ACOUSTICAL
DESIGN
GROUP INC

SOUND SYSTEM DESCRIPTION (*REVISED*)
as proposed for the FOOTBALL STADIUM
at BLUE VALLEY HIGH SCHOOL
Oxford Township, Kansas

October 17, 2002

INTRODUCTION

At the request of Mr. John Glessner of the Blue Valley School District, this ***revised*** programming description was prepared as part of a ***second*** feasibility study for a new sound system for the football stadium. The purpose of this new study is to address the requirements in regard to:

1. The means to provide significant improvement to the qualitative aspects of sound coverage, to include: voice intelligibility, music clarity, and relative uniformity of coverage for the east and west bleachers and the major portion of the field.

2. More effective system operation and announcing.

   Note: Since improvements to the east pressbox were implemented in the late summer of 2001, the associated sound system "front-end" improvements no longer need to be addressed in this ***revised*** study. Such improvements included a new audio rack containing new equipment (mixer, CD/cassette deck, equalizer, compressor, and small monitor loudspeaker), as well as a new announcer head-set microphone, and a new wireless microphone for on-field use.

3. Aspects of sound system design and operation intended to minimize the community noise issue of "spill-over" of sound into the residential areas on all sides of the stadium.

The description of the sound reinforcement system is arranged in the following order:

- **A.** ***Loudspeaker Coverage***
- **B.** ***Audio Equipment Room***
- **C.** ***Infra-structure Requirements***
- **D.** ***Implementation Process***

5799 Broadmoor, Suite 108, Mission, Kansas 66202 USA • Phone 913-384-1261 • Fax 913-384-1274

A. LOUDSPEAKER COVERAGE

1. A loudspeaker "line source" along the interior west fence, immediately behind the west pair of bleachers, would consist of one Electro-Voice FRX+940 coaxial loudspeaker mounted directly on each of four new 45-foot tall reinforced concrete (or steel) poles, and aimed due east, with a tilt-down of 50-degrees below horizontal. Each of these four loudspeakers would be at a nominal height of 41-feet.

2. One pair of these poles would be spaced 50-feet apart and centered behind the larger northwest bleachers. Another pair of these poles would be spaced 50-feet apart and centered behind the smaller southwest bleachers.

3. To separately cover the playing field, one Electro-Voice MH640P coaxial stadium horn would be added to each of the far north and south poles, aimed due east, with a tilt-down of 20-degrees, and at a nominal height of 45-feet (near the very top of the pole).

4. To provide level "make-up" for the distant east bleachers and pressbox, one new 45-foot reinforced concrete (or steel) pole would be mounted at the southwest corner of the bleachers. Two Electro-Voice FRX+940 loudspeakers would be mounted near the top of the pole, both aimed north/northeast, but one with a tilt-down of 70-degrees, and one with a tilt-down of 40-degrees. These speakers would receive delayed audio to coordinate with sound arriving from the west loudspeakers.

B. AUDIO EQUIPMENT ROOM

1. **Room Selection**: As a location for a power amplifier equipment rack and related electrical gear, use will be made of a portion of the Officials Locker Room, located near the center of the southeast Home Concession/Locker Building. Since this room is not air-conditioned, air-conditioning will need to be added to prolong the life of the rack-mounted audio equipment during the summer months.

2. **Power Amplifier Rack:** One full-size floor-mounted audio equipment rack will be required for mounting sound system electronic components, including: power amplifiers, test/monitor panel, equalizer(s), and delay device(s).

3. **AC Power for Racks:** Mounted near the racks will be certain AC power equipment (dedicated transformer and sequencing load center), providing "clean" AC power & ground circuits for the rack. Sequential AC power switching for On/Off control of the sound system AC power provides the following benefits:

- Remote power On/Off from the Sound Operator position in the pressbox.
- Sequencing-action protects the loudspeakers from unwanted "thumps" or "pops" generated by the electronic audio equipment as the AC power is turned On or Off.
- During system turn-on (or during automatic turn-on after a power outage), the sequencing action also prevents a sudden major in-rush of current from the building power source.

C. INFRA-STRUCTURE REQUIREMENTS

Certain physical requirements (defined collectively as "infra-structure") are necessary to allow the sound system to be installed, and are separate and distinct from the "low-voltage" audio installation work performed by a Sound Contractor. The infra-structure portion of the feasibility study, as well as later analysis and design in this regard, is the domain of other architectural and engineering disciplines retained by the School District, including.

1. **Architectural:** Overall coordination of project requirements.

2. **Structural:** Loudspeaker pole design and structural implications.

3. **Electrical:** Electrical power, trenching, and conduit coordination.

4. **Mechanical:** Cooling/ventilation for the audio equipment room.

D. IMPLEMENTATION PROCESS

1. **Consolidation of All Feasibility Study Information:** The School District is to consolidate and review feasibility study information from the various disciplines. Based on this information, including the estimated total cost involved, a determination is to be made as to the feasibility of proceeding with design at this time.

2. **Acoustical Consulting Design Services:** To implement the sound system design as described herein, drawings (SR-series) and specifications (Section 17100), fully defining the system, will be prepared by the Acoustical Consultant to allow competitive bids for installation to be obtained from qualified Sound Contractors. The Acoustical Consultant will also: assist in evaluating bids received, review applicable shop drawings, and respond to Sound Contractor questions.

3. **Architectural Services:** During sound system design, the School District's Architect is to provide review and comment related to any architectural or aesthetic implications, such as for the loudspeaker poles and for routing of new conduit. The Architect would also typically administer and coordinate the overall sound system program, to include: a) preparing the "front-end" documents (general conditions and contract forms); b) printing and issuing bid documents; c) receiving bids; d) reviewing relevant shop drawings; e) making field inspections; and f) performing related services.

4. **Engineering Services:** The School District's Consulting Engineer(s) would typically assist with: a) analysis and design related to the loudspeaker pole structure; b) review and direction related to loudspeaker weights and attachments to poles; c) analysis and design related to the interface of the sound system electrical power requirements with building electrical power, as well as coordinating all trenching and conduit requirements; and d) cooling/ventilating considerations related to the audio equipment room.

5. **Sound System Commissioning Services:** Commissioning of the new sound system, performed on-site near the completion of the installation work, includes: a) system tests; b) electronic & acoustic level adjustments; c) equalization; d) instruction; e) operating assistance; and f) punch list. Other related services include involvement in close-out documents, to include: a) updating sound system drawings with condition of record; b) preparing written system operating instructions; and c) review of submitted project close-out notebooks (O&M manuals). These services will be performed by the Acoustical Consultant, providing assurance to the School District that the system: has been properly installed, is performing as intended, and is properly documented.

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ACOUSTICAL
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October 16, 2002

Mr. John D. Glessner
Design & Construction Manager
Blue Valley Schools
15020 Metcalf / P.O. Box 23901
Overland Park, KS 66283-0901

Re: Football Stadium Sound System & Community Noise Issue
Blue Valley High School
6001 West 159th Street, Oxford Township, Kansas
ADG File 00245

Dear John:

To assure that the new sound system meets the more rigorous limit of 60 dBA for system audio incident to any of the surrounding residences, the system's power amplifiers (which drive individual loudspeakers) will be adjusted individually, and the system's compressor/limiter set accordingly.

This process will occur as a part of system on-site commissioning (testing, adjusting, and equalization), occurring after system installation has been completed. Based on sound pressure level measurements at representative residence locations, the necessary system adjustments will be made.

Sincerely,

George N. Damon
Senior Consultant

5799 Broadmoor, Suite 108, Mission, Kansas 66202 USA • Phone 913-384-1261 • Fax 913-384-1274

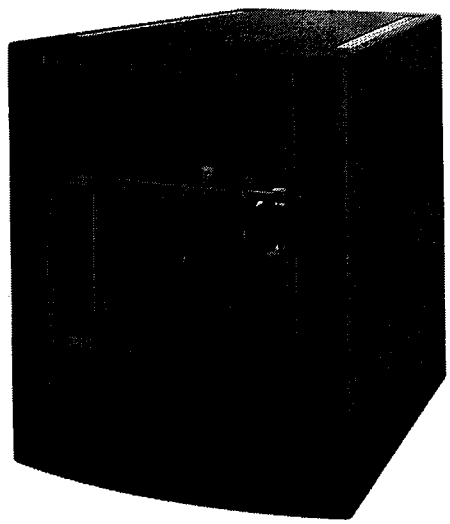
FRX+940

15-Inch Two-Way Horn-Loaded 90° x 40° Coaxial Speaker System

Step Up To Electro-Voice

Key Features:

- **Pattern Control to 500 Hz**
- **90° x 40° coverage**
- **Built-in L-track rigging**
- **Available in black, white and unfinished**
- **Passive or bi-amp operation**
- **High sensitivity, 104 dB**
- **Ring-Mode Decoupling / RMD™**
- **Full Coaxial Design**



General Description:

FRX+ series is designed for applications in highly reverberant spaces where excellent directivity control down to 500 Hz is critical. In a trapezoidal enclosure no taller than a typical compact system and only a bit wider, they maintain control of coverage angles down to 500 Hz. A 15" LF transducer is coaxially horn loaded with a mouth nearly the size of the enclosure to provide excellent LF pattern control. These professional fixed install speakers deliver a broad range of performance options including multiple rotatable horn patterns, matching sub-woofer, easily switchable passive or bi-amp operation, and EV's world renowned transducer technology for response that is smooth and linear. The FRX+ is an economical and flexible solution for the most demanding installations.

Same size full-range and sub-woofer systems allow the installer to construct arrays covering the most demanding acoustical environments while maintaining an aesthetic and uniform installation. The structural integrity of the FRX+ cabinets allows for vertical arrays up to 2 boxes in depth. All FRX+ systems are available in weather resistant black or white Futura, and unfinished. A severe environment weatherization option is also available. Performance may be further enhanced by bi-amping with the Electro-Voice Dx-38 Digital Sound System Processor.

Technical Specifications:

Freq. Response[1] (-3 dB):	60Hz-15kHz
Freq. Range[1] (-10 dB):	52Hz-16kHz
Max Calculated SPL:	133 dB
Horizontal Coverage:	90°
Vertical Coverage:	40°
LF Power Handling:	400W Continuous, 1600W Peak
HF Power Handling:	60W Continuous, 240W Peak
LF Sensitivity (Bi-Amp):	105 dB, 1W/1m
HF Sensitivity (Bi-Amp):	109 dB, 1W/1m
LF Transducer:	DL15X 15" (381mm) Driver
HF Transducer:	DH2t 2" (51mm) Diaphragm Comp. Driver
Passive Crossover Frequency:	1350 Hz
Connectors:	Two barrier strips
Enclosure Material:	13-ply Birch plywood
Grille:	16 GA steel
Environmental Spec:	IEC 529 IP24 MIL STD 810
Dim (H x W x D):	31.0" x 28.3" x 26.0" (787 x 719 x 660 mm)
Net Weight (each):	152 lbs (69.0 kg)
Shipping Weight:	157 lbs (71.2 kg)

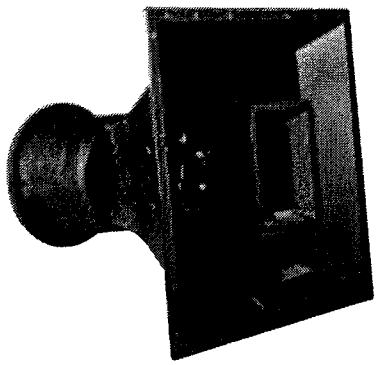
[1] Full Space measurement. Half Space use will improve LF response.

MH-Series Stadium Horns

MH-Series stadium horns are designed for large-scale stadiums and arenas where high-fidelity sound and directivity control from low mid-bass frequencies and below are absolutely essential. In 1974, EV pioneered the concepts of constant directivity (horn angles that are constant with frequency) and Manifold® technology (which combines the outputs of multiple transducers into one source). Large-format MH horns incorporate both in several horn/driver systems. Medium-format MH horns are excellent for short/medium throw applications or as infills for large-format MH-horns.

Medium-format MH-Series horns

MH medium-format horns have a high "Q," and uniform directivity control down to 500 Hz. The mid-bass section features an Aperiodic Enhancer™ phase plug which extends the high-end output to blend seamlessly into the coaxial high-frequency section. The HF section contains a small-format HP horn with EV's patented Transplanar™ design to provide exceptionally smooth frequency response. The one-piece main horn bell is a black polyester/fiberglass laminate with composite reinforcement. Up to three pieces can be paralleled in active or passive mode without a minimum impedance load at the amplifier.

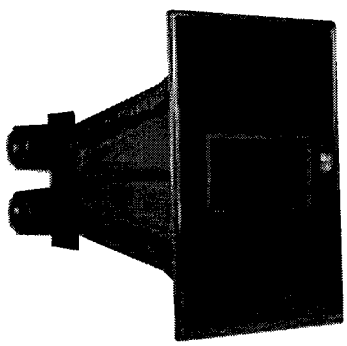


MH640C/MH640P (60° x 40°)
MH660C/MH660P (60° x 60°)
MH940C/MH940P (90° x 40°)

- Two-way, extraordinary output mid/high CD horn system
- High sensitivity: 107 dB/1 W/1 m
- Coaxial horn-loaded
- P version has passive crossover
- Water-resistant Kevlar® epoxy cone
- MB horn features Aperiodic Enhancer™ phase plug
- 2" voice coil (titanium diaphragm)
- HF driver protection circuit
- Uniform directivity control to 500 Hz
- All models have same dimensions for uniform-looking arrays
- Integral 4-point hanging hardware in polyester-powder-coated steel

Large-format MH-horns

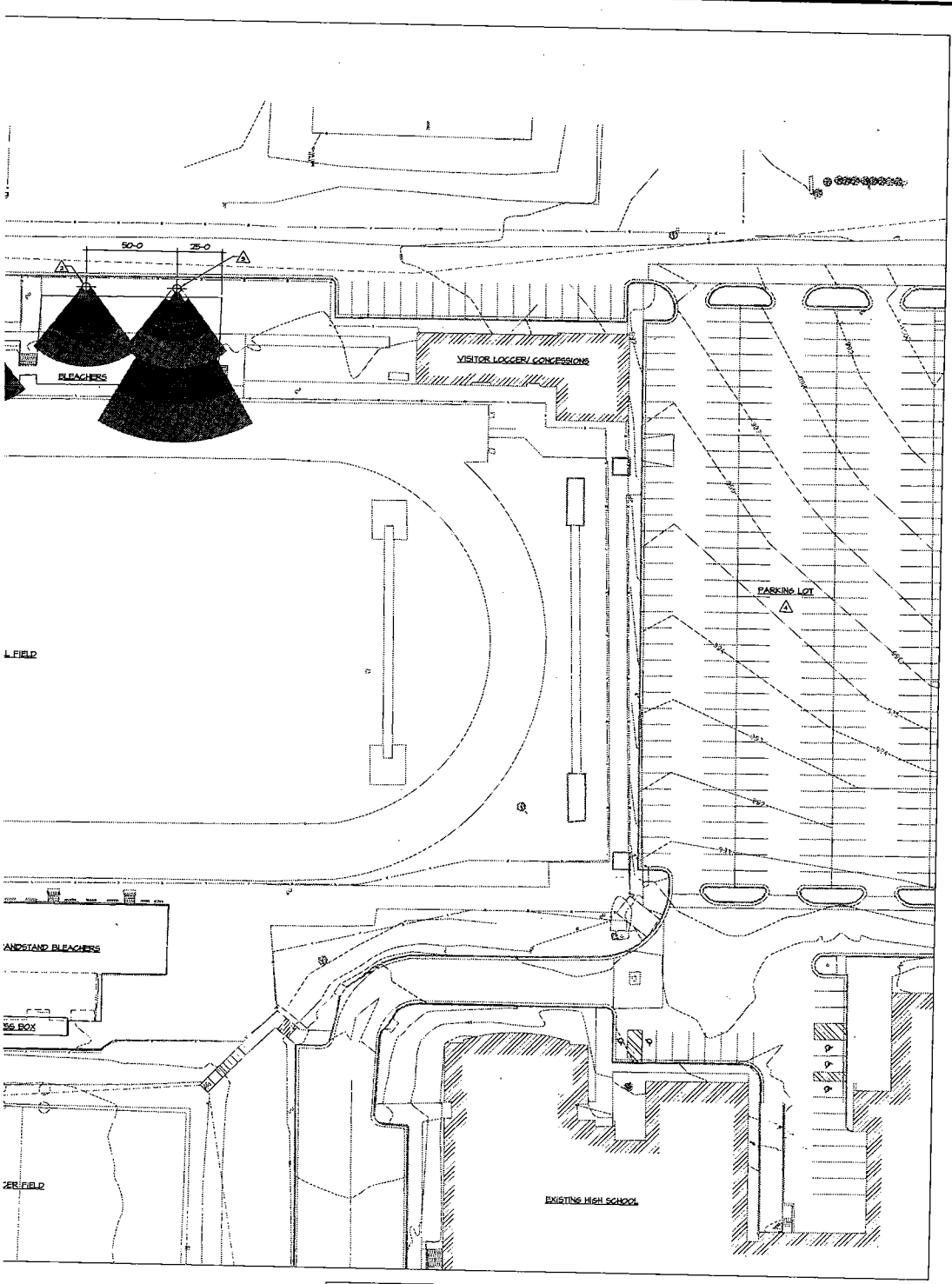
MH large-format horns feature Manifold® technology, high "Q," and uniform directivity control. MH horns maintain beamwidth to 250 Hz, reducing bass "spillover" and increasing intelligibility. The HF section contains an appropriate medium-format HP horn that accepts EV two-inch-exit single or dual drivers of the designer's choice, extending response to 20 kHz. The large horn size also provides frequency response to 100 Hz, typically eliminating the need for supplemental low-frequency systems. The mid-bass section features the Aperiodic Enhancer™ phase plug. The main horn bell is a one-piece black polyester and fibreglass with fibreglass rib reinforcement and an integral grille-protection screen built into the manifold chamber.



MH4020AC (40° x 20°)
MH6040AC (60° x 40°)
MH9040AC (90° x 40°)

- Two-way, extraordinary output CD horn system
- Coaxial horn-loaded
- Highest sensitivity
- Full-range down to 100 Hz (-10 dB)
- Mid-bass features Aperiodic Enhancer™ and Manifold® Technology
- Water-resistant Kevlar® epoxy cone
- HF-horn with 2-inch throat diameter (Designer chooses driver)
- Excellent uniform directivity control down to low frequencies
- Same front dimensions for uniform appearance when used in arrays
- Integral 18-point hanging hardware in powder-coated steel

Specifications	MH640C/P	MH660C/P	MH940C/P	MH4020AC	MH6040AC	MH9040AC
Frequency range (-3 dB)	150 Hz–20 kHz	150 Hz–20 kHz	150 Hz–20 kHz	100 Hz–20 kHz	100 Hz–20 kHz	100 Hz–20 kHz
Recommended high-pass frequency	160 Hz (24 dB/Oct.)	160 Hz (24 dB/Oct.)	160 Hz (24 dB/Oct.)	130 Hz (24 dB/Oct.)	130 Hz (24 dB/Oct.)	130 Hz (24 dB/Oct.)
Sensitivity (SPL 1 W/1 m)	107/111 dB; 107 dB	107/111 dB; 107 dB	107/111 dB; 107 dB	109 dB	107 dB	105 dB
Max. SPL/1m (calc.)	138 dB	138 dB	138 dB	146 dB	141 dB	139 dB
Long-term power handling	300 W/60 W; 300 W	300 W/60 W; 300 W	300 W/60 W; 300 W	1,200 W	600 W	600 W
Short-term power handling	1,200 W/240 W; 1,200 W	1,200 W/240 W; 1,200 W	1,200 W/240 W; 1,200 W	4,800 W	2,400 W	2,400 W
Coverage (H° x V°)	60° x 40° (CD Horn)	60° x 60° (CD Horn)	90° x 40° (CD Horn)	40° x 20° (CD Horn)	60° x 40° (CD Horn)	90° x 40° (CD Horn)
Directivity Index (500 Hz–20 kHz)	13.7 dB (+1.6/-2.8 dB)	13.7 dB (+1.6/-2.8 dB)	12.6 dB (+3.8/-4.0 dB)	18.0 dB (—/—)	13.8 dB (+0.9/-1.1 dB)	10.2 dB (+0.9/-1.1 dB)
LF driver	10" (DL10X)	10" (DL10X)	10" (DL10X)	4 x 10" (DL10X)	2 x 10" (DL10X)	2 x 10" (DL10X)
HF driver	2"	2"	2"	2"	2"	2"
Crossover frequencies (slope in biamp mode)	1,600 Hz (24 dB/Oct.)	1,600 Hz (24 dB/Oct.)	1,600 Hz (24 dB/Oct.)	1,600 Hz (24 dB/Oct.)	1,250 Hz (24 dB/Oct.)	1,250 Hz (24 dB/Oct.)
Nominal impedance	16 Ω/8 Ω; 8 Ω	16 Ω/8 Ω; 8 Ω	16 Ω/8 Ω; 8 Ω	2 x 8 Ω	8 Ω	8 Ω
Input connections	Dual barrier strips	Dual barrier strips	Dual barrier strips	Heavy-duty copper cable	Heavy-duty copper cable	Heavy-duty copper cable
Dimensions (H x W at front x D)	27" x 27" x 28" 686 x 686 x 711 mm	27" x 27" x 28" 686 x 686 x 711 mm	27" x 27" x 28" 686 x 686 x 711 mm	59" x 39" x 73.9" 1500 x 991 x 1880 mm	59" x 39" x 73.9" 1500 x 991 x 1873 mm	59" x 39" x 60.4" 1500 x 991 x 1534 mm
Net weight (Large format: without HF driver)	60 lbs (27.2 kg)	60 lbs (27.2 kg)	60 lbs (27.2 kg)	237 lbs (108 kg)	165 lbs (75 kg)	165 lbs (75 kg)



SITE PLAN NOTES:

1. FLOOR MOUNTED EQUIPMENT RACK LOCATED IN EQUIPMENT ROOM. REF. SAU.1 & ELEC.
2. NEW 45' HIGH CONCRETE POLE W/ 1 LOUD SPEAKER MOUNTED REF. A.J.1
3. NEW 45' HIGH CONCRETE POLE W/ 2 LOUD SPEAKERS MOUNTED REF. A.X.X
4. PROVIDE CONSTRUCTION ACCESS TO THE STAGING AREA SO THAT PARKING LOT TRAFFIC IS NOT INTERRUPTED.
5. ELECTRICAL WIRE, TRENCHED REF. ELEC.

SITE PLAN LEGEND:

- NEW CONSTRUCTION LOCATION
- EXISTING BUILDING
- (1) NOTE

BLUE VALLEY HIGH SCHOOL: STADIUM SOUND SYSTEM

BLUE VALLEY SCHOOL DISTRICT-U.S.D. 229, 15020 METCALF, OVERLAND PARK, KANSAS

Horst, Fernill & Karst ARCHITECTS, P.A.

MARK E. FRAZIER LICENSED 3292 KANSAS PROFESSIONAL ARCHITECT

Date
SEPTEMBER 20, 2002

Revised Date

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- SITE PLAN
- SITE PLAN NOTES
- SITE PLAN LEGEND

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0 1 0 8 . 0 6

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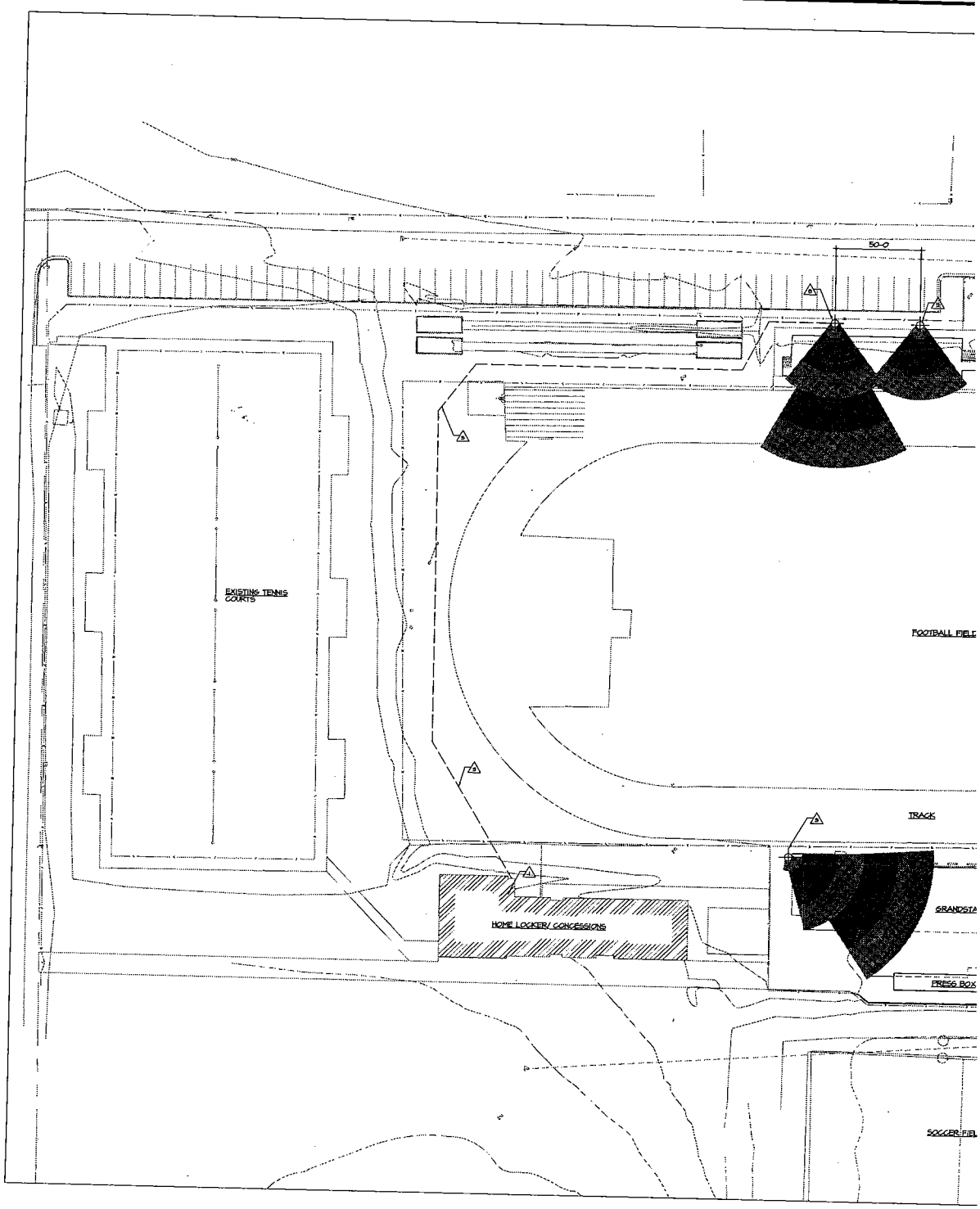
C1.1



SITE PLAN
1" = 90'-0"

NORTH