes, and the themes enable people to easily group buildings together in terms of when they were built. The newer buildings located on campus display similar themes to those displayed in Innovation Park. However, Innovation Park's themes and architecture are more simplistic compared to the campus's. Here are some visual examples of the parallel's between campus and the park:

Campus Buildings:



Smeal School of Business

Leonhard Building

Innovation Park Buildings:

The Lupurt Building

328 Innovation Boulevard

Outreach Building