

Davidson Academy Governing Board Meeting – May 29, 2026

Supplemental Materials

Correspondence Received May 26, 2026

From: Alfredo Cid <al.ciro@hotmail.com>

Sent: Tuesday, May 26, 2026 8:37 AM

To: Board Comments <boardcomments@davidsonacademy.unr.edu>

Subject: Summary for Board Review: Technical Proposal Optimization (Ref: Full Text via Ms. Fredericks): Technical Proposal Optimization (Ref: Full Text via Ms. Fredericks)

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Note for the official record: This text outlines some of the core arguments of a comprehensive structural proposal, the full text of which has been formally filed for the Board's detailed review.

This proposal presents a high-level structural optimization for the new Davidson Academy building, aimed at aligning its infrastructure with its mission of absolute educational excellence. It advocates for substituting conventional carbon steel rebar with high-strength, non-magnetic austenitic stainless steel rebar throughout the concrete matrix.

The strategic benefits rest on three pillars:

- **Neurocognitive Optimization:** Conventional ferromagnetic steel distorts the Earth's natural geomagnetic field, creating artificial spatial gradients that generate background neural noise and reduce the brain's alpha waves—the bio-electric marker for deep focus. Highly gifted students are particularly vulnerable to this environmental stressor. Grade 316LN steel, combined with an indirect lighting system, ensures complete geomagnetic transparency, providing an optimal biophysical environment for academic performance. Under this architectural configuration, the geomagnetic anomaly originating from the underground parking garage does not reach the occupants of the ground floor.
- **Advanced Seismic Risk Mitigation:** Nevada is the third most seismically active state in the nation. Under catastrophic loads, the extreme ductility and strain-hardening properties of Grade 316LN steel prevent permanent plastic deformation. Post-seismic assessments following a major earthquake typically result in the mandatory demolition of 25% to 40% of non-collapsed structures due to irreversible structural degradation. Choosing Grade 316LN steel reduces this probability to less than 5%.
- **Asset Preservation:** Continuous micro-seismic activity in Reno induces micro-fissures in concrete, accelerating atmospheric carbonation. Grade 316LN steel remains entirely immune to carbonation-induced corrosion, thereby eliminating future financial liabilities for structural building rehabilitation.

Financial Conclusion

Representing a premium of less than 10% over the estimated baseline budget for a 70,000 sq. ft. multi-story academic facility with underground parking, this modification constitutes an unprecedented asset protection policy. It drastically reduces the probability of mandatory demolition after a major earthquake, eliminates future structural rehabilitation costs, and applies pioneering neuro-architecture to place the Academy at the international forefront of educational design.

From: Alfredo Cid <al.ciro@hotmail.com>

Sent: Friday, May 22, 2026 5:56 PM

To: Aimee Fredericks <afredericks@davidsonacademy.unr.edu>

Subject: Technical Proposal: Cognitive Performance Optimization and Structural Safety (Evans Ave. Facility)

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Dear Mrs. Fredericks,

I hope this message finds you well.

As an independent advocate for gifted education and an admirer of the Davidson Academy's exceptional mission, I have compiled a technical review aimed at optimizing the neurocognitive environment of the Academy's new facility.

This analysis, based on recent peer-reviewed scientific literature, synthesizes existing research on the neurophysiological impact of structural magnetic fields on high-capacity profiles and notes the potential benefits of utilizing specialized non-magnetic steel components in the upcoming construction.

Given the strategic nature of this architectural approach, I kindly request your assistance in routing this brief to the members of the Governing Board for their preliminary review. I would be honored to provide any further clarification or technical references should the Board or their designated consultants find this research of interest to the Academy's long-term development.

Thank you very much for your time and invaluable assistance in facilitating this communication.

Sincerely,

Alfredo Cid

Advocate for Gifted Education

Technical Report: Structural Non-magnetic Steel Substitution for Neurocognitive Optimization

Prepared for the Davidson Academy Governing Board

May 2026 | Technical Report for Review

1. Executive Summary

This proposal presents a high-level structural optimization for the new Davidson Academy building, designed to align its physical infrastructure with its core mission of absolute educational excellence. It advocates for the substitution of conventional carbon steel rebar (such as ASTM A706) with specialized, high-strength non-magnetic austenitic stainless steel rebar (ASTM A955, Grade 316LN) throughout the building's concrete matrix, complemented by an electrical layout that keeps ceilings entirely free of wiring through the use of indirect lighting..

The proposal is built upon three pillars optimized for the Board's evaluation:

- **Neurocognitive Optimization:** Peer-reviewed research from the California Institute of Technology (Caltech) confirms that the human brain actively processes the Earth's geomagnetic field via biogenic magnetite microcrystals anchored to glial membranes. Conventional ferromagnetic steel structures distort this natural vector, creating artificial spatial gradients that induce subliminal neuro-muscular micro-adjustments, alter cortical excitability, and suppress alpha-wave activity—the bio-electric marker for deep focus and cognitive processing. Profoundly gifted students, characterized by hyper-reflective nervous systems and sensory hyperexcitability, are highly vulnerable to this environmental stressor. Substituting Grade 316LN steel (magnetic permeability $\mu \approx 1.005$, matching a vacuum) ensures complete geomagnetic transparency, turning classrooms into stress-free biophysical environments equivalent to the open air.
- **Advanced Seismic Risk Mitigation:** Nevada is the third most seismically active state in the nation. Grade 316LN austenitic steel possesses extraordinary mechanical ductility and superior energy dissipation capacity compared to conventional steel. While post-seismic assessments typically result in the demolition and total loss of **25% to 40%** of structurally compromised buildings that did not collapse, the implementation of this material reduces that probability to less than **5%**. In the event of a major seismic occurrence in Reno, this choice prevents severe plastic deformation of the core skeleton, effectively eliminating the residual structural degradation that leads to immediate multi-million-dollar asset write-offs.
- **Asset Preservation and Capital Cost Avoidance:** Continuous micro-seismic activity from Reno's fault system inevitably induces micro-fissures throughout the building's concrete structure over time. These fissures accelerate atmospheric carbonation, allowing moisture and carbon dioxide to penetrate deeply into the core. Grade 316LN steel remains completely immune to this carbonation-induced oxidation and subsequent concrete spalling. By ensuring permanent structural

integrity, this choice eliminates the risk of future deferred maintenance liabilities. Consequently, it safeguards the institution's long-term endowment, ensuring that philanthropic and institutional funds remain dedicated to educational excellence rather than structural rehabilitation.

Financial Conclusion: While this modification represents an upfront capital expenditure (CapEx) premium over standard procurement budgets, it should not be evaluated as an auxiliary expense. It functions simultaneously as an unprecedented asset protection policy in a high-seismic zone, a long-term fiscal hedge that zeroes out future structural remediation costs, and a pioneering application of neuro-architecture that safeguards the homeostatic balance and intellectual stamina of the Academy's students.

2. Technical Justification: Neurocognitive Optimization and Geomagnetic Integrity

I formally propose to the Governing Board a strategic upgrade in the material specifications for the new Davidson Academy building, a modification that directly impacts our core mission of academic and intellectual excellence. This optimization consists of substituting conventional structural carbon steel with specialized, high-strength non-magnetic austenitic stainless steel rebar (under US standard ASTM A955, Grade 316LN) throughout the building's concrete matrix. This alloy possesses exceptional anti-seismic and anti-corrosive properties, and most crucially for a profoundly gifted student body, it is completely non-magnetic.

While this structural substitution represents a substantial initial financial commitment, detailed in the economic sections below, this investment transforms the new facility into an unprecedented architectural and biophysical haven tailored for an exceptional institution.

2.1. Neurocognitive Optimization via Geomagnetic Structural Transparency

For the new Davidson Academy building—the physical space where our students will build their futures—the selection of Grade 316LN non-magnetic stainless steel aims to actively enhance neurocognitive well-being and optimize the intellectual stamina of both students and faculty by achieving absolute magnetic neutrality within the structural core. In nature, the Earth's geomagnetic field (GMF) presents itself as a clean, parallel, and homogeneous vector. Over millions of years of biological evolution, the human brain has developed an extreme sensitivity to this field, utilizing it as a baseline biophysical reference signal for homeostatic balance. The human brain actively, permanently, and subconsciously processes and maps this geomagnetic signal, as demonstrated by pioneering research from the California Institute of Technology (Caltech). This process occurs because the human cerebral cortex contains billions of microscopic, biologically sourced magnets: biogenic magnetite microcrystals (Fe_3O_4) [1, 2]. These crystals are widely distributed throughout brain tissue, averaging approximately 5 million microcrystals per gram, with significantly higher concentrations localized within the frontal and temporal lobes. These microscopic magnets function as cellular micro-compasses, highly sensitive to the Earth's natural lines of force.

2.2. The Impact of Conventional Structural Steel on Geomagnetic Field Distortion

Conventional carbon steels standard in construction—including ductile variants designed for high-seismic zones like Reno (such as ASTM A706)—severely disrupt the homogeneity of the natural geomagnetic field through two distinct, combined physical processes:

- **Macroscopic Shielding and Flux Diversion:** Due to its high relative magnetic permeability ($\mu_r \approx 5,000$), conventional steel acts as a magnetic sink, sucking in and deflecting the planet's natural lines of force. This phenomenon does not impact space uniformly; instead, it creates sharp, irregular spatial gradients within rooms, severely weakening field intensity near reinforced beams and concrete columns, while distorting the vector's inclination angle across the usable space.
- **Remanent Ferromagnetism:** The structural iron framework itself acquires permanent remanent magnetism during manufacturing, mechanical bending, structural welding, and through exposure to stray currents (minor residual electrical leakages circulating through slabs from building equipment and cabling). This transforms the internal rebar skeleton into a fixed, three-dimensional network of artificial magnets. The superposition of these two phenomena shatters the regularity of the natural geomagnetic vector, confining building occupants within an electromagnetically artificial and anomalous spatial volume.

2.3. Empirical Evidence: The Caltech Geomagnetic Experiments

Research developed at Caltech by Dr. Wang's team and co-directed by Dr. Joseph L. Kirschvink—internationally recognized as a leading scientific authority in magnetobiology [3]—empirically confirmed that the human nervous system actively processes directional information from geomagnetic fields at a subconscious level [4].

The experimental matrix placed a sample of 34 adult participants inside a double-walled, acoustically sealed chamber completely shielded against external electromagnetic interference. The chamber was equipped with three-axis Merritt coils capable of dynamically manipulating the orientation of the localized magnetic vector to simulate the Earth's field intensity. Subjects remained seated in total darkness and silence, monitored via high-density 64-channel electroencephalograms (EEG).

When the direction of the magnetic field was rotated in a manner completely imperceptible to the senses, statistical analysis revealed that 12% of the cohort (4 out of 34 participants) exhibited an immediate, robust, and perfectly replicable neurophysiological magnetoreception across sessions separated by several weeks. Within this highly magnetoreceptive group, the EEG documented a net drop of 15% to 25% in alpha-wave amplitude (specifically, one critical peak case at 25%, two participants stabilized at a 20% reduction, and a fourth subject at 15%). These data unequivocally demonstrated the existence of a human magnetoreception pathway that responds in real time to alterations in the surrounding magnetic matrix.

While the Caltech study restricted its experimental framework to evaluating neurophysiological responses under the dynamic manipulation of a clean, homogeneous magnetic vector, it proved conclusively that the human brain actively processes geomagnetic data.

Methodological Clarification: The potential biophysical impact on the human brain caused by the highly heterogeneous, fragmented magnetic fields and sharp spatial gradients generated by static carbon steel structural grids represents a direct inference based on current neurobiological and bioengineering models. The active investigation and validation of these environmental design stressors are formally promoted by international reference institutions such as the Academy of Neuroscience for Architecture (ANFA) [9].

2.4. The Biophysical Mechanism: Magnetomechanical Coupling within the Tripartite Synapse

To fully understand how a conventional building framework impacts the human brain, we must analyze magnetomechanical coupling (the transduction of a magnetic signal into a physical pull) within the cerebral tripartite synapse. This synaptic space is the fundamental hub where neurons communicate under the active regulation of glial cells—specifically astrocytes—which shield neurons and modulate cerebral electrical rhythms. This phenomenon is identical to the principles of cellular mechanotransduction (the capacity of cells to sense and react to physical pressure) and the established mechanics of magnetogenetics [1, 2, 5, 6].

The brain's biogenic magnetite microcrystals are firmly anchored to the lipid membranes of these regulatory glial cells. The behavior of these cellular micro-compasses alters drastically depending on the structural environment of the occupant, operating under two opposing scenarios:

Scenario 1: The Homogeneous Natural Environment (Open Air)

In nature, the Earth's magnetic field is clean, parallel, and regular. The magnetic lines of force pass through the biological magnetite micro-compasses uniformly. Because the field is homogeneous, it exerts no linear translation force toward the ground. Lacking local distortions or opposing forces, the biological system remains in a state of biophysical repose, and the net mechanical tension across the cell membrane is zero.

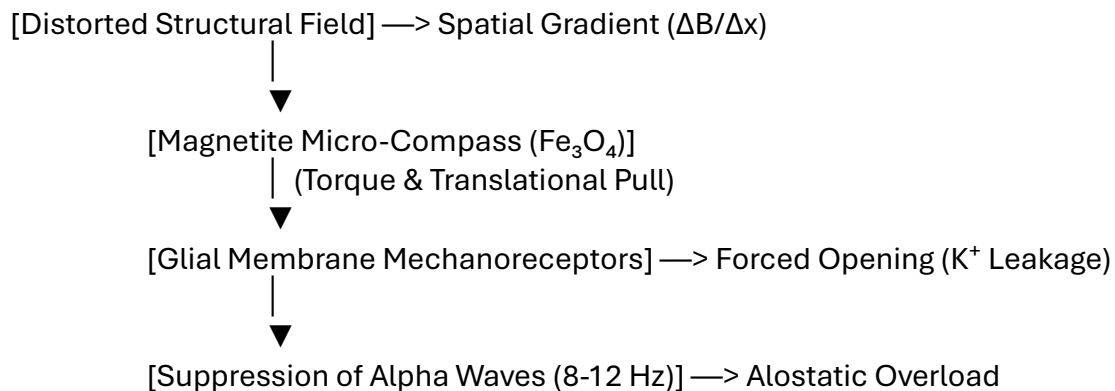
Scenario 2: Inside a Conventional Carbon Steel Structure (Spatial Gradients)

Because a conventional steel framework becomes an active, fixed 3D network of ferromagnetism due to manufacturing stresses, structural welding, and building stray currents, it warps and fragments the Earth's field lines passing through the room. When an occupant enters this space, the field lines crossing their cranium arrive highly fragmented. This generates severe spatial gradients—marked variations in magnetic intensity and vector direction occurring every few millimeters.

Because the physical mass of an individual magnetite microcrystal is infinitesimal, it becomes hyper-sensitive to these local, anomalous gradients. The severe distortion of the

ambient field subjects each micro-compass to two simultaneous mechanical forces:

1. Microscopic Torque: The fragmented field pushes one end of the magnetite crystal in one direction and the opposite end in the reverse direction, attempting to twist the micro-compass on its own axis.
2. Linear Translational Pull: The crystal experiences a direct physical push along the axis of the spatial gradient toward the area of densest local magnetism—namely, toward the nearest magnetized structural steel element.
3. Since these micro-compasses are physically integrated into the glial cell membranes, this dual magnetic pull transfers directly to the cellular architecture. It manifests as a continuous, non-stopping mechanical tug that stretches and deforms the membrane of the support cell. Because this is a direct physical force acting upon the cell's structure, this mechanism entirely bypasses standard sensory habituation or neural adaptation pathways. Unlike a constant ambient sound or a persistent smell, which the brain eventually filters out and ignores after prolonged exposure, the mechanical tension on the cell membrane never stops as long as the subject remains within the structural magnetic gradient.



This uninterrupted physical traction acts as a constant pressure on the glial surface:

- It mechanically forces open mechanoreceptor ion channels (pressure-sensitive molecular gates regulating fluid and ion passage).
- It alters the osmotic equilibrium and physical volume of the regulatory glial cell.
- It compromises cellular homeostasis, impairing the astrocyte's capacity to clean and balance the intercellular chemical environment, resulting in an anomalous accumulation of potassium ions (K^+) in the extracellular space surrounding neurons.

The central nervous system cannot adapt to this physical membrane stretching. The resulting secondary chemical imbalance in potassium levels alters the electrical firing threshold of adjacent neurons, causing an immediate desynchronization and suppression of the alpha-wave rhythm. In neurobiology, alpha waves (8–12 Hz) are the definitive electroencephalographic marker for focused attention, mental calmness, and deep cognitive processing.

Consequently, deep concentration is replaced by an underlying neurolaboratory background noise—a subtle but unceasing biophysical stressor. The nervous system is forced to expend continuous, subconscious metabolic energy (allostatic load) simply to process and attempt to suppress this parasitic physical interference, leading to cumulative cognitive fatigue that competes directly for the executive intellectual resources required by students and faculty.

2.5. Collateral Neurobiological Research Beyond Caltech

Subsequent neurobiological studies have expanded significantly upon Caltech's foundational findings:

- **Subconscious Cognitive Maps:** A research team led by Dr. K. S. Chae [10] evaluated how disruptions to the baseline geomagnetic field influence non-spatial cognitive processing, using abstract strategy games (such as Go) as a test model. When individuals were placed in chambers where the natural magnetic field was artificially cancelled to near-zero levels, subconscious decision-making profiles, reaction times, and error rates shifted significantly. This demonstrates that the human brain relies on the baseline environmental magnetic vector as an invisible but fixed coordinate framework—a starlike reference map—to structure logical thought and executive processing, even during tasks that do not involve physical navigation.
- **Cortical Excitability Changes:** Advanced neuroimaging trials led by Dr. S. Tanaka [11] utilizing functional Magnetic Resonance Imaging (fMRI) documented that exposure to subtle static magnetic field variations measurably alters human cortical excitability and modifies somatosensory processing pathways. From an environmental design perspective, this confirms that conventional structural frameworks are not biologically neutral: the artificial magnetic gradients generated by standard carbon steel force the brain to perform constant neuromuscular micro-adjustments and active sensory filtering to compensate for environmental field distortions.

Consequently, implementing a structural skeleton based on non-magnetic Grade 316LN steel functions as a form of preventive bio-engineering. By eliminating these parasitic physical interferences at the source, it eradicates a secondary source of metabolic exhaustion, providing optimal baseline conditions to preserve cognitive stamina and mitigate neurological fatigue at the end of the academic day.

2.6. The Timeline of Human Magnetoreception and Structural Prudence

The scientific validation of human magnetoreception is the culmination of more than five decades of rigorous empirical research. Following the confirmation of this capacity across diverse animal models in the 1970s and the subsequent physical isolation of biogenic magnetite in human brain tissue in the early 1990s [1], the field has progressed rapidly

alongside advancements in high-density neurophysiological recording and ultra-shielded SQUID magnetometry. Recent successes in Caltech and international laboratories have closed the theoretical debate: the human brain actively reads and processes the Earth's geomagnetic field.

In the chronological evolution of this science, the next natural milestone is the formal quantification of the specific cognitive deficits and neurological fatigue profiles induced by the artificial magnetic gradients of conventional building skeletons. While environmental neuroscience has yet to execute systematic field trials of this exact nature, the trajectory of magnetobiology indicates that this structural impact will be validated in the near future.

By integrating Grade 316LN steel into the current design phase, the Davidson Academy possesses a unique strategic opportunity to anticipate this coming scientific certainty. This fulfills the structural principle of prudence in a facility explicitly designed to house profoundly gifted students, whose nervous systems routinely exhibit heightened vulnerability and sensitivity to background environmental stressors.

2.7. General Population Penetration vs. Gifted Hyperexcitability

The researchers at Caltech explicitly state that the 12% explicit response rate observed in their study does not imply that magnetoreception is absent in the rest of the population. Rather, it indicates that this specific group displayed an electrophysiological reaction so robust and mathematically clear that it cleared the most conservative statistical software filters ($p < 0,05$ after multi-comparison corrections). The research team highlights three primary reasons why this neurobiological capacity is a generalized trait within the human species, even if its external manifestation varies:

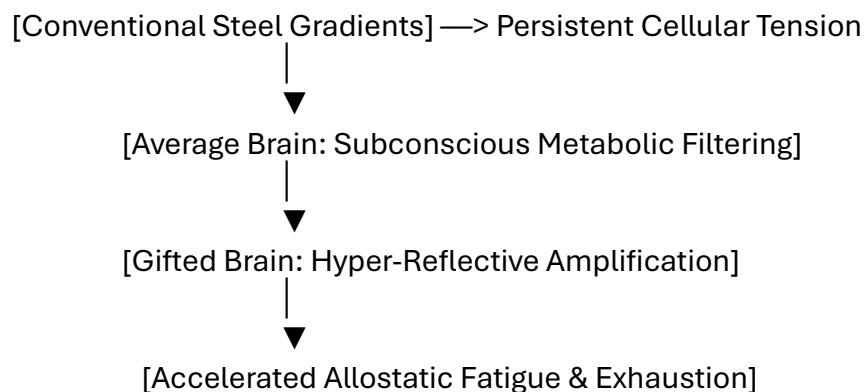
1. **Signal-to-Noise Ratio in Electroencephalography:** Because the waking brain processes millions of computational tasks simultaneously, tracking subconscious magnetic transduction via scalp electrodes is equivalent to tuning into a weak, distant radio signal during a severe thunderstorm. In the highly receptive group, the alpha-wave drop was powerful enough to stand out starkly against baseline brain activity, whereas in the remaining participants, the processing likely occurred just as actively at the localized cellular-glia level, remaining masked by concurrent cognitive processes.
- 2.
3. **Sensory Acuity Variations:** The authors establish a direct analogy with standard human senses. While the entire human species possesses an auditory system designed to process pitches and frequencies, only a small fraction of the population possesses perfect pitch; similarly, visual acuity and retinal sensitivity to low-light fluctuations vary drastically between individuals. The experiment proved that the underlying neurobiological pathway for processing geomagnetism is a shared evolutionary asset, while the sharpness of the electrophysiological readout reflects natural variations in neural connectivity.

4. **Sub-Threshold Trends:** The study documented clear alpha-attenuation trends in multiple other participants who fell just short of the automated statistical significance cut-off. The Caltech team deliberately applied a severe mathematical filter to eliminate any possibility of false positives, shielding the publication from international methodological criticism.

2.8. The Case for the Profoundly Gifted Brain

While standard research has not yet isolated magnetoreceptive mechanics within high-ability cohorts, established neurobiological and psychopedagogical literature confirms that profoundly gifted students frequently exhibit an hyper-reflective nervous system. This profile is characterized by profound sensory hyperexcitability (as modeled by Dabrowski's overexcitabilities framework) and a documented reduction in latent inhibition, meaning their brains do not automatically filter out background environmental stimuli [7, 8].

From the perspective of neurophysiological vulnerability, an architectural environment that introduces permanent, artificial magnetic gradients imposes a continuous, unvetted cognitive load on profoundly gifted minds. For this student body, characterized by exceptionally high neural connectivity and dendritic density, structural background noise is not an innocuous variable; it is an active environmental stressor that directly accelerates allostatic fatigue within the classroom.



If a baseline brain registers these field distortions with enough intensity to desynchronize its alpha waves by up to 25%, a student body possessing the neuroatypical hyper-connectivity and sensory sensitivity native to the Davidson Academy's demographic sits, with a high degree of biophysical probability, within the zone of maximum vulnerability to structural magnetic noise.

An infrastructure built with Grade 316LN steel prevents any distortion or fragmentation of the Earth's natural magnetic lines of force. This intervention will not make profoundly gifted students more intelligent; rather, it systematically removes a persistent source of subconscious neurocognitive drainage. By eradicating this structural background noise, we minimize brain fatigue during extended study hours, mitigating the long-term risks of chronic academic stress and mental exhaustion.

While the current performance metrics of Davidson Academy students represent absolute educational excellence, this does not imply their current physical environment is structurally optimal. The true efficiency of an educational model must also be measured by the long-term sustainability of its students' psychological and neurological health. Protecting the mechanisms of the tripartite synapse from the spatial gradients of conventional steel preserves homeostatic balance and optimizes neurological well-being—a critical intervention for high-capacity profiles whose nervous systems are biologically predisposed to environmental overstimulation.

2.9. Architectural Implementation of Geomagnetic Neutrality

Because Reno's climate prevents students from studying outdoors for large portions of the academic year, the construction of the new facility provides a unique opportunity to align the Academy's physical framework with its mission of uncompromised excellence. We can ensure that the reinforced core does not act as a biophysical barrier between the students' brains and the natural environment.

This is achieved via Grade 316LN steel. The relative magnetic permeability of this material is extraordinarily low ($\mu_r \approx 1.005$), which is practically equivalent to that of a vacuum or open air ($\mu_r = 1$). In a facility structurally reinforced with Grade 316LN, the Earth's lines of force are neither absorbed nor deflected; floors, structural slabs, and load-bearing columns become entirely magnetically invisible. For the neurobiology of students and faculty, working inside these classrooms becomes biophysically identical to working in the open air: the planet's lines of force pass through their brains cleanly, parallelly, and harmoniously.

The utilization of non-magnetic stainless steel is currently the mandated engineering standard in international specifications for the load-bearing concrete elements of high-field Magnetic Resonance Imaging (MRI) facilities and ultra-sensitive electrophysiology laboratories [4]. In those environments, absolute magnetic neutrality is legally required to prevent any distortion in the reading of subtle neurophysiological signals.

Selecting non-magnetic Grade 316LN steel places the new Davidson Academy facility at the absolute global forefront of neurobiologically grounded environmental design, perfectly matching the high-performance cognitive needs of a profoundly gifted student body while securing the structural excellence of the facility for centuries.

2.10. Indirect Room Lighting to Maintain Geomagnetic Transparency

Preserving geomagnetic integrity within the classrooms requires neutralizing not only structural anomalies but also those induced by the electrical infrastructure. Horizontal electrical conduits running across ceilings generate dynamic magnetic flux planes that induce local distortion and fragmentation of the Earth's natural magnetic field.

Conversely, electrical conductors running horizontally or vertically within the perimeter walls do not present a critical issue for the geomagnetic stability of the usable space. The

fields they generate remain confined to a peripheral vertical plane and undergo exponential electromagnetic attenuation just a few inches from the wall, without interacting with the central volume of the room where students are located. Consequently, the most efficient and cost-effective design strategy consists of completely eliminating horizontal wiring running through the building's ceilings.

To resolve the luminous habitability of the classrooms under this premise, an indirect lighting system is proposed based on high-power architectural luminaires with wide-range asymmetric projection optics. These commercial solutions, specifically designed for homogeneous wall-washing from vertical surfaces, project a high-intensity luminous flux toward the central area of the upper slab. The classroom ceiling will thus act as an active optical diffuser through the application of a technical white paint with a Light Reflectance Value (LRV) exceeding 90%.

It is critical that the specifications for this technical paint strictly prohibit the use of coatings formulated with iron oxide pigments due to their ferromagnetic properties. The mandatory use of pure bases formulated exclusively with titanium dioxide or other stable diamagnetic minerals—which guarantee maximum luminous bounce—must be required. Excellent pure white commercial options that meet these strict chemical and optical requirements out of the box are currently available in the North American market without representing a cost premium.

This passive engineering solution eliminates any electrical interference on the upper plane and significantly reduces labor and material costs by confining the wiring to partitions and structural walls.

2.11. Geomagnetic Behavior of the Underground Parking Structure

It might be assumed that in a building with an underground parking lot, the presence of vehicles with large steel chassis and massive ferromagnetic components (such as engine blocks) would cause a distortion and fragmentation of the Earth's magnetic field equivalent to that produced by a conventional steel structural grid.

However, the laws of field physics demonstrate that, unlike the structural skeleton of the building, the presence of vehicles in the underground parking lot is harmless to the building's geomagnetic transparency. This difference in behavior is governed by three objective physical factors:

1. **The Inverse-Cube Law of Distance Attenuation:** A vehicle's chassis acts as a passive, localized distorter (an induced magnetic dipole). In electromagnetic physics, the perturbation generated by such an object does not decrease linearly, but rather exponentially with the cube of the distance ($1/d^3$). Between the metallic roof of a vehicle parked in the basement and the head of an occupant seated on the ground floor, there is a net vertical separation of approximately 2.80 meters. This means that by the time the field lines reach the head level of an occupant on the

ground floor, the distortion of the Earth's magnetic field has decayed drastically, dropping below 0.3 microteslas. Since the natural geomagnetic field in the region is approximately 51 microteslas, this minor fluctuation represents less than 0.5% of the total, seamlessly integrating into the ordinary magnetic background noise of any urban environment.

2. **Geometric Discontinuity and Field Cancellation:** For metallic masses to massively alter the geomagnetic field, they require continuity and interconnection, as seen in the welded rebar grid of a conventional building. Vehicles in the parking lot are isolated masses separated by large volumes of air. Lacking mechanical connection, their small local fields do not aggregate to create a large-scale geomagnetic anomaly; instead, they tend to neutralize and cancel each other out at a very short distance from the chassis.
3. **The Principle of Flux Vector Restoration:** The Earth's magnetic field lines form a continuous flux that follows the path of least resistance. Upon encountering a vehicle in the basement, the lines curve and compress temporarily to pass through the vehicle. However, as they exit the vehicle and return to the open medium, the flux naturally recovers its parallelism, its northward direction, and its original inclination angle. Thanks to this physical buffer zone, the geomagnetic vector is smoothed and almost completely restored before crossing the ground floor slab. By the time it reaches the head level of an occupant on the ground floor, it has fully recovered its natural parameters, provided that the structural slab separating the basement from the ground floor is magnetically transparent through the use of Grade 316LN steel.

3. Financial and Life-Cycle Cost Analysis (LCCA)

Since ASTM A955 Grade 316LN stainless steel does not operate under static price catalogs but rather through monthly alloy surcharges based on nickel and molybdenum trading prices, the figures presented below constitute a Rough Order of Magnitude (ROM) Cost Model. These estimations have been calculated applying current North American market surcharge ratios for supply from mills such as Valbruna Slater (Indiana) or Outokumpu (Calvert, Alabama, procured through distributors such as Salit Specialty Rebar). It accounts for interstate freight trucking to Nevada, specialized workshop cutting/bending fabrication surcharges for high-hardness steel, and required structural rebar accessories.

The cost estimates are modeled for a building with a total area of 70,000 sq ft plus an underground parking structure. It assumes the comprehensive integration of Grade 316LN steel across 100% of the structure: the massive foundation mat, the peripheral retaining walls of the underground parking, columns throughout their full extension, beam-column joints (the highest rebar density zones in seismic design), moment-resisting frames, and all mezzanine and roof slabs.

3.1. Installed Unit Cost Breakdown

The installed cost premium of Grade 316LN steel over conventional carbon steel currently stands at 7,150.76 USD per metric ton. This figure encompasses all real-world project line items:

- Material Net Premium (5,710.00 USD / ton): The baseline material cost differential between Grade 316LN and conventional steel.
- Interstate Logistics (340.76 USD / ton): Flatbed trucking freight over a distance exceeding 2,100 miles from midwestern/southern mills to Reno, adhering to legal highway weight limits of 45,000 lbs per truckload.
- Fabrication and Bending (850.00 USD / ton): Grade 316LN experiences severe strain hardening (work hardening). This requires specialized high-resistance cutting blades, reduced fabrication speeds, and dedicated clean lines to prevent cross-contamination from carbon iron particles.
- Seismic Accessories (250.00 USD / ton): Mandatory stainless steel mechanical couplers and tying wire to maintain material homogeneity across all connections.

3.2. Structural Cost Projections by Architectural Configuration

Applying this cost model to the structure, the total capital expenditure (CapEx) variance adapts to the two architectural vertical designs under consideration by the Board:

- **Option A: 3 Stories + Underground Parking**

This configuration yields a wider footprint on the terrain, expanding the underground parking footprint while moderating height-induced seismic shear forces.

- Total Required Tonnage: 592.7 metric tons (414.9 tons longitudinal bars / 177.8 tons stirrups and distribution ties).
- **Total Installed CapEx Premium: 4,240,000 USD (±15%)**

- **Option B: 4 Stories + Underground Parking**

This configuration yields a more slender profile. While reducing land occupation and parking square footage, the increased height multiplies the overturning moment during a seismic event. This forces a denser longitudinal reinforcement in columns and highly congested perimeter ties to prevent structural buckling.

- *Total Required Tonnage:* 714.4 metric tons (500.1 tons longitudinal bars / 214.3 tons stirrups and distribution ties).
- **Total Installed CapEx Premium: 5,110,000 USD (±15%)**

3.3. Long-Term Asset Protection: Seismic Risk Mitigation

Reno is classified under Severe Seismic Design Category D. While current building codes ensure life safety (Life Safety threshold) during extreme events using highly ductile conventional steel like ASTM A706, they do not guarantee post-event asset survival. Predictive models from the Federal Emergency Management Agency (FEMA) and USGS risk maps for the Reno basin fault system reveal a critical reality: under the code-regulated design basis earthquake, between **25% and 40%** of conventional reinforced concrete

structures that successfully prevent collapse suffer irreversible inelastic degradation in their critical sections, rendering repair technically or financially unfeasible.

This creates a **25% to 40%** statistical probability of forced post-seismic demolition for a conventional building due to unrecoverable permanent residual drifts, where reconstruction costs exceed 50% of the asset's replacement value.

Choosing Grade 316LN steel reduces this structural asset risk to less than **5%** due to three scientific factors:

1. **Total Elongation Capacity:** While standard ASTM A706 seismic steel exhibits a total elongation at fracture between 10% and 14%, nitrogen-strengthened Grade 316LN (ASTM A240 standard) guarantees a code minimum of 40% and reaches 50% to 55% in tensile testing. This allows structural nodes to flex drastically and dissipate energy without inducing mechanical necking or brittle fracture.
2. **Low-Cycle Fatigue Resilience:** Low-cycle fatigue testing using hysteresis loops reveals that under severe cyclic plastic deformation, conventional steel rebar exhausts its load-bearing capacity after an average of 12 to 15 load reversal cycles due to internal micro-cracking. Conversely, stainless steel reinforced sections consistently endure between 30 and 38 cycles before cross-sectional degradation crosses the 20% threshold—a 150% increase in cyclic resistance that secures the building against successive major aftershocks.
3. **Impact Toughness:** Under standardized Charpy V-Notch impact testing (ASTM E23), Grade 316LN records exceptionally high energy absorption values, exceeding 160 Joules at room temperature. This prevents accelerated microstructural degradation.

By substituting conventional steel with this alloy in critical superstructure elements (slabs, dynamic beam-column joints, and column bases), a major earthquake in Reno would cause only superficial concrete cracking while keeping the elasticity and toughness of the internal skeleton completely intact. The building would remain operational, and structural remediation would be achieved rapidly through standard high-strength grout injection.

3.4. Operation and Maintenance (OpEx) Reductions: Corrosion Immunity

Conventional carbon steel embedded in the semi-arid climate of Reno exhibits excellent durability, capable of reaching a century of service life. Therefore, selecting Grade 316LN is not a response to short- or mid-term corrosion risks, but a financial strategy to optimize the Whole Life Cost (WLC) of the asset.

Over decades, micro-fissures inevitably appear in concrete structures within moderate-to-high seismic basins. These micro-cracks breach the alkaline protective barrier of the concrete, initiating slow oxidation of conventional steel through atmospheric carbonation and chloride penetration from winter de-icing salts and local soils. Grade 316LN is

metallurgically immune to these degradation mechanisms. By keeping its structural cross-section and mechanical capacity unaltered over centuries, it elevates the facility to an indefinite lifespan standard.

Under American Society of Civil Engineers (ASCE 11) evaluation protocols, structural micro-fissures in conventional buildings mandate recurring technical inspections and deep remediation overhead to manage latent oxidation. Grade 316LN ensures that any future metallurgical audit records an unblemished structural state. Because no degradation occurs at critical nodes, future lifecycle maintenance is reduced to superficial concrete cosmetic sealing, completely shielding the Academy's operational budget from structural capital remediation levies for future generations.

Bibliographic References

- [1] Kirschvink, J. L., Kobayashi-Kirschvink, A., & Woodford, B. J. (1992). Magnetite biomineralization in the human brain. *Proceedings of the National Academy of Sciences (PNAS)*, 89(16), 7683-7687.
- [2] Gilder, S. A., Wack, M., Kaub, L., Roud, S. C., Kranfield, N., Heinsen, H., ... & Kirschvink, J. L. (2018). Distribution of magnetic anisotropy in the human brain. *Scientific Reports*, 8(1), 1-11.
- [3] Wang, C. X., Hilburn, I. A., Wu, D. A., Mizuhara, Y., Cousté, C. P., Abrahams, J. N., ... & Kirschvink, J. L. (2019). Transduction of the geomagnetic field as evidenced by alpha-band activity in the human brain. *eNeuro*, 6(2), ENEURO.0483-18.2019.
- [4] National Institutes of Health (NIH) & U.S. Department of Veterans Affairs (VA). (2024). *Technical Design Manuals for High-Field MRI Facilities and Biomagnetic Research Laboratories: Structural and Materials Requirements* (Section 26 05 00 / 13 49 00). Federal Infrastructure Specifications.
- [5] Winklhofer, M., & Kirschvink, J. L. (2010). A quantitative assessment of torque-transducer models for magnetoreception. *Journal of The Royal Society Interface*, 7(Suppl_2), S273-S289.
- [6] Duret, G., Serrano, R. M., & Robinson, J. T. (2019). Safety and magnetic properties of materials for magnetogenetics and magnetic neuromodulation. *Advanced Healthcare Materials*, 8(23), 1900465.
- [7] Silverman, L. K. (2012). *Asynchronous Development: A New Definition of Giftedness*. In *Giftedness 101*. Springer Publishing Company.
- [8] Dąbrowski, K. (1964). *Positive Disintegration*. Little, Brown and Co.
- [9] Academy of Neuroscience for Architecture (ANFA). (2022). *Acoustic, Thermal, and Electromagnetic Guidelines for Neuroarchitecture and Cognitive Performance in Educational Spaces*. ANFA Monographs, San Diego, California.
- [10] Chae, K. S., Kim, S. C., & Lee, H. J. (2022). Human subliminal decision-making and cognitive performance variations under near-zero magnetic fields. *Scientific Reports*, 12(1), 14382.
- [11] Tanaka, S., & Takahashi, M. (2020). Neuromodulatory effects of static magnetic fields on human cortical excitability: A functional magnetic resonance imaging (fMRI) study. *Frontiers in Human Neuroscience*, 14, 258.